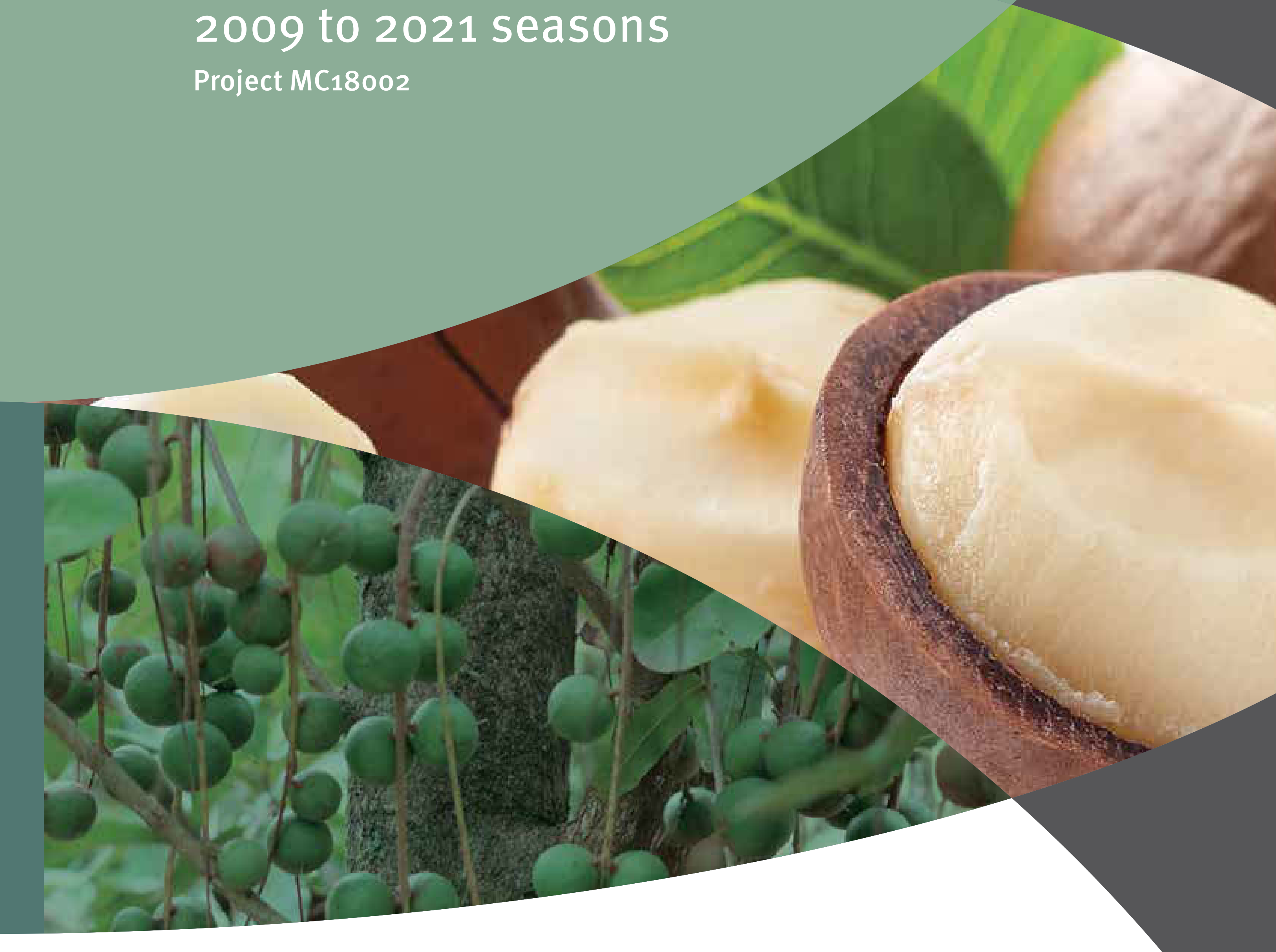
Macadamia industry benchmark report

2009 to 2021 seasons

Project MC18002



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Acknowledgements

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Disclaimer

About the benchmarking project

The benchmarking project is supporting improved productivity and profitability within the Australian macadamia industry. The current project builds on previous benchmarking and best practice work conducted since 2001.

Yield, quality and planting information has been collected annually from macadamia farms throughout Australia since 2009. This information is provided either directly by growers or by processors on their behalf. Production cost data has also been collected annually since 2013.

Each season all benchmarking participants receive a confidential, personalised farm benchmark report that compares their individual farm performance with groups of similar farms based on a range of criteria including region, locality, farm size, management structure, irrigation status and tree age. This industry report provides all stakeholders with a summary of yield, quality and cost trends within the Australian macadamia industry.

Benchmark data further supports a range of industry projects and initiatives. **Figure 1** shows linkages to some current projects that benefit from the availability of reliable industry benchmark data. Although summary information such as that published in this report is publicly available to a range of industry stakeholders, it is important to note that individual farm business data remains strictly confidential.

Figure 1 Benchmark project linkages

Scope and coverage

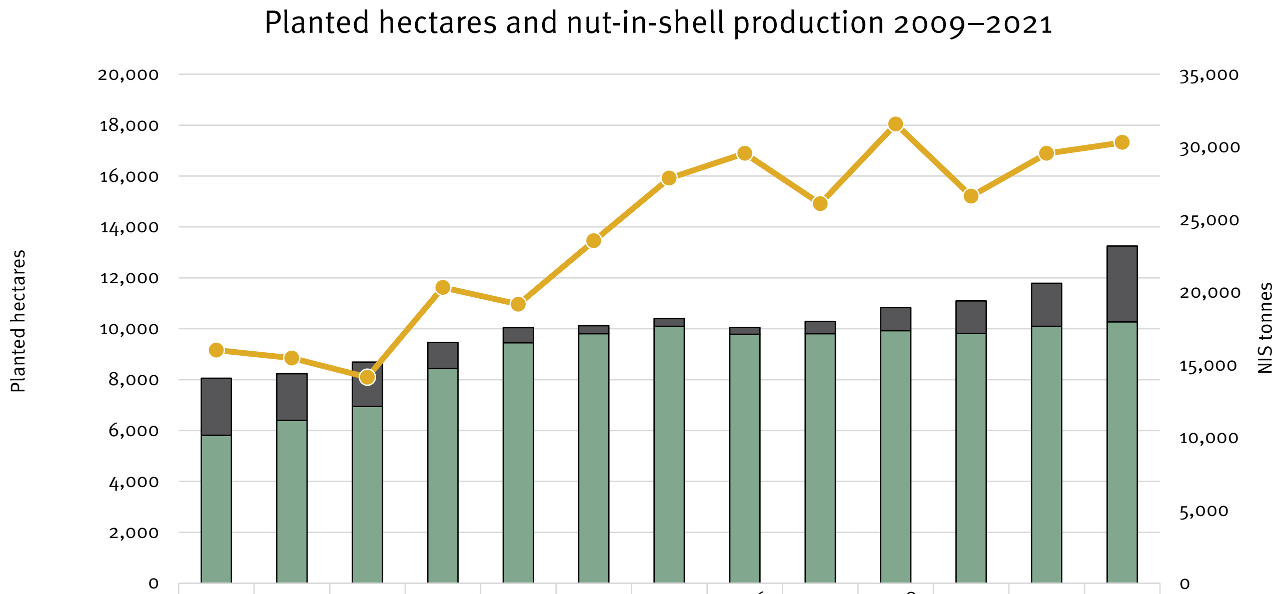
This report summarises macadamia farm yield and quality results for the 2009–2021 seasons and production costs for 2013–2021. Many of the yield benchmarks presented are based on tonnes of nut-in-shell (NIS) or saleable kernel (SK) per bearing hectare, as these are widely accepted measures of orchard productivity.

Major macadamia production regions are shown in **Figure 2**. These include Central Queensland (CQ), South East Queensland (SEQ), Northern Rivers of New South Wales (NRNSW) and Mid North Coast of New South Wales (MNNSW).

Figure 2 Major macadamia production regions

Figure 3 shows annual planted and bearing hectares and NIS production for all farms in the benchmark sample since data collection commenced in 2009. Trees aged five or more years are generally considered bearing for the purposes of the benchmark study.

Yield and quality data collected since 2009 totals 3219 farm-years. The term farm-year is used to describe data for an individual farm for a given year or season. Since 2013 some participating businesses have also provided data on annual production costs. Cost data collected since 2013 totals 613 farm-years. Data on unpaid labour hours have also been collected since 2017, totaling 426 farm-years.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Non-bearing ha	2,249	1,840	1,743	1,029	590	317	307	268	484	905	1,278	1,691	2,978
Bearing ha	5,810	6,398	6,949	8,435	9,454	9,804	10,096	9,785	9,809	9,923	9,818	10,096	10,274
NIS production	16,030	15,478	14,159	20,337	19,181	23,539	27,846	29,556	26,098	31,570	26,609	29,550	30,303
Bearing farms	178	184	192	243	262	267	271	271	274	275	265	273	264
Total farms	192	195	207	252	265	268	271	273	278	281	279	290	305

Figure 3 Total planted hectares and production by season for farms in the benchmark sample by season 2009–2021

Table 1 shows the number of farms participating in benchmarking in each major production region for the 2021 season. It also shows median farm size, total nut-in-shell production and average tree age for farms within each of those regions. Total planted hectares can vary substantially between farms, particularly in some regions. Median rather than average planted hectares are presented as these better represent typical farm sizes in these instances.

A total of 305 farms submitted data for the 2021 season. These farms totalled 13,251 hectares (10,274 bearing) and produced approximately 30,303 tonnes of NIS at 10% moisture content. This represents approximately 55% of total industry production in 2021, based on the Australian Macadamia Society's estimate of 55,200 tonnes of NIS at 10% moisture content (published December 2021).

A total of 89 bearing farms submitted cost data in 2021, representing 29% of the benchmark sample and 21% of national production in 2021. This included 39 farms in NRNSW, 26 farms in CQ, 13 farms in MNNSW and 11 farms in SEQ.

In 2021 almost half of all farms in the benchmark sample (45%) were from NRNSW, although the region accounted for a smaller percentage of the sample by production (23%). There were fewer farms in the CQ region (29%) however their relatively high median size meant that this region accounted for the largest percentage the sample by production in 2021 (57%).

Regional breakdown of participating farms in 2021

Region	Total farms (% of sample)	Bearing farms (% of sample)	Median planted hectares per farm	Total planted hectares (% of sample)	Total NIS tonnes (% of sample)	Average tree age
Central Queensland (CQ)	88 (29%)	56 (21%)	57.9	8129 (61%)	17,248 (57%)	16
South Queensland (SQ)	52 (17%)	52 (20%)	13.6	1495 (11%)	4875 (16%)	26
Northern Rivers of NSW (NRNSW)	136 (45%)	131 (50%)	17.6	3163 (24%)	7100 (23%)	25
Mid North Coast of NSW (MNNSW)	29 (9%)	25 (9%)	14.1	464 (4%)	1080 (4%)	21
All regions	305	264	19.8	13,251	30,303	20

Table 1 Regional breakdown of farms in the 2021 benchmark sample

Figure 4 shows a breakdown of planted hectares by tree age for the benchmark sample. The bars shown for each age are coloured according to production region.

In 2021 the weighted average age of trees was 19 years for all farms in the benchmark sample and 20 years for bearing farms. Trees in the CQ region were the youngest with an average of 16 years, while SEQ and NRNSW had the oldest (26 and 25 years respectively).

Almost 1 million trees or more than 3000 hectares were less than 5 years of age and therefore not considered bearing in 2021. Over 90% of those young trees are in the CQ region. Almost 1.2 million trees (3700 hectares) were less than 10 years of age, which represents approximately 30% of the benchmark sample.

Farms in the SEQ region had the largest span of tree ages, from newly planted through to 49 years of age. By comparison tree ages spanned 47 years in NRNSW, 41 in MNNSW and 32 in CQ.

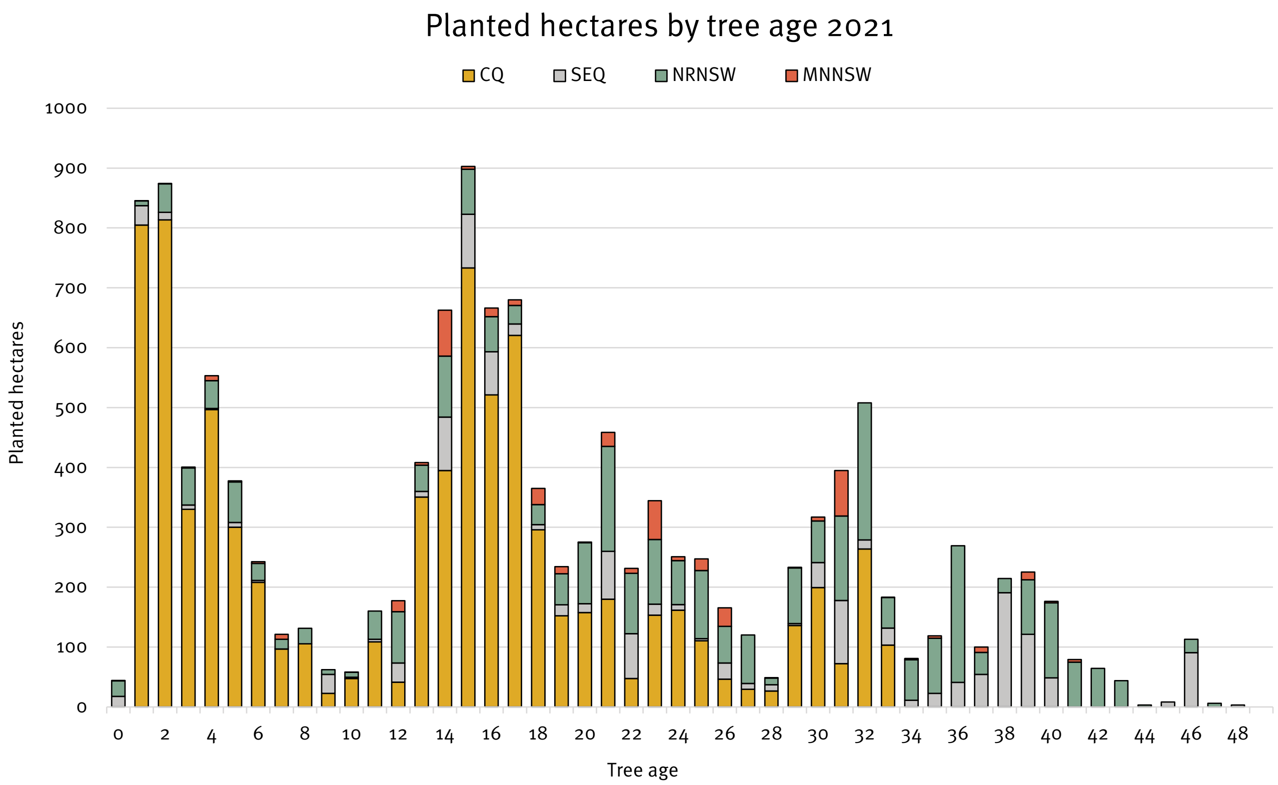
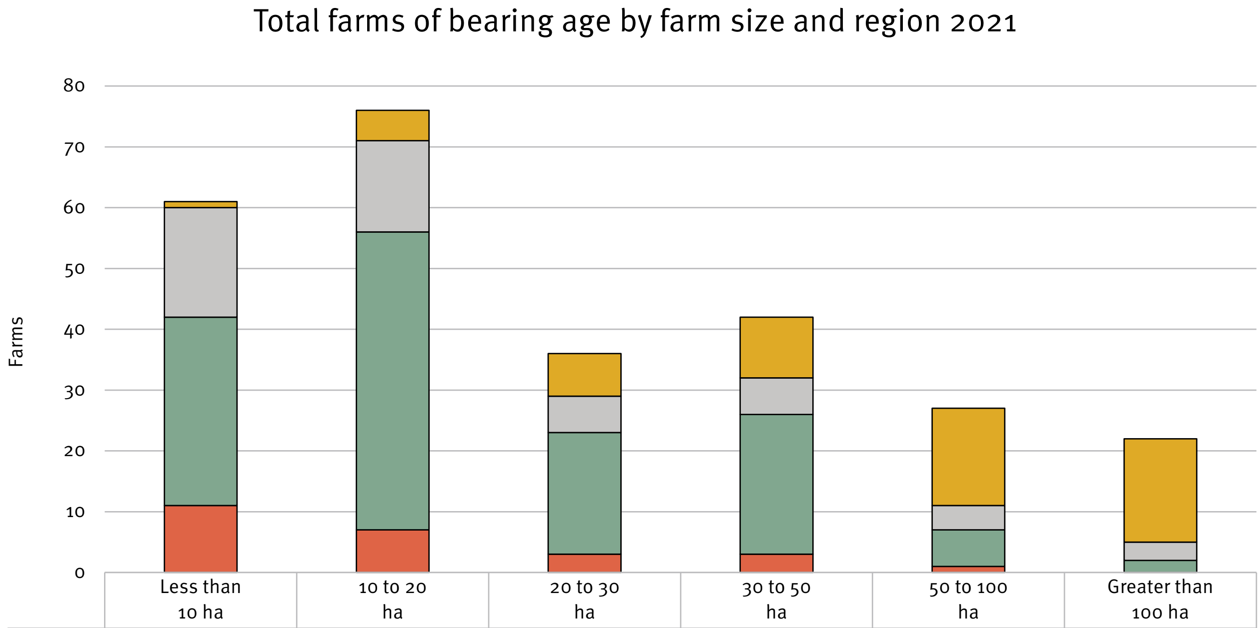


Figure 4 Total planted hectares by tree age and region in 2021

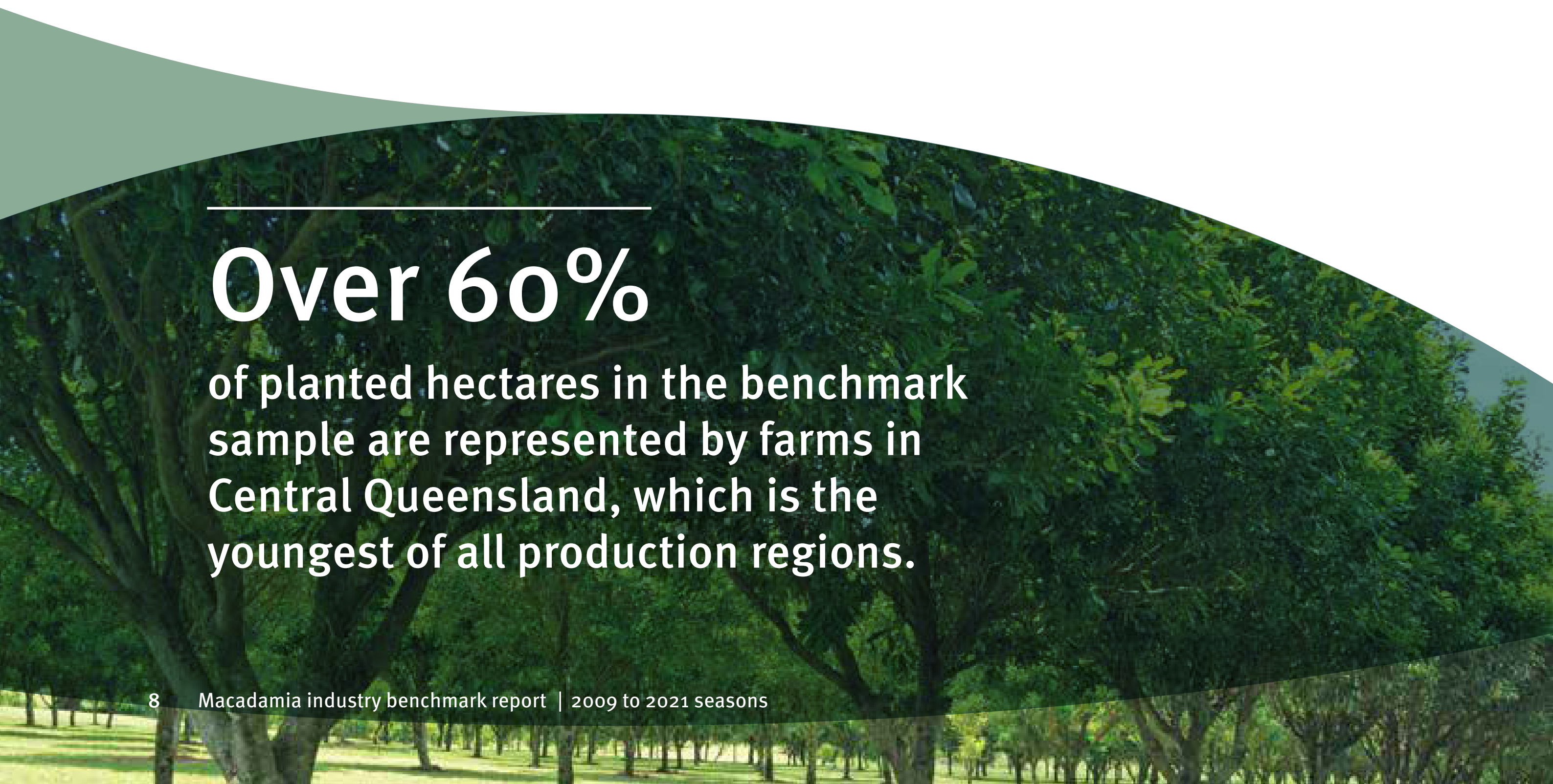
Figure 5 shows a breakdown of bearing farms in the benchmark sample (average tree age 5 years or more) grouped according to farm size category.

More than half of all farms in the sample had less than 20 hectares of bearing trees. Most of these farms are in the MNNSW, NRNSW and SEQ regions. By comparison, most larger farms (> 50 hectares) were in the CQ region. Approximately 8% of farms in the sample had more than 100 hectares of bearing trees.



	Less than 10 ha	10 to 20 ha	20 to 30 ha	30 to 50 ha	50 to 100 ha	Greater than 100 ha
CQ	1	5	7	10	16	17
SEQ	18	15	6	6	4	3
NRNSW	31	49	20	23	6	2
MNNSW	11	7	3	3	1	0

Figure 5 Bearing farms by farm size and region in 2021



Over 60%

of planted hectares in the benchmark sample are represented by farms in Central Queensland, which is the youngest of all production regions.

2021 season results

Figure 6 shows a summary for the benchmark sample in 2021. The yield and quality figures are derived from 264 bearing farms, including some young farms that are yet to reach full maturity. Cost summaries are derived from a subset of 83 mature (10+ years old) farms that provided cost data in the 2021 season. Corresponding averages over multiple recent seasons are shown in brackets for comparison. Long-term data on yield, quality and plantings spans the previous five seasons (2016–2020). Long-term cost averages are sourced from the previous four seasons (2017–2020) to include imputed labour, which has been collected since 2017. All values are weighted by NIS production.

Average productivity, saleable kernel recovery (SKR) and expenditure all continued to exceed long-term averages in 2021, while average reject kernel recovery (RKR) was almost 30% lower than the long-term average. The 2021 season was generally favourable for many benchmark participants despite ongoing dry conditions in some growing regions.

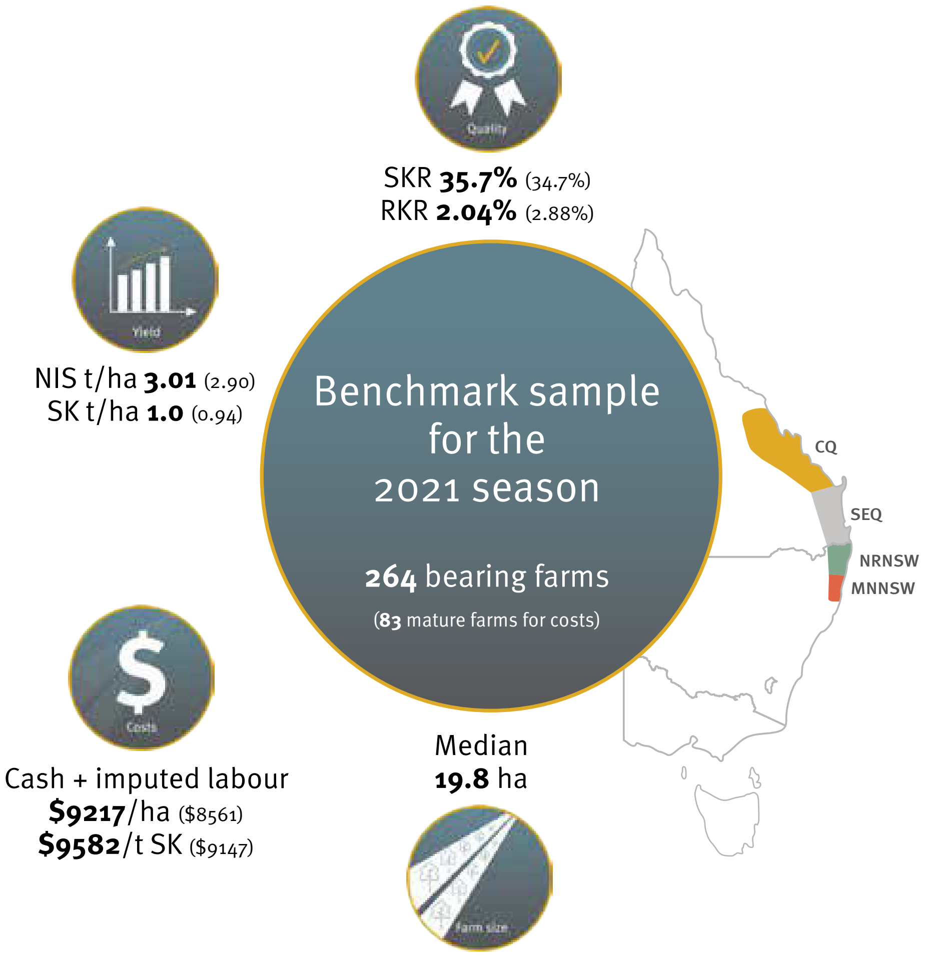


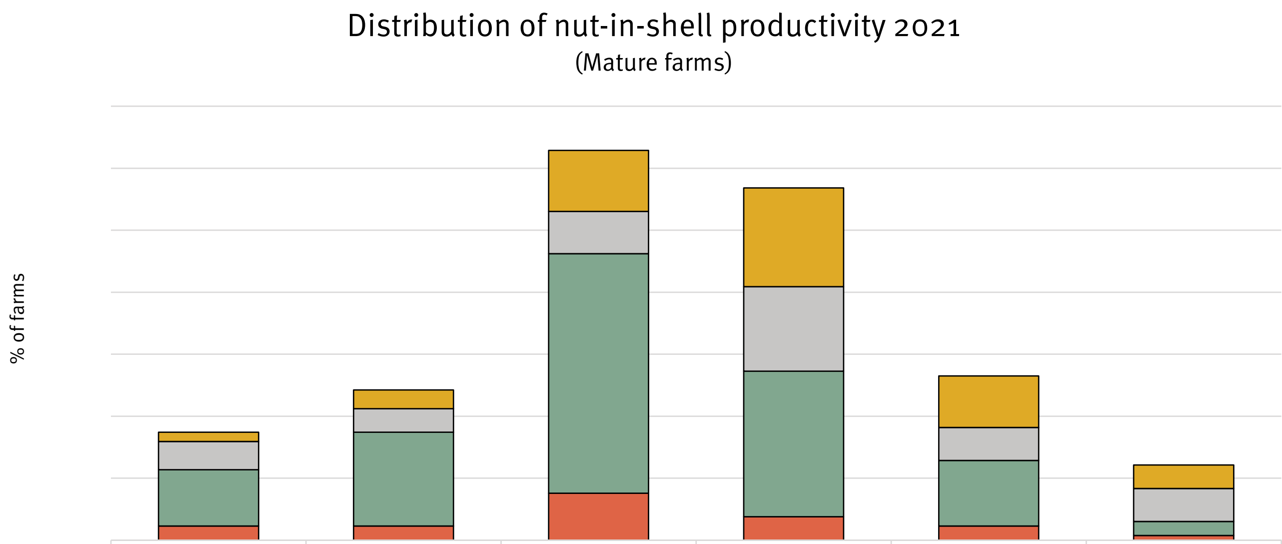
Figure 6 Benchmark sample summary for the 2021 season (long-term averages shown in brackets)

Yield and quality in 2021

Productivity data shown is based on mature farms only (10+ years old) to exclude the influence of younger bearing farms (5 to 10 years old) that are yet to reach full production.

Figure 7 shows the percentage of farms in the benchmark sample in 2021, grouped by region and categorised by nut-in-shell productivity. Each of the major production regions was represented across all productivity categories in 2021. In 2021 59% of the benchmark sample produced between 2 and 4 t/ha of NIS per bearing hectare, while 21% averaged less than 2 t/ha and 19% averaged more than 4 t/ha. A total of 35 farms (13%) achieved NIS productivity of 4-5 t/ha and 16 farms (6%) achieved more than 5 t/ha. The highest NIS yield recorded for an individual farm in 2021 was over 7.7 t/ha, or 2.9 t/ha SK.

Most Queensland farms averaged 3-4 t/ha in 2021 although there were also many farms that averaged lower or higher productivity. Most farms in NSW averaged 2-3 t/ha (19%) although again there were many farms in both NRNSW and MNNSW that achieved lower and higher productivity.



	< 1 t/ha	1–2 t/ha	2–3 t/ha	3–4 t/ha	4–5 t/ha	>5 t/ha
CQ	1%	2%	5%	8%	4%	2%
SEQ	2%	2%	3%	7%	3%	3%
NRNSW	5%	8%	19%	12%	5%	1%
MNNSW	1%	1%	4%	2%	1%	0%
All regions	9%	12%	31%	28%	13%	6%

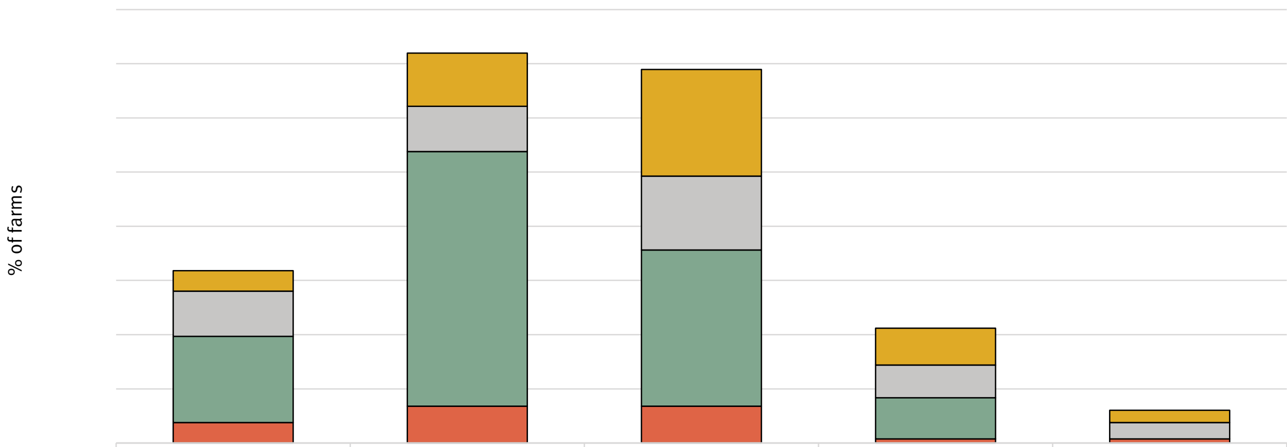
Yield (tonnes per bearing hectare)

Figure 7 Farms by NIS productivity and region in 2021

Figure 8 shows the equivalent percentage of farms in the benchmark sample grouped by region and saleable kernel productivity in 2021. Most farms in the sample averaged SK productivity of 0.5-1.0 t/ha (36%) followed by 1.0-1.5 t/ha (34%). Almost 38% of farms in those productivity categories were in NRNSW, followed by CQ (15%), SEQ (11%) and MNNSW (6%).

Just 8 farms in the sample (3%) achieved saleable kernel productivity of more than 2 t/ha. These farms were in CQ, SEQ and MNNSW.

Distribution of saleable kernel productivity 2021
(Mature farms)



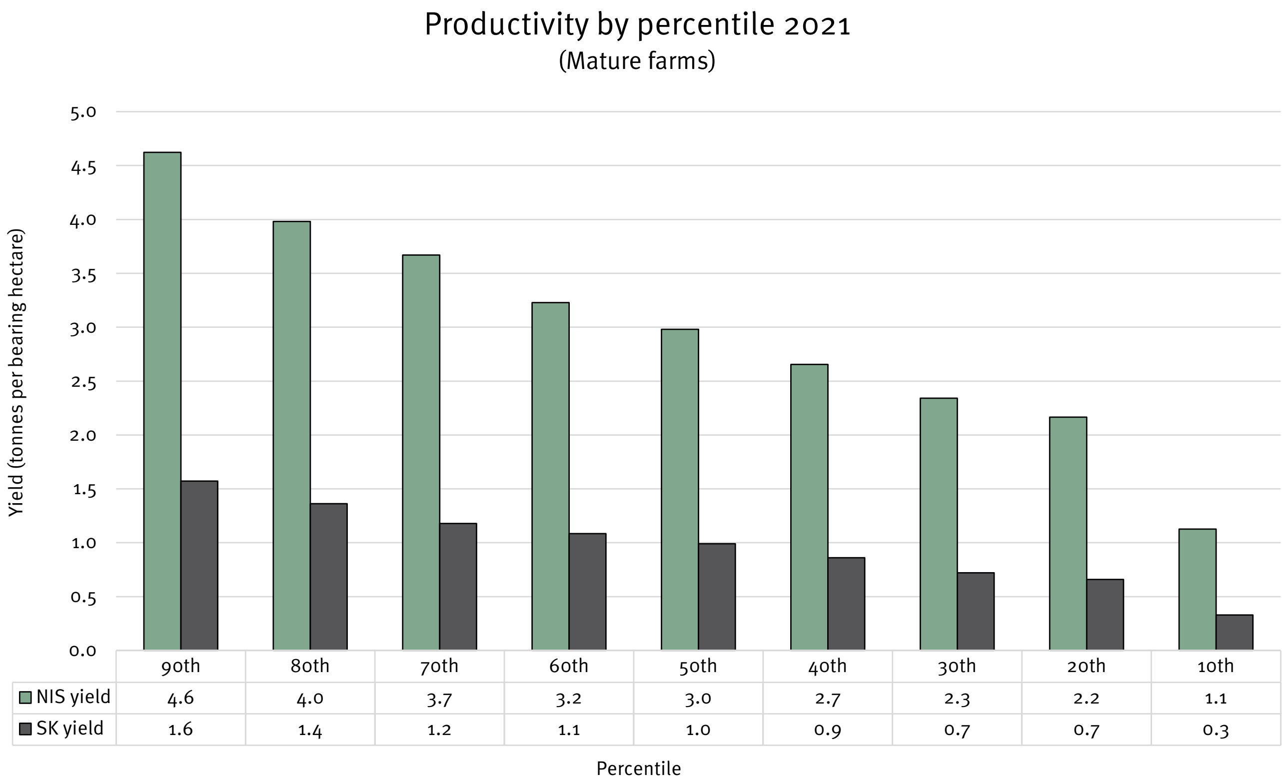
	< 0.5 t/ha	0.5-1.0 t/ha	1.0-1.5 t/ha	1.5-2.0 t/ha	>2 t/ha
CQ	2%	5%	10%	3%	1%
SEQ	4%	4%	7%	3%	2%
NRNSW	8%	23%	14%	4%	0%
MNNSW	2%	3%	3%	0%	0%
All regions	16%	36%	34%	11%	3%

Yield (tonnes per bearing hectare)

Figure 8 Farms by SK productivity and region in 2021

Figure 9 shows percentiles of NIS and SK productivity per hectare for mature farms in 2021. Each percentile indicates the percentage of farms in the sample where productivity was below a particular value. For example, the 90th percentile shows that 90% of farms achieved less than 4.6 t/ha NIS and less than 1.6 t/ha SK, and conversely that 10% of farms achieved or exceeded these values.

Comparing the 90th and 10th percentiles for 2021 reveals that the top 10% of farms achieved significantly higher productivity than the bottom 10% (> 5 times higher for SK and >4 times higher for NIS). Similar differences have been observed in previous seasons. Average productivity for the 50th percentile (the median) was 3.0 t/ha NIS and 1.0 t/ha SK.



	90th	80th	70th	60th	50th	40th	30th	20th	10th
NIS yield	4.6	4.0	3.7	3.2	3.0	2.7	2.3	2.2	1.1
SK yield	1.6	1.4	1.2	1.1	1.0	0.9	0.7	0.7	0.3

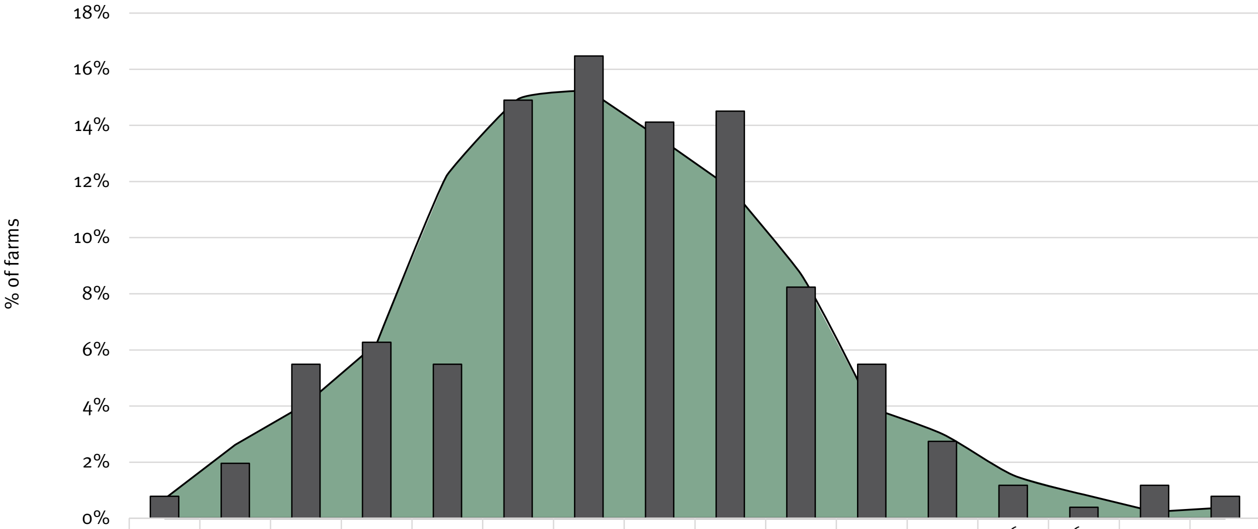
Figure 9 NIS and SK productivity by percentile for mature farms in 2021

Figure 10 shows how NIS productivity per hectare for mature farms was distributed within the benchmark sample in 2021 (grey bars) compared with the preceding five seasons (2016–2020, green shaded area).

As in previous seasons 2021 followed a relatively ‘normal’ distribution, with most farms averaging between 2.5–4 t/ha NIS. Average NIS productivity was slightly higher in 2021 compared with 2020 and the long-term average for the previous five seasons. In 2021 the number of farms achieving 4 t/ha was up by 3% compared with the previous five seasons, and those achieving more than 7 t/ha were up by more than 1% (5 farms).

Nut-in-shell distribution 2021 versus 2016–20

(Mature farms)



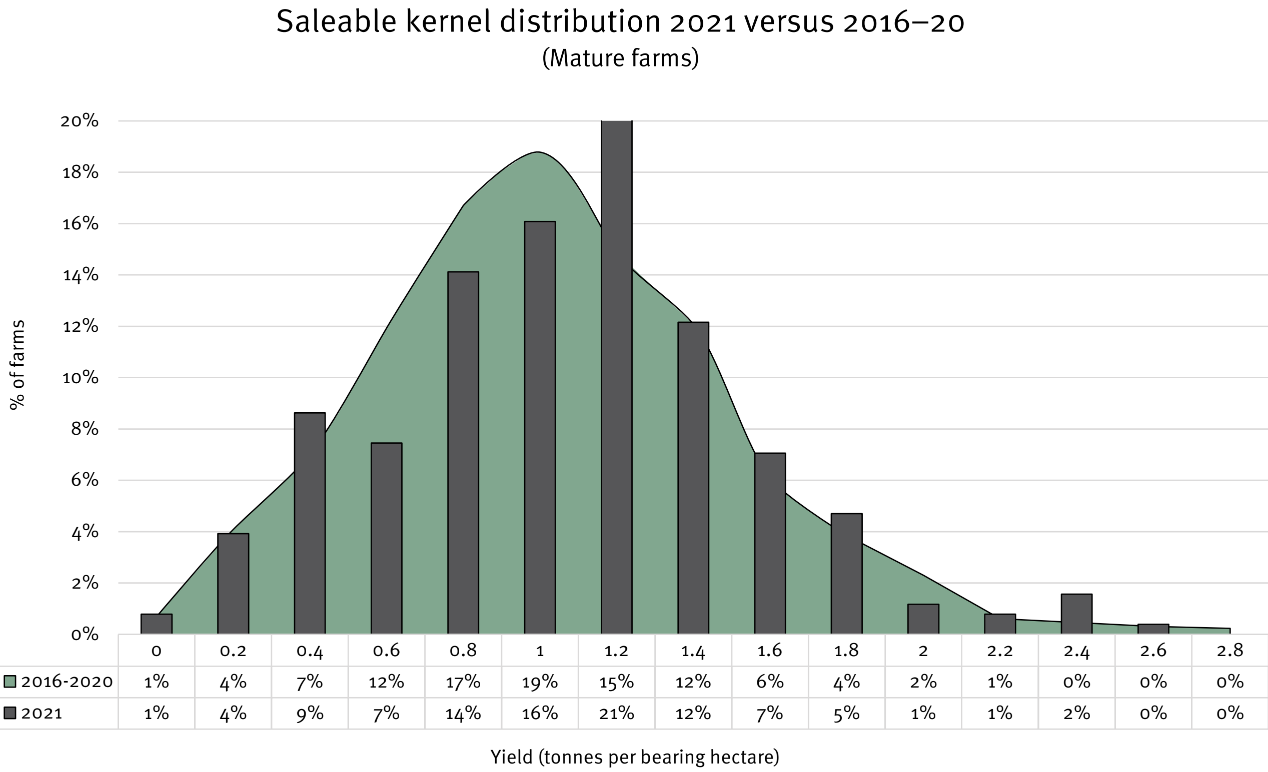
	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5
2016–2020	1%	3%	4%	6%	12%	15%	15%	14%	12%	9%	4%	3%	2%	1%	0%	0%
2021	1%	2%	5%	6%	5%	15%	16%	14%	15%	8%	5%	3%	1%	0%	1%	1%

Yield (tonnes per bearing hectare)

Figure 10 Distribution of NIS for mature farms (2021 versus 2016–2020)

Figure 11 shows the distribution of saleable kernel productivity for mature farms within the benchmark sample for the 2021 season (grey bars) compared with the preceding five seasons (2016–2020, green shaded area).

The distribution of the sample in 2021 was consistent with the long-term average for the previous five seasons. Average SK productivity in 2021 (1.0 t/ha) compared favourably with the long-term average for the previous five seasons (0.94 t/ha). In 2021 the number of farms achieving 1.2 t/ha SK was up by 6% compared with the previous five seasons.

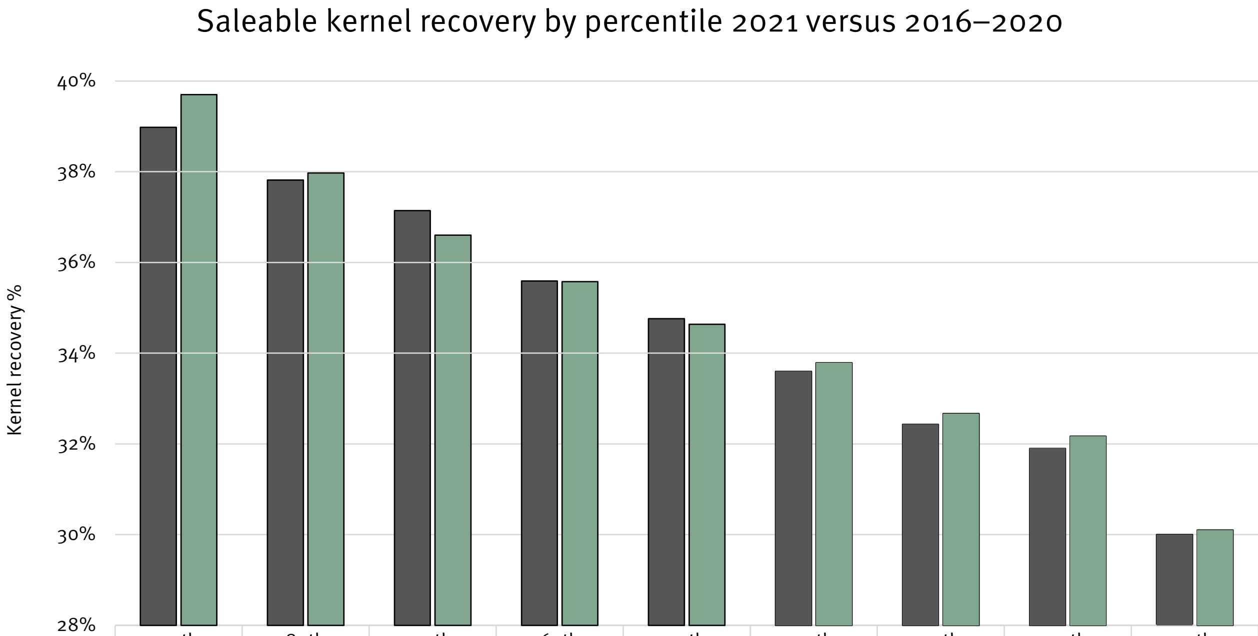


	0	0.2	0.4	0.6	0.8	1	1.2	1.4	1.6	1.8	2	2.2	2.4	2.6	2.8
2016-2020	1%	4%	7%	12%	17%	19%	15%	12%	6%	4%	2%	1%	0%	0%	0%
2021	1%	4%	9%	7%	14%	16%	21%	12%	7%	5%	1%	1%	2%	0%	0%

Figure 11 Distribution of SK for mature farms (2021 versus 2016–2020)

Figure 12 shows saleable kernel recovery (SKR) percentiles for all farms for the 2021 season compared with the previous five seasons (2016–20). Each percentile shows the percentage of farms in the sample where SKR was below a particular value. For example, the 90th percentile shows that 90% of farms achieved less than 39.0% SKR in 2021 and less than 39.7% SKR for 2016–20.

Comparing the 90th and 10th percentiles reveals significant differences in SKR (> 9%). A similar trend was evident for previous seasons. Average SKR for the 50th percentile (the median) was 34.8% in 2021, which is consistent with the average for 2016-20.

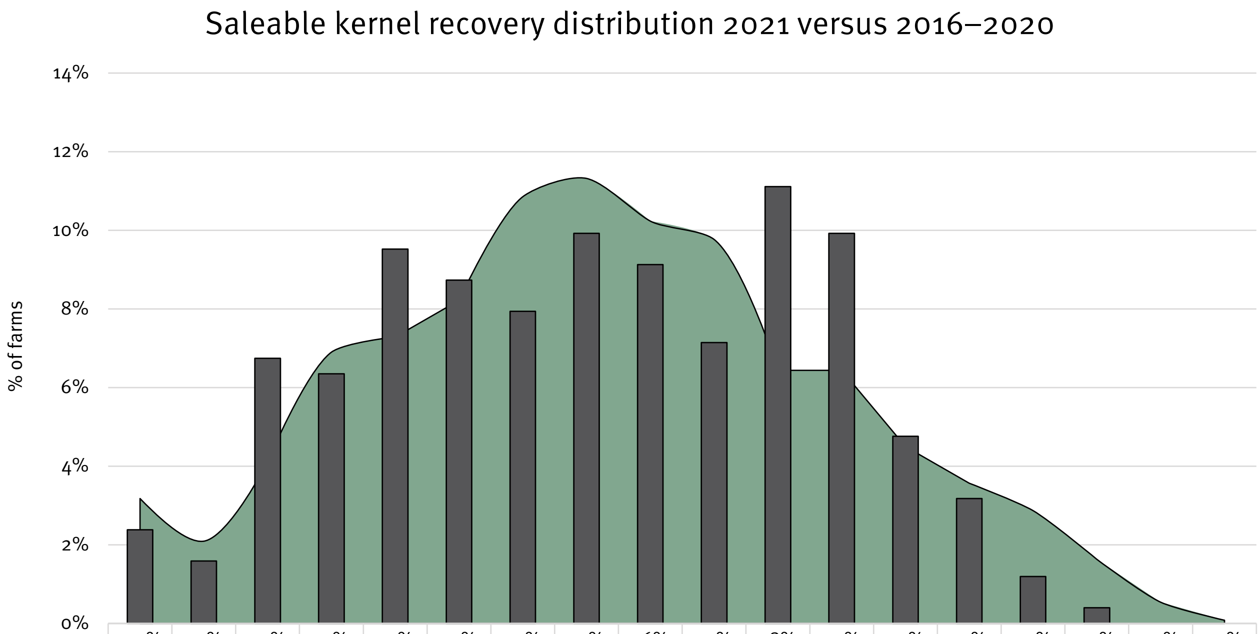


	90th	80th	70th	60th	50th	40th	30th	20th	10th
2021	39.0	37.8	37.1	35.6	34.8	33.6	32.4	31.9	30.0
2016–20	39.7	38.0	36.6	35.6	34.6	33.8	32.7	32.2	30.1

Figure 12 SKR by percentile for all farms (2021 versus 2016–2020)

Figure 13 shows the distribution of SKR for all farms within the benchmark sample in 2021 (grey bars) compared with the preceding five seasons (2016–2020, green shaded area).

The chart shows SKR was more variable across the benchmark sample in 2021 than over the previous five seasons. This was particularly evident in the CQ region where average SKR was 1.8% higher in 2021 (36.8%) than the previous 5 years (35%). The net result across the whole sample was slightly higher average SKR in 2021 compared with the previous five seasons.



	<29%	29%	30%	31%	32%	33%	34%	35%	36%	37%	38%	39%	40%	41%	42%	43%	44%	45%
2016–20	3%	2%	4%	7%	7%	8%	11%	11%	10%	10%	6%	6%	4%	4%	3%	2%	1%	0%
2021	2%	2%	7%	6%	10%	9%	8%	10%	9%	7%	11%	10%	5%	3%	1%	0%	0%	0%

Kernel recovery %

Figure 13 Distribution of SKR for all farms (2021 versus 2016–2020)

The weight of factory reject losses in 2021 was estimated for all farms in the benchmark sample. **Figure 14** shows a breakdown of those estimated losses per bearing hectare for each factory reject category. The weight of rejects was derived from individual farm reject kernel recovery percentages and then converted to equivalent nut-in-shell (NIS) weights.

It is important to note that the averages shown are weighted according to NIS production, which means larger farms generally exert more influence on the average than smaller farms. This provides the most accurate estimate of the total weight and value of factory rejects across the benchmark sample.

Total losses due to factory rejects in 2021 averaged approximately 164 kg/ha for all farms in the benchmark sample. The most significant of those losses were due to insect damage (51.1 kg/ha) and brown centres (46.8 kg/ha), which collectively accounted for 60% of all losses by weight.

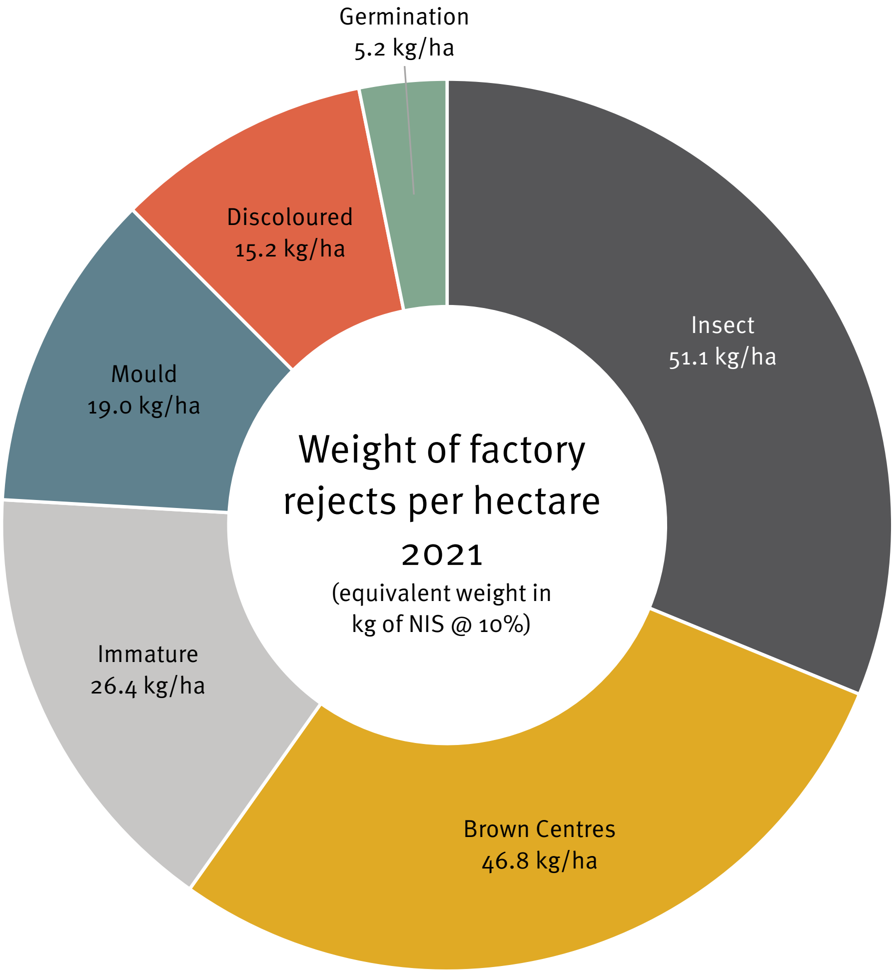


Figure 14 Average weight of factory reject losses per hectare in 2021 (weighted by production)

Factors limiting production in 2021

Since 2017 benchmark participants have been asked to indicate the major limiting factors affecting production on their farm, based on their observations during the season. An average of 216 farms per season have provided these observations. Participants are asked to list their top three seasonal limitations in each of three categories including general factors, pests and diseases.

General limitations

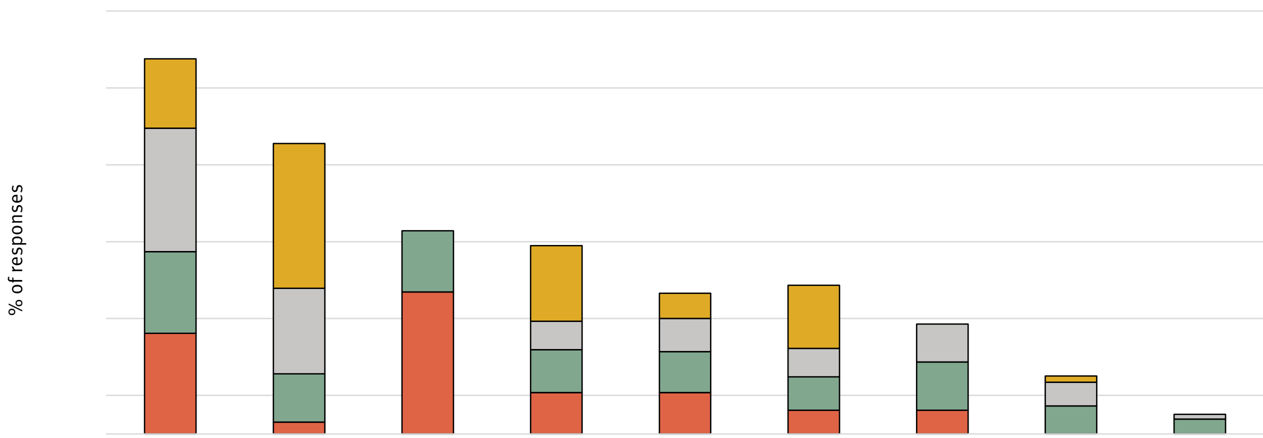
Figure 15 shows the major limiting factors reported in 2021 for each region as well as combined responses for all regions. These are ranked according to the number of times they were listed among the top three limitations across all regions. The numbers shown indicate the percentage of all responses received from each region as well as the overall percentage of responses across the whole sample.

A total of 207 farms indicated 414 seasonal limitations in 2021, representing approximately 78% of all bearing farms in the benchmark sample.

Pests were the major limiting factor reported across the whole sample and particularly for farms between SEQ and MNNSW. More farms reported pests as a limiting factor in 2021 than in the previous two seasons. Hot or dry weather was the major limitation reported in the CQ region in 2021, despite generally more favourable weather conditions compared with the previous year. Many farms in SEQ also indicated hot or dry weather was a limitation in 2021. Wet weather was reported as a limitation in NSW, particularly in the MNNSW region, which was impacted by significant rain events early in the season.

Farms in all regions reported a small number of other limitations, which accounted for 3% of responses overall. Factors included poor flowering, erosion, mistletoe and ongoing effects from previous seasons' drought.

Factors limiting production for the 2021 season



	Pests	Hot/dry weather	Wet weather	Soil or tree health	Disease	Tree or limb removal	Storm or hail	Other	None
CQ	18%	38%	0%	20%	7%	16%	0%	2%	0%
SEQ	32%	22%	0%	7%	9%	7%	10%	6%	1%
NRNSW	21%	13%	16%	11%	11%	9%	13%	7%	4%
MNNSW	26%	3%	37%	11%	11%	6%	6%	0%	0%
All regions	24%	17%	15%	12%	10%	9%	9%	3%	2%

Figure 15 Major factors limiting production in 2021

Pest limitations

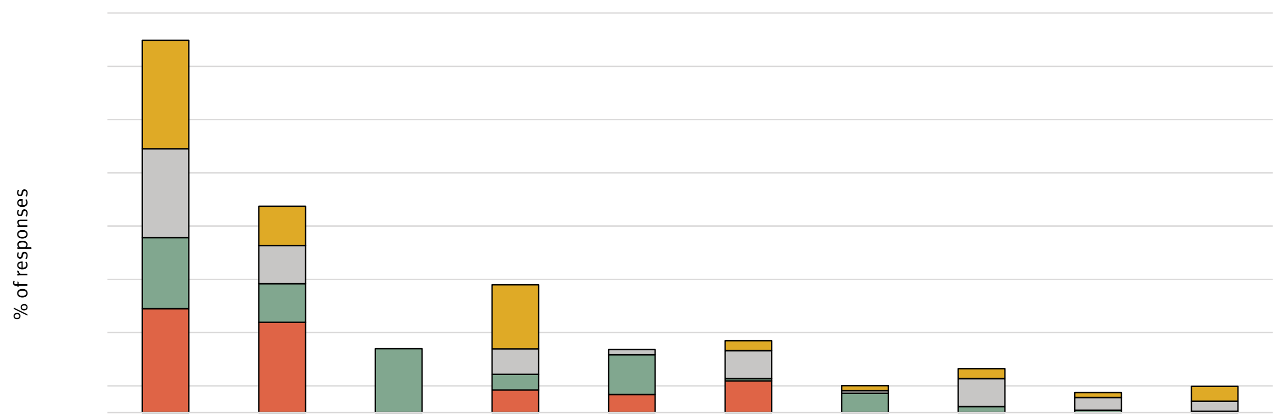
Figure 16 shows a regional breakdown of pest limitation responses received for the 2021 season. The chart shows the percentage of all responses indicating that a specific pest limited production in 2021. A total of 197 farms submitted 439 responses. These farms represented 75% of all bearing farms in the sample.

Fruit spotting bug was the most reported pest limiting production, averaging 37% of responses across all regions. The proportion of farms reporting Fruit spotting bug ranged from 27% in NRNSW to 41% in CQ. Rats were the next most reported pest limitation in all regions, averaging 20% of responses across the sample. The highest proportion of farms reporting rat damage were in MNNSW (34%).

Losses due to Macadamia seed weevil were the next most common response (14% overall), although it is important to note that this pest is largely limited to the NRNSW region, where it accounted for 24% of responses. The remainder of pest responses included Lace bug (10%), Macadamia nut borer (11%), birds (6%), Flower caterpillar (2%) and Green vegetable bug (2%). Although relatively fewer responses were received for these pests overall, significant responses were reported in some regions such as Macadamia nut borer in CQ (24%).

Approximately 5% of farms across all regions indicated other limitations including Bark beetle, Leptocoris, feral pigs, leaf miner and kernel grub.

Pests limiting production for the 2021 season

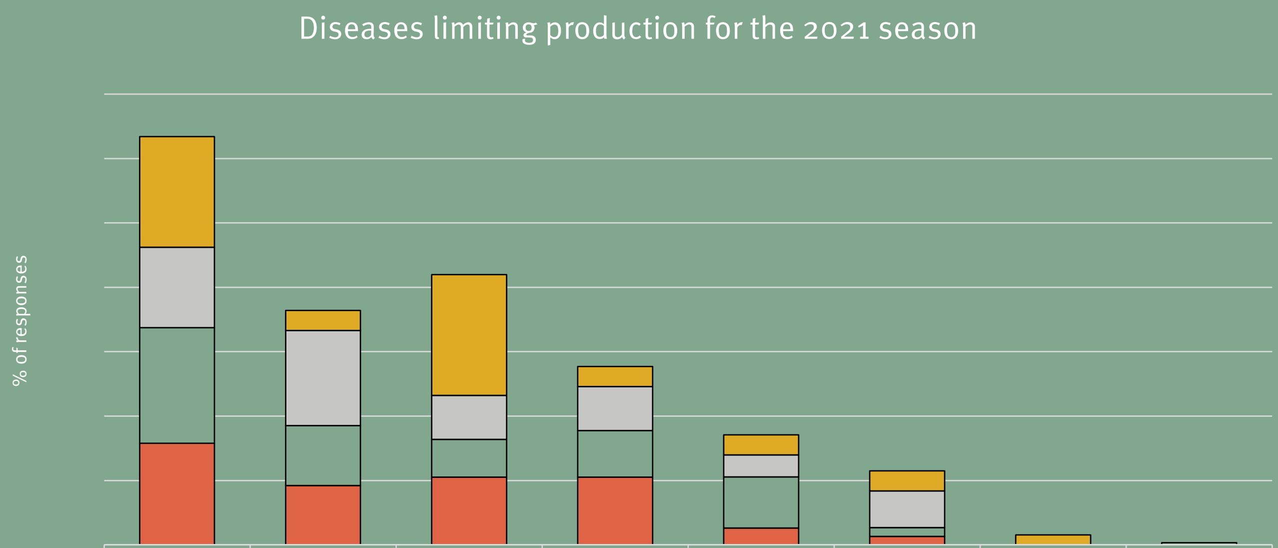


	Fruit spotting bug	Rats	Macadamia seed weevil	Macadamia nut borer	Lace bug	Birds	None	Other	Flower caterpillar	Green vege bug
CQ	41%	15%	0%	24%	0%	4%	2%	4%	2%	6%
SEQ	33%	14%	0%	10%	2%	10%	1%	10%	5%	4%
NRNSW	27%	14%	24%	6%	15%	1%	7%	2%	1%	0%
MNNSW	39%	34%	0%	8%	7%	12%	0%	0%	0%	0%
All regions	37%	20%	14%	11%	10%	6%	5%	5%	2%	2%

Figure 16 Major pests limiting production in 2021

Disease limitations

Figure 17 shows a regional breakdown of disease limitations reported in 2021. The disease most reported was Phytophthora root rot, which averaged 33% of responses across the sample. Branch or tree dieback was the next most reported disease in 2021, with the highest rates evident in CQ (38%). Flower diseases were again reported in NRNSW (16%) but were generally lower in other regions. Although husk spot averaged just 14% of responses overall it was more prevalent in NSW farms and particularly in MNNSW. Husk rot was also reported, mostly in SEQ. Approximately 19% of farms across all regions indicated no significant disease limitations in 2021.



	Phytophthora	None	Branch / tree dieback	Husk spot	Flower diseases	Husk rot	AVG	Leaf diseases
CQ	34%	6%	38%	6%	6%	6%	3%	0%
SEQ	25%	30%	14%	14%	7%	11%	0%	0%
NRNSW	36%	19%	12%	14%	16%	3%	0%	1%
MNNSW	32%	18%	21%	21%	5%	3%	0%	0%
All regions	33%	19%	17%	14%	12%	5%	0%	0%

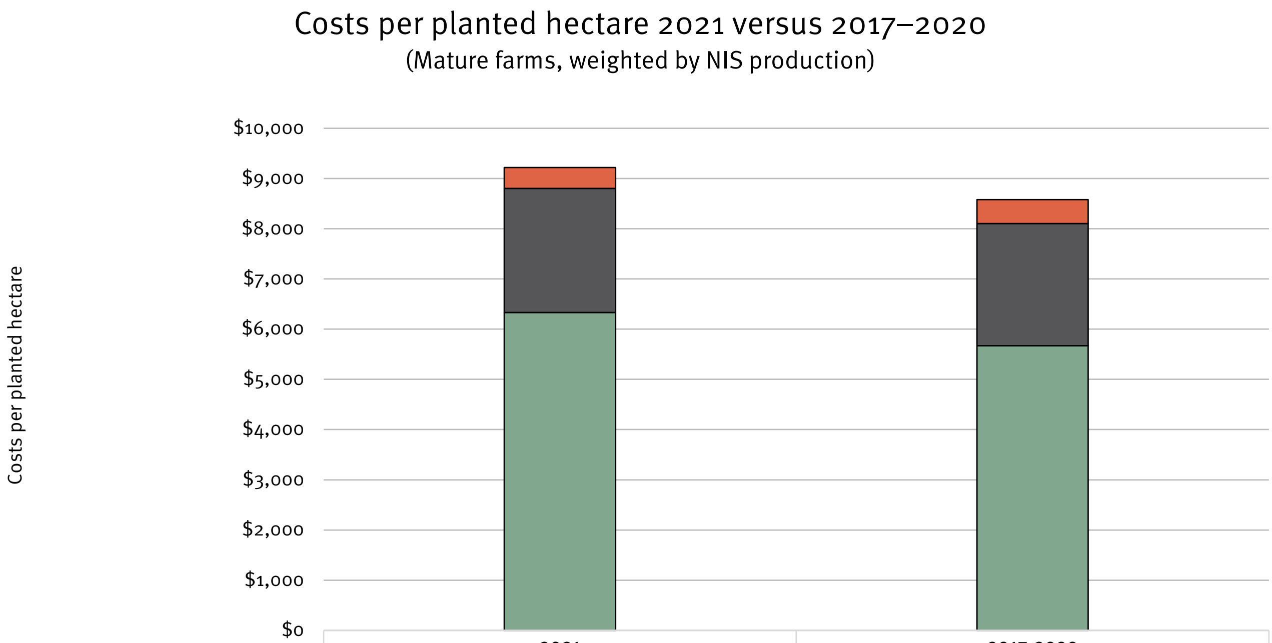
Figure 17 Major diseases limiting production in 2021

Costs in 2021

The benchmarking project has been collecting cost data since 2013. Since 2017 data has also been collected on unpaid labour hours undertaken by owners and managers, to provide a more consistent basis for comparing costs between managed and owner-operated farms. A standard wage rate of $30/hour is applied to unpaid labour hours to derive a notional cost. See the Analyses and methods section for more information about unpaid labour and associated imputation rates.

Figure 18 shows average production costs per planted hectare for 83 mature farms (10+ years old) in 2021 compared with the average of the previous four seasons. Labour is divided into cash and imputed costs and reported separately to all other cash costs. Averages are weighted by NIS production, so farms that produce more NIS exert greater influence on the average.

Weighted average production costs were higher in 2021 compared with the previous four seasons. In 2021 the weighted average of total costs was $9217/ha and $8802/ha for cash costs. Labour cash costs accounted for 28% of total cash costs. When cash and imputed labour costs are combined they account for 31% of total costs in 2021. This is similar to the previous four seasons (34%).



	2021	2017-2020
Unpaid labour (imputed @ $30/hr)	$414	$474
Labour cash costs	$2,472	$2,432
All other cash costs	$6,330	$5,672

Figure 18 Weighted average costs for mature farms (2021 versus 2017–2020)

Figure 19 shows weighted average costs per planted hectare across major heads of expenditure for mature farms in the benchmark sample. Results for the 2021 season (red bars) are compared with the previous four seasons for which imputed labour data is available (grey bars). The costs shown are weighted by planted hectares.

In 2021 the weighted average of total costs including imputed labour was $9217/ha, which is approximately 8% higher than the average for the previous four seasons ($8561/ha). In 2021 employment costs accounted for approximately one-third of total costs, followed by crop nutrition (16%) contractors (7%) and R&M plant (7%).

The most significant cost increases over previous seasons were in leases, nutrition, contractors and utilities.

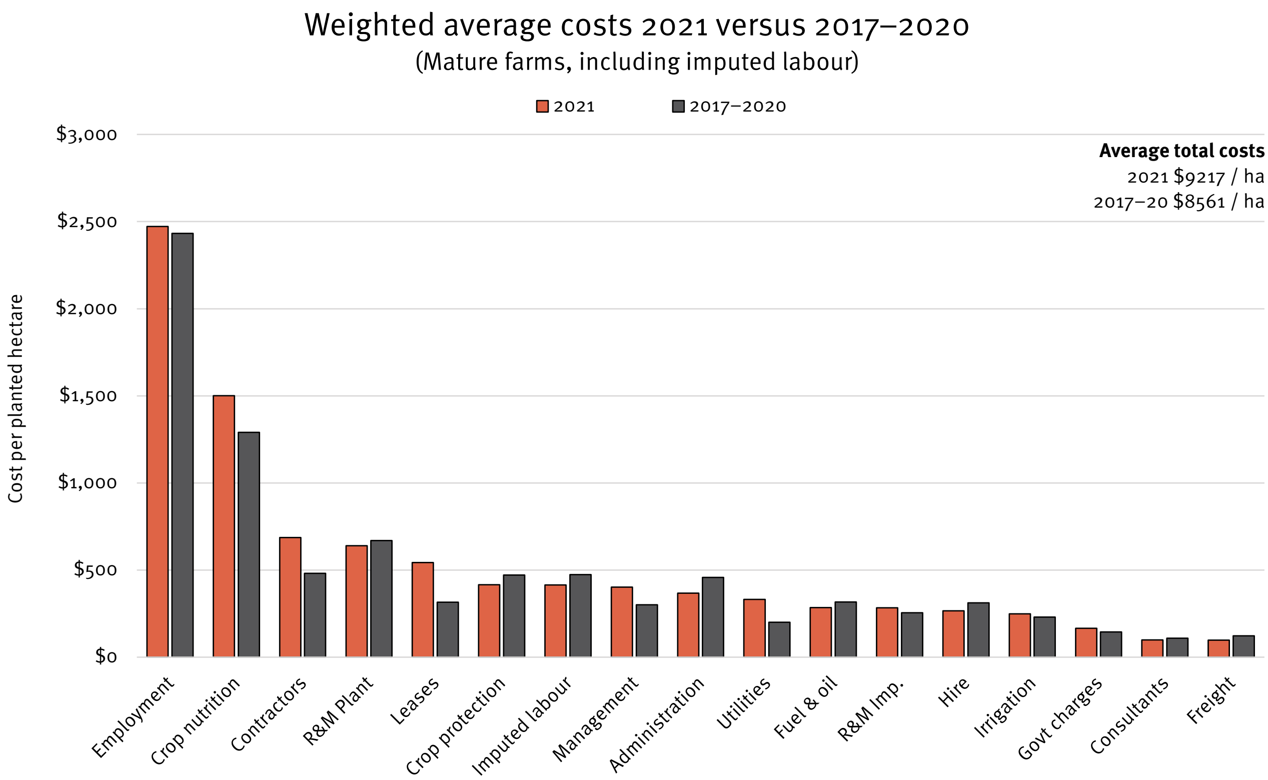


Figure 19 Weighted average heads of expenditure for mature farms (2021 versus 2017–2020)

Figure 20 shows the expenditure priorities nominated by businesses providing cost data in 2021. Each participating business was asked to nominate their top three priorities. These were combined to show the most common priorities for the group.

Mulching or composting was the most reported (37%) followed by canopy management (27%), drainage work (13%), tree removal (9%) and tree planting (5%). The remainder of responses (9%) were grouped into “Other” priorities. These included nutrition, harvesting and irrigation maintenance.

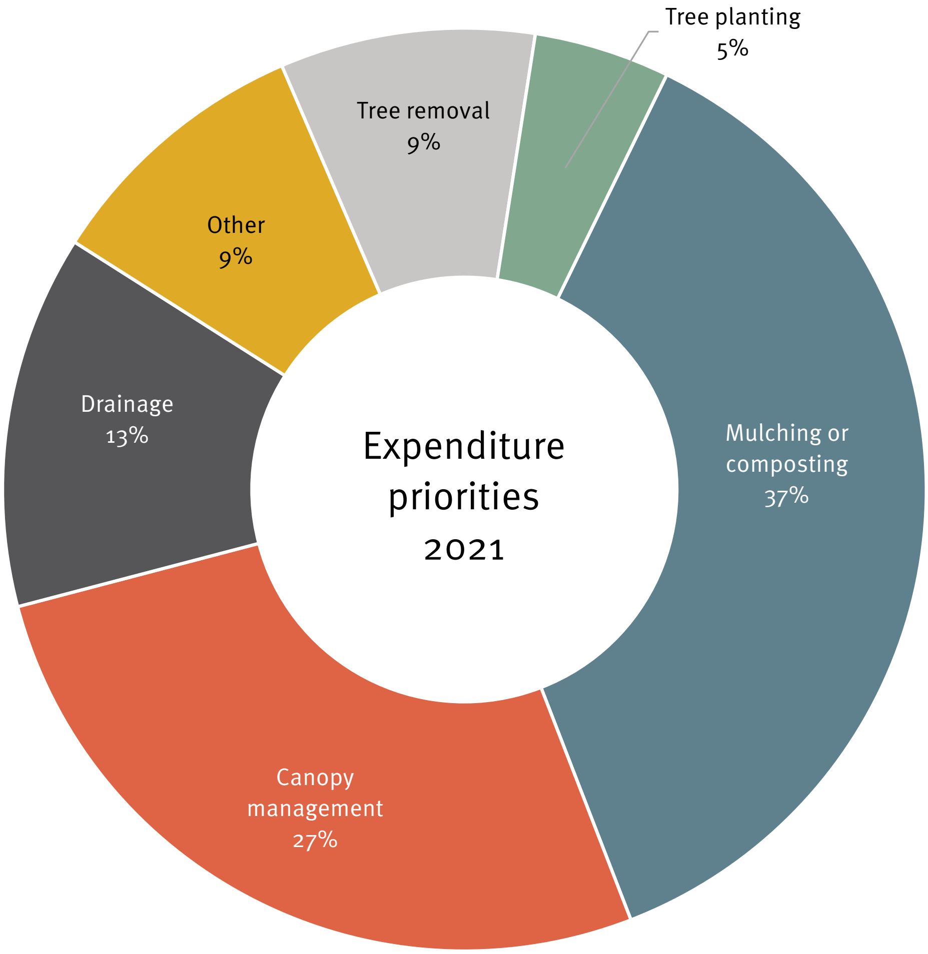
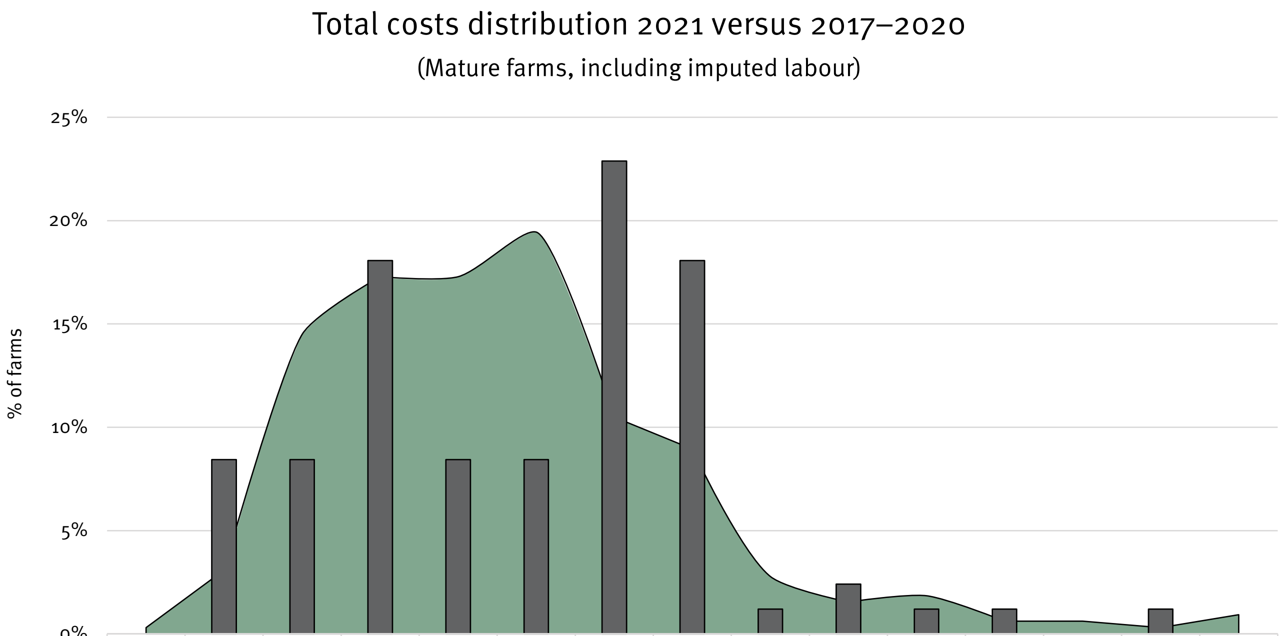


Figure 20 Expenditure priorities for farms that provided cost data in 2021

Figure 21 shows the distribution of total operating costs per hectare for mature farms in the benchmark sample in 2021 (grey bars) and compares this with the previous four seasons (2017–2020, green shaded area). In this instance total costs include unpaid labour, which has been imputed at $30 per hour. The figures at the bottom of the chart show the percentage of farms in each expenditure category.

Expenditure is highly variable between farms and in some cases between seasons for specific farms, particularly where infrequent, relatively expensive operations are undertaken such as orchard rejuvenation. The most common expenditure per hectare in 2021 was around $14,000/ha (23% of farms), although a significant number of farms had both higher and lower expenditure.

More than 40% of farms in the sample had expenditure of between $14,000 and $16,000 per hectare in 2021, which resulted in an 8% increase in weighted average expenditure across the sample. In 2021, as with previous seasons, the distribution of costs is further skewed by a relatively small number of farms with higher-than-average costs (› $18,000/ha). Almost half of all farms that provided cost data in 2021 indicated they had undertaken orchard rejuvenation, which is consistent with the previous four seasons (48%).



	$2K	$4K	$6K	$8K	$10K	$12K	$14K	$16K	$18K	$20K	$22K	$24K	$26K	$28K	$30K
2017–20	0%	3%	15%	17%	17%	19%	10%	9%	3%	2%	2%	1%	1%	0%	1%
2021	0%	8%	8%	18%	8%	8%	23%	18%	1%	2%	1%	1%	0%	1%	0%

Total costs per hectare

Figure 21 Distribution of total costs for mature farms (2021 versus 2017–2020)

Long-term results and trends

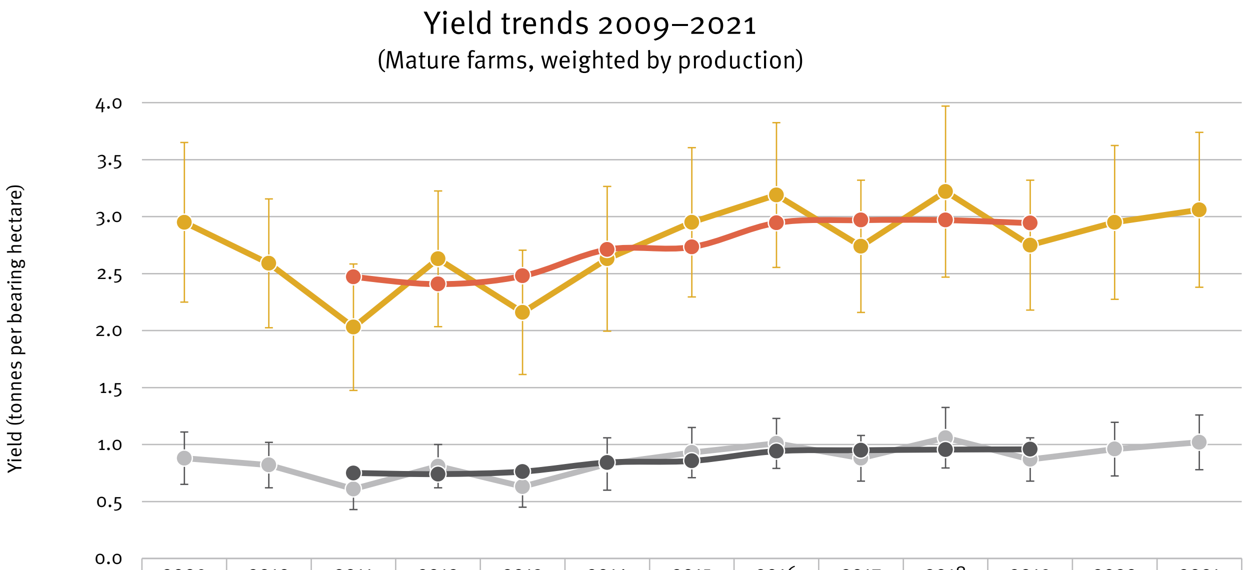
This section shows seasonal productivity and kernel recovery from 2009–2021. This provides insight into long-term trends as well as seasonal variability within the sample. Cost trends are also shown for each year since 2013, when collection of cost data commenced. Costs are related to both planted area and production to highlight any relationships between expenditure and productivity.

Yield and quality trends

Figure 22 shows trends in weighted 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 within the sample.

The long-term average NIS yield for the benchmark sample was 2.8 t/ha with a standard deviation of 1.29 t/ha (46%). The long-term average SK yield was 0.89 t/ha with a standard deviation of 0.45 t/ha (40%). Average NIS and SK yield in 2021 were higher than both 2020 and long-term averages.

Seasonal outcomes typically vary according to factors such as weather, canopy management and orchard rejuvenation. A five-year moving average is included to minimise the impact of seasonal fluctuations and identify long-term shifts in productivity. The five-year moving average from 2009–2021 shows a net increase of approximately 0.47 t/ha (19%) for NIS productivity and 0.2 t/ha (25%) for saleable kernel.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
NIS yield	2.95	2.59	2.03	2.63	2.16	2.63	2.95	3.19	2.74	3.22	2.75	2.95	3.06
NIS Std.dev.	1.40	1.13	1.11	1.19	1.09	1.27	1.31	1.27	1.16	1.50	1.14	1.35	1.36
SK yield	0.88	0.82	0.61	0.81	0.63	0.83	0.93	1.01	0.88	1.06	0.87	0.96	1.02
SK Std.dev.	0.46	0.40	0.36	0.38	0.36	0.46	0.44	0.44	0.40	0.53	0.38	0.47	0.48
NIS 5-year avg			2.47	2.41	2.48	2.71	2.73	2.95	2.97	2.97	2.94		
SK 5-year avg			0.75	0.74	0.76	0.84	0.86	0.94	0.95	0.96	0.96		

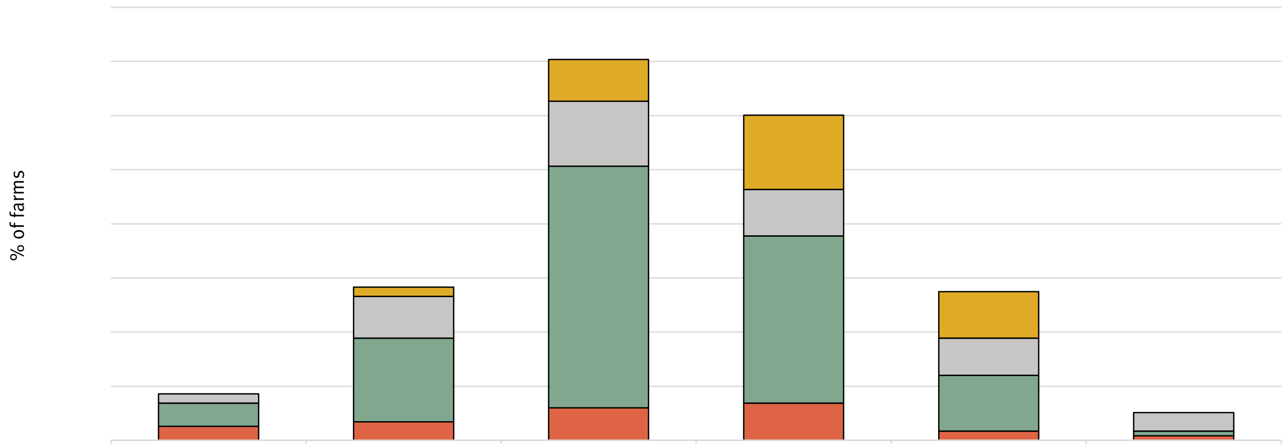
Figure 22 Weighted average NIS and SK yield trends for mature farms 2009–2021

Figure 23 shows the percentage of farms that fall into various NIS productivity categories, ranging from less than 1 t/ha to more than 5 t/ha. This is based on average productivity for each mature farm in the sample over a minimum of four seasons between 2017 and 2021.

Almost two-thirds of farms in the benchmark sample averaged between 2–4 t/ha of NIS. Just 3% of the sample averaged more than 5 t/ha while 4% averaged less than 1 t/ha during the same period.

The CQ region had the smallest range in productivity over the last 5 years (1–5 t/ha) and although most farms averaged 3–4 t/ha (44%) almost one third of farms in this region averaged 4–5 t/ha. All other regions had farms represented across all productivity categories, although there were very few farms in the >5t/ha category in NSW.

Distribution of nut-in-shell productivity 2017–2021
(Mature farms)



	< 1 t/ha	1-2 t/ha	2-3 t/ha	3-4 t/ha	4-5 t/ha	>5 t/ha
CQ	0%	1%	4%	7%	4%	0%
SEQ	1%	4%	6%	4%	3%	2%
NRNSW	2%	8%	22%	15%	5%	0%
MNNSW	1%	2%	3%	3%	1%	0%
All regions	4%	14%	35%	30%	14%	3%

Yield (tonnes per bearing hectare)

Figure 23 Regional long-term NIS productivity for mature farms 2017–2021

Figure 24 shows a regional breakdown of average SK yield per bearing hectare by tree age category for 2009– 2021. Missing values on the chart and in the table indicate that there was insufficient data available for specific tree age categories in some regions. It is important to note that there is relatively less data available for higher average age groups, such as beyond 30 years.

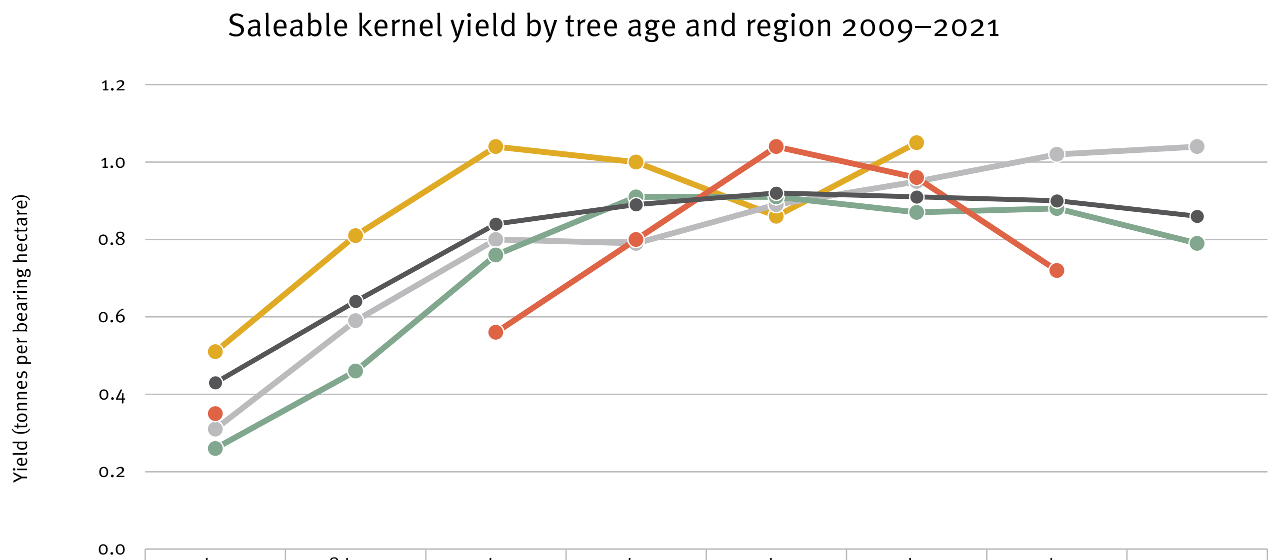
CQ farms with an average tree age of 19 years or younger had significantly higher average yield of SK per hectare than farms of the same age in other regions (P<0.01). This shows that while there is a significant positive correlation between tree age and yield in younger trees, these relationships are complex and farm performance can be influenced by other regional, genetic, climatic or management factors.

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

In NRNSW average SK yield appears to plateau from around 15 years onwards.

There is a significant negative correlation between tree age and yield (SK and NIS per bearing hectare) among farms 35 years and over, indicating a decline in yields for trees above this age in this region (P<0.05). This may also potentially be related to external factors such as those mentioned above rather than tree age.

In MNNSW SK yields appear to peak in the 20 to 24 years age group, with a general decline in older age groups. It is important to note that there are fewer farms in the benchmark sample from the MNNSW region than from other regions and in this case long-term averages for specific age categories are being more heavily influenced by seasonal variation due to the smaller sample size.



	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	0.51	0.81	1.04	1.00	0.86	1.05	-	-
SEQ	0.31	0.59	0.8	0.79	0.89	0.95	1.02	1.04
NRNSW	0.26	0.46	0.76	0.91	0.91	0.87	0.88	0.79
MNNSW	0.35	-	0.56	0.8	1.04	0.96	0.72	-
All regions	0.43	0.64	0.84	0.89	0.92	0.91	0.90	0.86

Figure 24 SK productivity by tree age and region 2009–2021

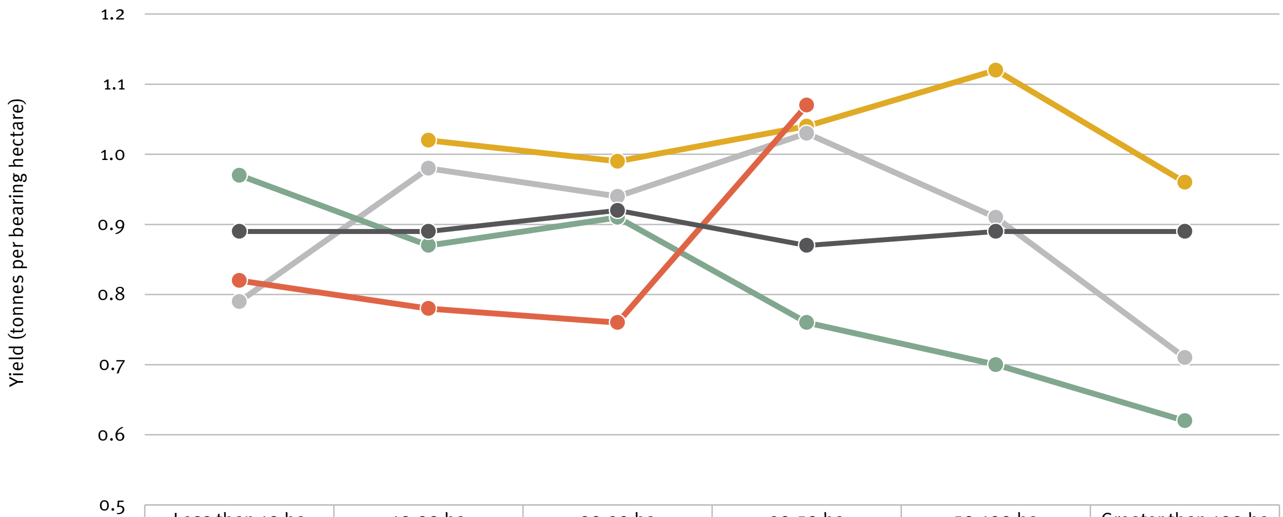
Figure 25 shows average saleable kernel yield by farm size category for mature farms from 2009–2021. It should be noted that there is substantially more data available for some regions such as NRNSW than others such as MNNSW. Similarly, the amount of available data varies according to tree age category. More data is available for larger farm categories than small in the CQ region, whereas the opposite is true for all other regions. Results are shown only where more than 10 farm-years of data are available in any given farm size category.

Analysis of both NIS and SK yield revealed no significant correlations between yield and farm size across the whole benchmark sample ($P>0.05$).

There is however a significant negative correlation between farm size and both NIS and SK productivity in NRNSW ($P<0.01$). There appears to be substantial differences in productivity for 30-50 ha farms compared with smaller farms in MNNSW, although it should be noted that less data is available for this region, particularly within the 20-30 ha category and above 50 ha. For this reason, care should be taken when interpreting any apparent differences between farm size categories in this region.

Saleable kernel yield by farm size and region 2009–2021

(Mature farms, weighted by SK production)

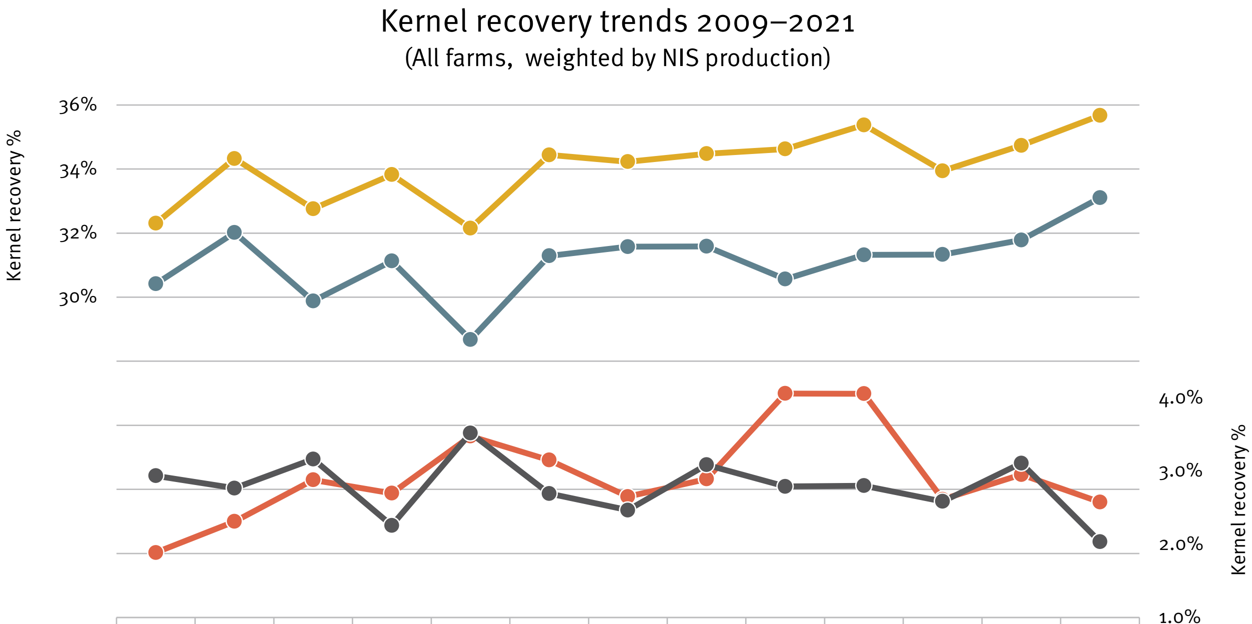


	Less than 10 ha	10-20 ha	20-30 ha	30-50 ha	50-100 ha	Greater than 100 ha
CQ	-	1.02	0.99	1.04	1.12	0.96
SEQ	0.79	0.98	0.94	1.03	0.91	0.71
NRNSW	0.97	0.87	0.91	0.76	0.70	0.62
MNNSW	0.82	0.78	0.76	1.07	-	-
All regions	0.89	0.89	0.92	0.87	0.89	0.89

Figure 25 Saleable kernel yield by farm size and region for mature farms 2009–2021

Figure 26 shows trends in average kernel recovery for all farms in the benchmark sample from 2009–2021. These averages are weighted by NIS yield to reflect the majority of industry production. The left axis shows trends in saleable kernel recovery (SKR) and premium (or sound) kernel recovery (PKR). SKR is the sum of premium and commercial grades. The right axis shows trends in commercial kernel recovery (CKR) and reject kernel recovery (RKR).

SKR and PKR weighted averages were both higher in 2021 than 2020, reaching their highest recorded levels since 2009. Conversely weighted average CKR and RKR were both lower in 2021 than in 2020, with RKR reaching its lowest recorded level since 2009. This was evident across all regions, particularly in CQ where RKR dropped from 3.46% in 2020 to 2.09% in 2021.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
SKR%	32.3	34.3	32.8	33.8	32.2	34.4	34.2	34.5	34.6	35.4	33.9	34.7	35.7
PKR%	30.4	32.0	29.9	31.1	28.7	31.3	31.6	31.6	30.6	31.3	31.3	31.8	33.1
CKR%	1.9	2.3	2.9	2.7	3.5	3.2	2.7	2.9	4.1	4.1	2.6	3.0	2.6
RKR%	2.9	2.8	3.2	2.3	3.5	2.7	2.5	3.1	2.8	2.8	2.6	3.1	2.0

Figure 26 Weighted average kernel recovery trends for all farms 2009–2021

Analysis of factory reject categories provides insight into the specific causes of postharvest losses in any season. Detailed analyses of factory rejects for each region are shown in the Regional results and trends section.

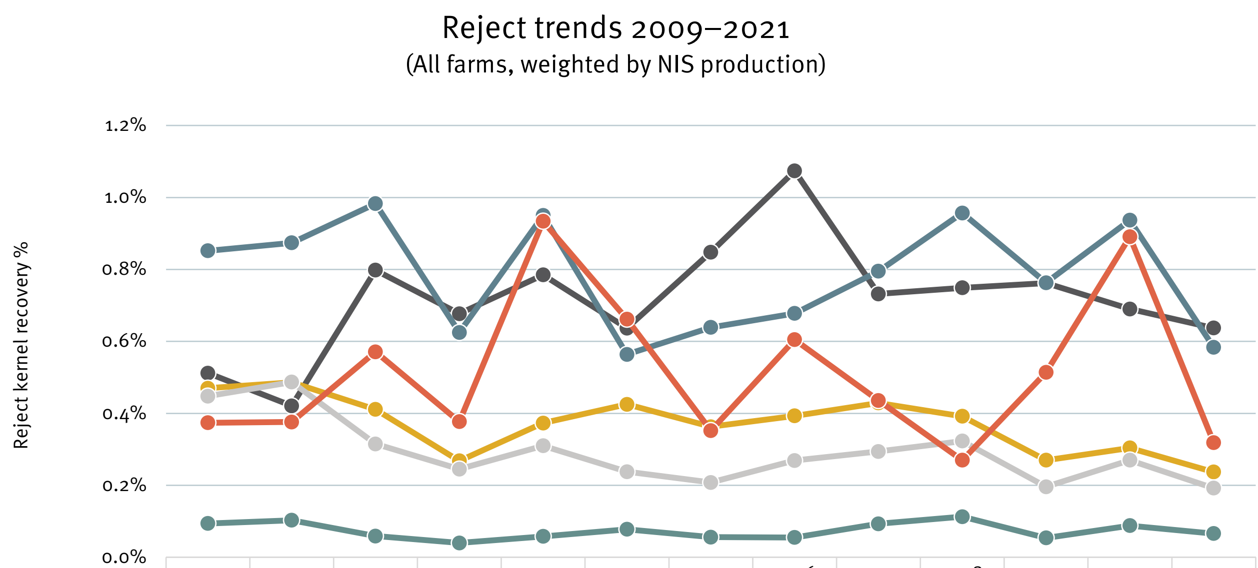
Figure 27 shows the seasonal average percentages of factory reject kernel. Results are weighted by nut-in-shell production, meaning farms that produce more NIS exert greater influence on the average, so this chart provides insight into the relative significance of each reject category at a whole-industry level.

Brown centres has been the most significant cause of factory rejects over the last 13 seasons, when weighted by NIS production. Brown centres rejects tend to be more prevalent on larger farms in the benchmark sample, particularly in the CQ region.

Rejects due to brown centres were well down in 2021 compared with 2020 and previous seasons, particularly on Queensland farms.

Immaturity levels also decreased significantly in 2021 to well below both the 2020 level and the long-term average. While immaturity levels are typically lower than both brown centres and insect damage, levels tend to spike in some seasons. This was particularly evident for Queensland farms in 2020, which in many cases was the result of prolonged hot and dry weather.

Insect damage remains the leading cause of factory reject for many farms in the benchmark sample. Despite this, weighted average insect damage declined further in 2021 to its lowest level since 2014.

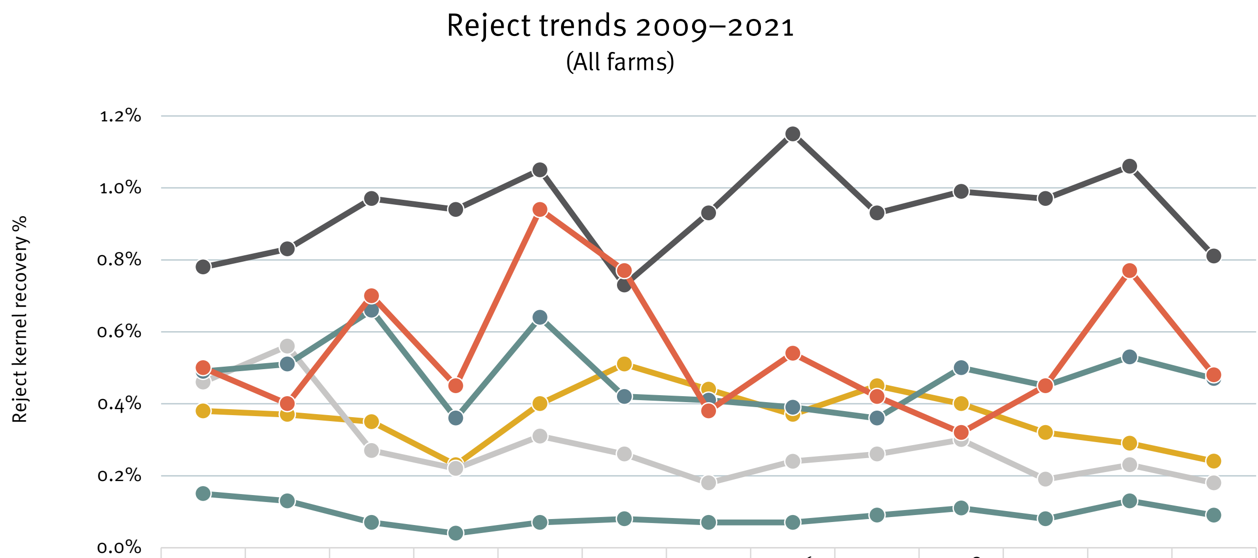


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Insect	0.51	0.42	0.80	0.68	0.79	0.64	0.85	1.07	0.73	0.75	0.76	0.69	0.64
Mould	0.47	0.49	0.41	0.27	0.37	0.43	0.36	0.39	0.43	0.39	0.27	0.30	0.24
Discoloured	0.45	0.49	0.32	0.25	0.31	0.24	0.21	0.27	0.29	0.32	0.20	0.27	0.19
Brown centres	0.85	0.87	0.98	0.63	0.95	0.56	0.64	0.68	0.80	0.96	0.76	0.94	0.58
Immaturity	0.37	0.38	0.57	0.38	0.93	0.66	0.35	0.61	0.44	0.27	0.51	0.89	0.32
Germination	0.09	0.10	0.06	0.04	0.06	0.08	0.06	0.06	0.09	0.11	0.05	0.09	0.07

Figure 27 Average RKR trends by reject category for all farms 2009–2021 (weighted by NIS production)

Figure 28 shows the unweighted averages of all major factory reject categories for farms in the benchmark sample from 2009–2021. As these averages are unweighted each farm in the sample exerts equal influence, regardless of its size or level of production. This provides insight into what is typical for most farms in the sample, rather than most of the production.

Insect damage remained the major cause of factory reject for most farms in the benchmark sample in 2021, despite reduced levels compared with 2020. Immaturity was the next most common cause of factory rejects, although levels in 2021 were much lower than in 2020 and closer to their long-term average of 0.55%. All other forms of factory reject were consistent with or lower than their long-term average.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Insect	0.78	0.83	0.97	0.94	1.05	0.73	0.93	1.15	0.93	0.99	0.97	1.06	0.81
Mould	0.38	0.37	0.35	0.23	0.40	0.51	0.44	0.37	0.45	0.40	0.32	0.29	0.24
Discoloured	0.46	0.56	0.27	0.22	0.31	0.26	0.18	0.24	0.26	0.30	0.19	0.23	0.18
Brown centres	0.49	0.51	0.66	0.36	0.64	0.42	0.41	0.39	0.36	0.50	0.45	0.53	0.47
Immaturity	0.50	0.40	0.70	0.45	0.94	0.77	0.38	0.54	0.42	0.32	0.45	0.77	0.48
Germination	0.15	0.13	0.07	0.04	0.07	0.08	0.07	0.07	0.09	0.11	0.08	0.13	0.09

Figure 28 Average RKR trends by reject category for all farms 2009–2021 (unweighted)

Figure 29 shows rolling five-year averages for all major factory reject categories for farms in the benchmark sample from 2009–2021. Five-year averages help to remove seasonal or short-term fluctuations within each category, providing a clearer view of long-term trends. The averages shown are weighted by NIS production to indicate relative significance of each reject category on broad industry production.

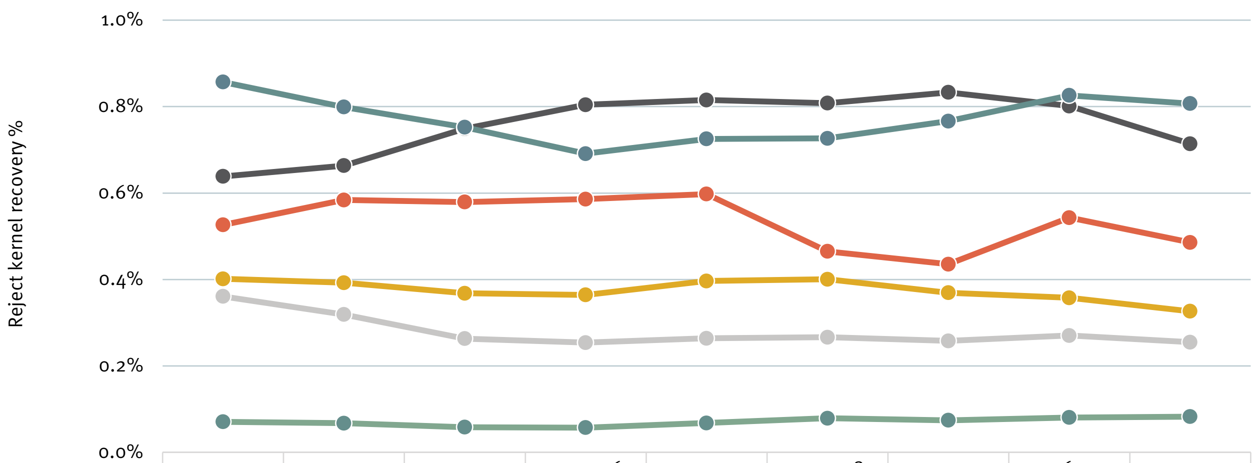
Insect damage followed a rising trend over many years but more recently has shown some signs of plateauing and perhaps declining. This coincides with increased production from farms in the CQ region, which tend to have lower average levels of insect damage compared with other regions.

Levels of brown centres declined for several seasons following their highest recorded levels more than twelve years ago, but have since generally increased in more recent seasons, particularly in Queensland. This trend also coincides with increased production in the CQ region during this period.

Rejects due to immaturity were relatively stable for many years and have more recently shown some signs of decreasing. Despite this trend immaturity levels can vary significantly between farms, regions and seasons.

Rejects due to mould, discolouration and germination fluctuate between seasons but have been generally lower and more stable than other reject categories over the long-term.

Reject trends—rolling five-year averages 2009–2021
(All farms, weighted by NIS production)



	2009–13	2010–14	2011–15	2012–16	2013–17	2014–18	2015–19	2016–20	2017–21
Insect	0.64	0.66	0.75	0.80	0.82	0.81	0.83	0.80	0.71
Mould	0.40	0.39	0.37	0.36	0.40	0.40	0.37	0.36	0.33
Discoloured	0.36	0.32	0.26	0.25	0.26	0.27	0.26	0.27	0.26
Brown centres	0.86	0.80	0.75	0.69	0.73	0.73	0.77	0.83	0.81
Immaturity	0.53	0.58	0.58	0.59	0.60	0.47	0.44	0.54	0.49
Germination	0.07	0.07	0.06	0.06	0.07	0.08	0.07	0.08	0.08

Figure 29 Average RKR trends by reject category for all farms 2009–2021

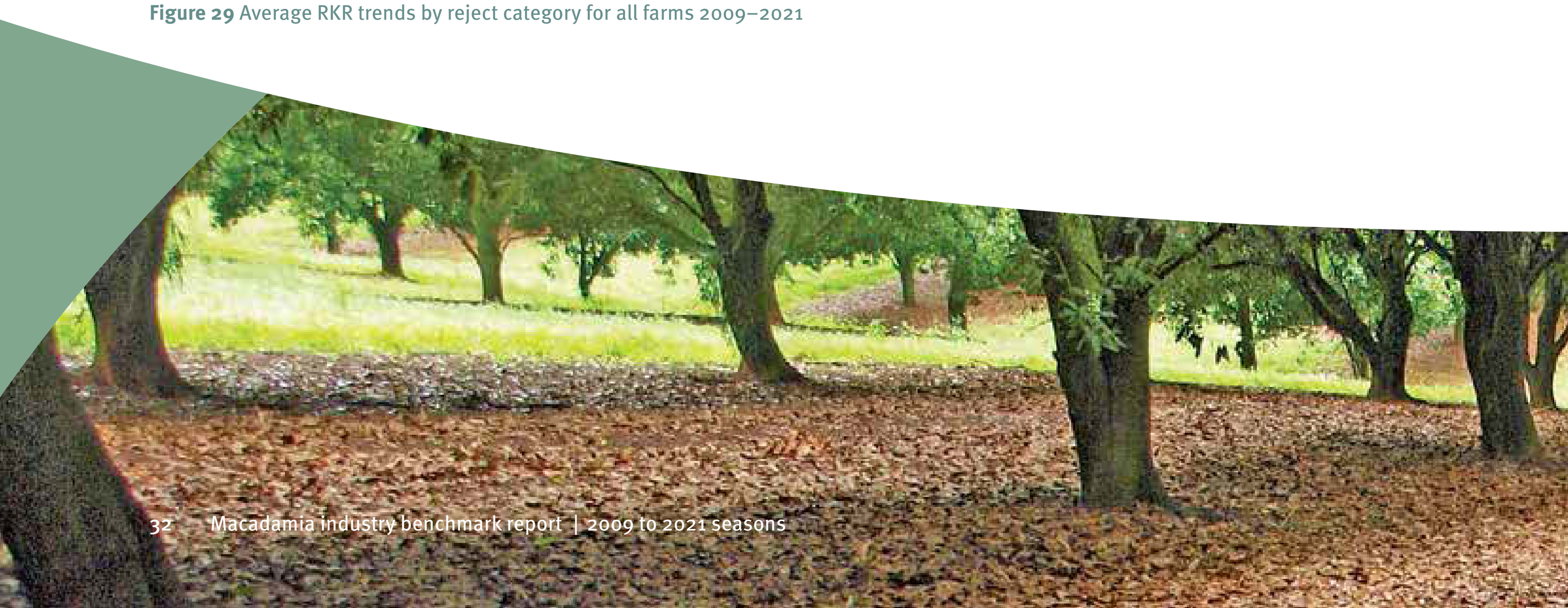
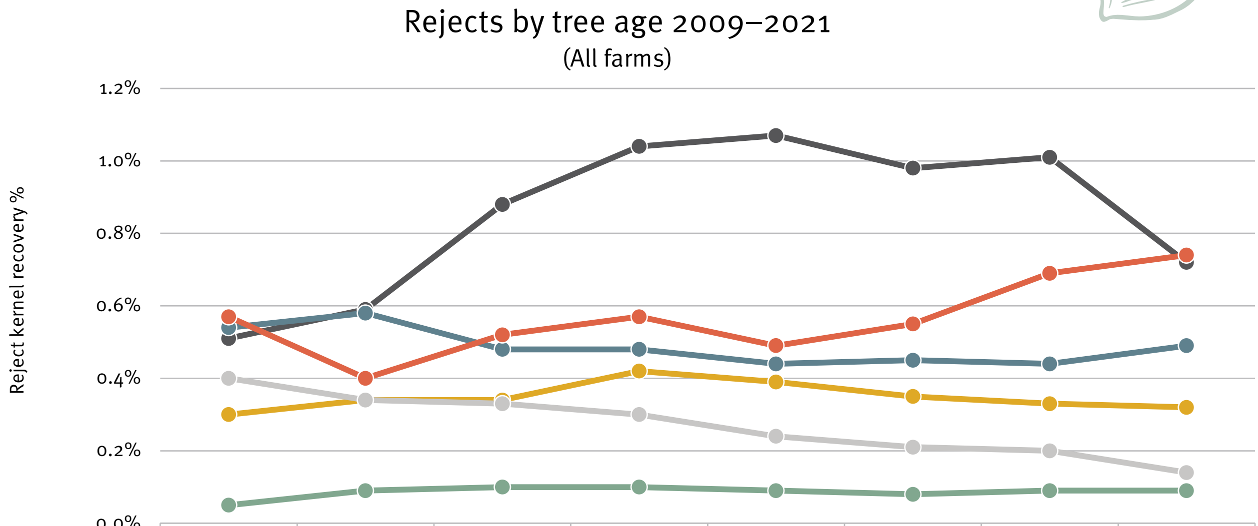


Figure 30 shows average factory rejects by tree age from 2009–2021. The averages shown are unweighted to illustrate the typical influence of tree age at individual farm level rather than across the whole sample.

Insect damage was the major reject category for most age groups and generally increases as tree age increases. Insect damage levels were highest among farms aged 15 to 24 years. Further analysis of rejects by farm size revealed that many small farms fall within this age group, so farm size may also be a contributing factor to high levels of insect damage.

Average immaturity levels were also highest among older farms in the sample. Some of this immaturity may be related to premature nut drop associated with husk spot damage. It is however important to note that weather-related moisture stress has caused significant levels of immaturity in some seasons. This was particularly evident in Queensland in 2013, 2014 and 2020.



	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	0.51	0.59	0.88	1.04	1.07	0.98	1.01	0.72
Mould	0.30	0.34	0.34	0.42	0.39	0.35	0.33	0.32
Discolouration	0.40	0.34	0.33	0.30	0.24	0.21	0.20	0.14
Brown centres	0.54	0.58	0.48	0.48	0.44	0.45	0.44	0.49
Immaturity	0.57	0.40	0.52	0.57	0.49	0.55	0.69	0.74
Germination	0.05	0.09	0.10	0.10	0.09	0.08	0.09	0.09

Figure 30 Average RKR by reject category and tree age 2009–2021

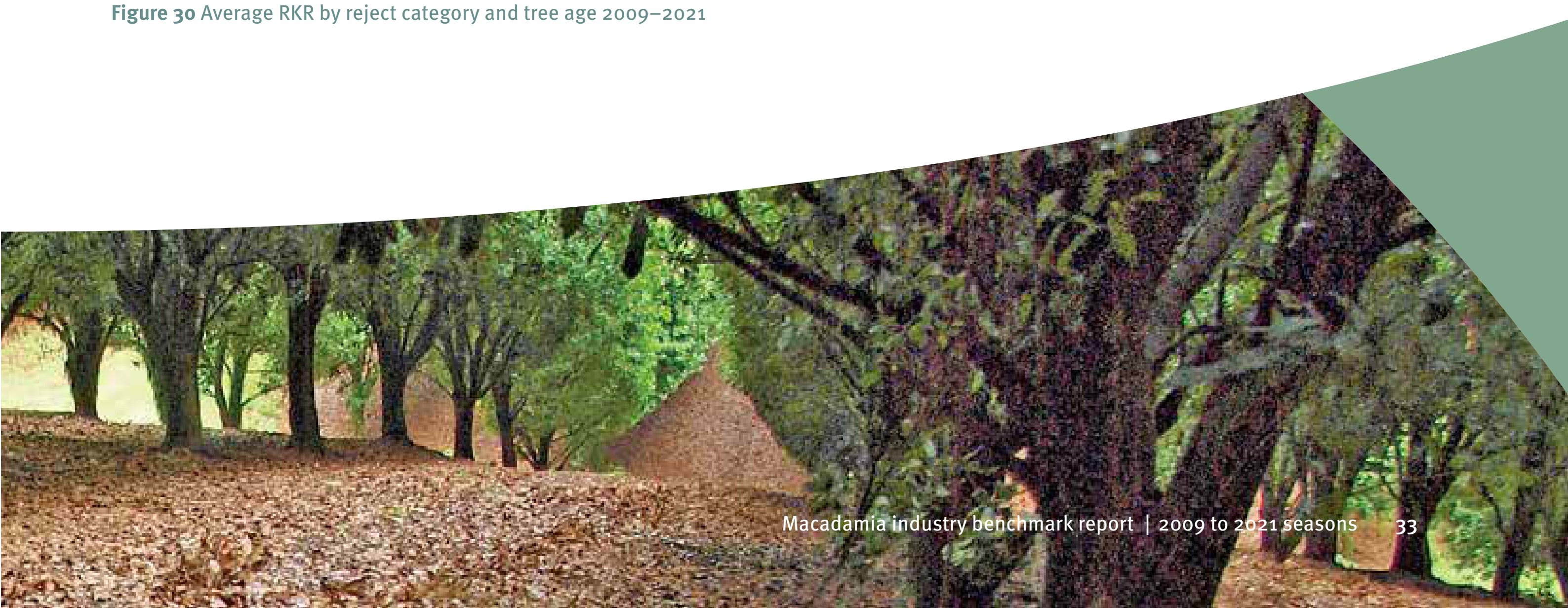
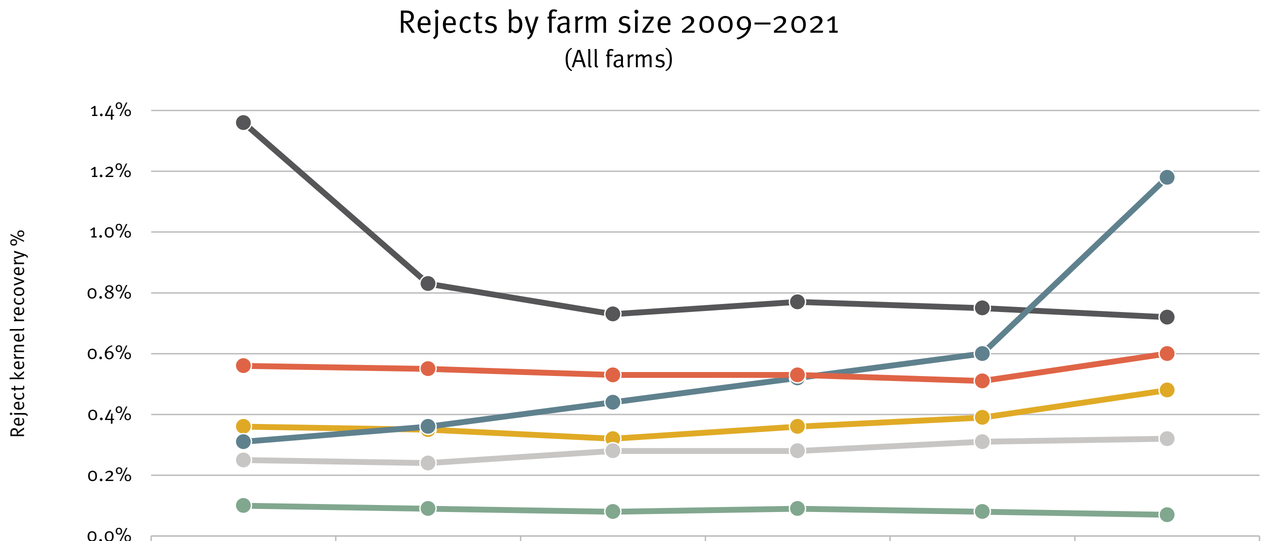


Figure 31 shows a breakdown of long-term average factory rejects by farm size for 2009–2021.

Rejects due to brown centres are directly correlated with farm size (P<0.01). Farms larger than 100 hectares also averaged significantly higher levels of brown centres than all other farm sizes (P<0.01). Rejects due to insect damage were significantly higher on farms less than 10 hectares than all other farm sizes (P<0.01). There was no correlation between insect damage and farm size above 10 hectares. There was also no correlation between farm size and other factory rejects including mould, discolouration, immaturity and germination.



	Less than 10 ha	10 to 20 ha	20 to 30 ha	30 to 50 ha	50 to 100 ha	Greater than 100 ha
Insect	1.36	0.83	0.73	0.77	0.75	0.72
Mould	0.36	0.35	0.32	0.36	0.39	0.48
Discolouration	0.25	0.24	0.28	0.28	0.31	0.32
Brown centres	0.31	0.36	0.44	0.52	0.60	1.18
Immaturity	0.56	0.55	0.53	0.53	0.51	0.60
Germination	0.10	0.09	0.08	0.09	0.08	0.07

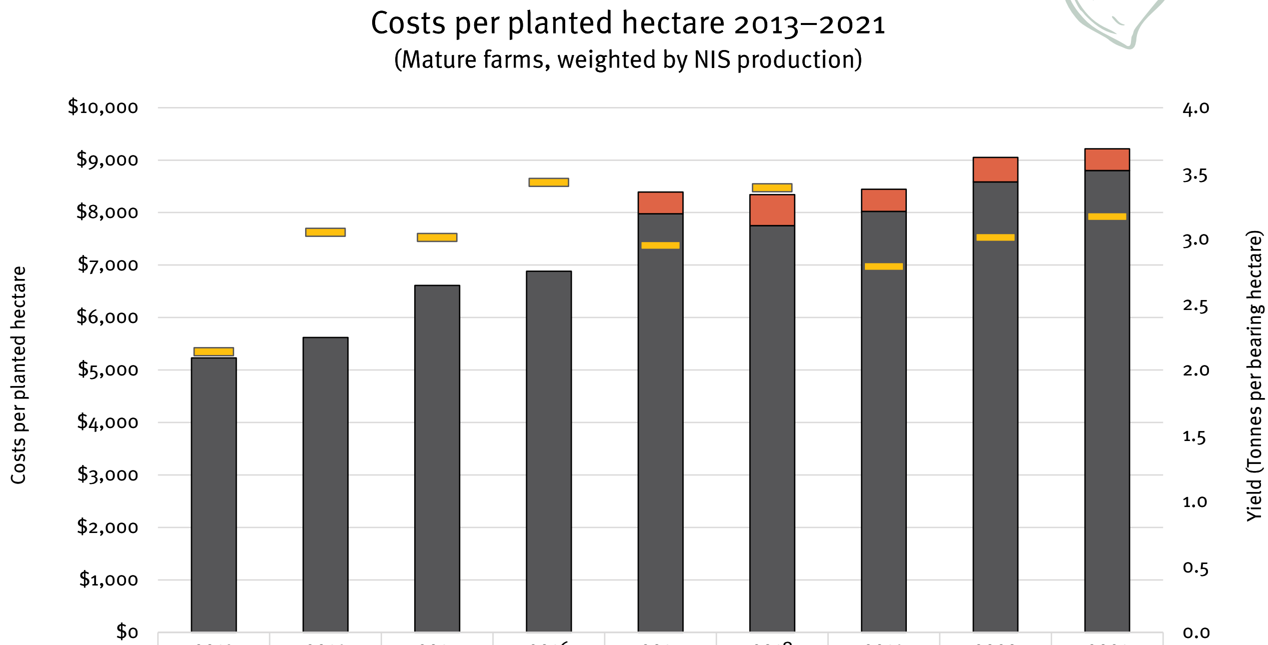
Figure 31 Average RKR trends by reject category and farm size for all farms 2009–2021

Cost trends

Annual cash operating costs have been collected since 2013. Since 2017 participants have also been asked to estimate unpaid labour hours, which are imputed at a standard hourly rate to estimate an equivalent cost. The following analyses are based on data from farms with a weighted average tree age of 10+ years to estimate typical mature farm costs. Cost data from this group totals 561 farm-years since 2013 and 407 farm-years since 2017.

Figure 32 shows weighted average costs per hectare for mature farms from 2013–2021. The use of weighted averages emphasises trends associated with most of industry production. Cash-only costs are shown from 2013–2016 (grey bars) while those from 2017 onwards also include unpaid labour (red bars), which has been imputed at $30/hour. Average NIS yield for those contributing cost data is also shown for each year (gold steps).

Average operating costs per hectare have increased in most seasons since 2009. Cash costs increased by almost 70% over the nine-year period from 2013 to 2021. When imputed at a standard hourly rate of $30, unpaid labour accounted for approximately 5% of total costs from 2017–2021. Total operating costs, including imputed labour, increased by approximately 11% from 2017 to 2021. Feedback from growers suggests that favourable margins in recent years may have supported increased farm expenditure.



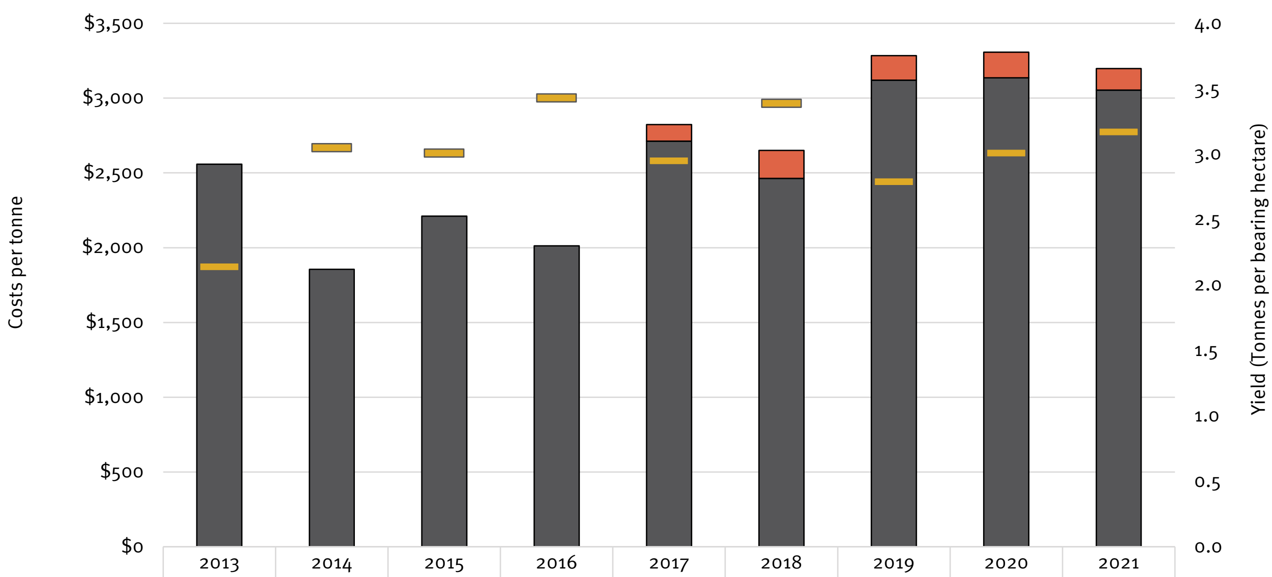
	2013	2014	2015	2016	2017	2018	2019	2020	2021
Imputed labour	-	-	-	-	$415	$589	$421	$470	$414
Cash costs	$5,232	$5,619	$6,611	$6,881	$7,976	$7,752	$8,023	$8,583	$8,802
Total costs					$8,303	$8,341	$8,443	$9,052	$9,217
NIS yield	2.14	3.05	3.01	3.43	2.95	3.39	2.79	3.01	3.17

Figure 32 Weighted average costs per hectare for mature farms 2013–2021

Figure 33 shows weighted average costs per tonne of nut-in-shell for mature farms (10+ years old) from 2013–2021. The use of weighted averages emphasises trends associated with most of industry production.

Cash-only costs are shown from 2013–2016 (grey bars) while those from 2017 onwards also include unpaid labour (red bars), which has been imputed at $30/hour. Average NIS yield is also shown for each year (gold steps).

Average operating costs per tonne of NIS are more variable than costs per hectare due to seasonal variation in productivity. Cash costs per tonne of NIS increased by almost 20% over the nine-year period from 2013 to 2021. Total operating costs including imputed labour increased by approximately 13% over the last five years.



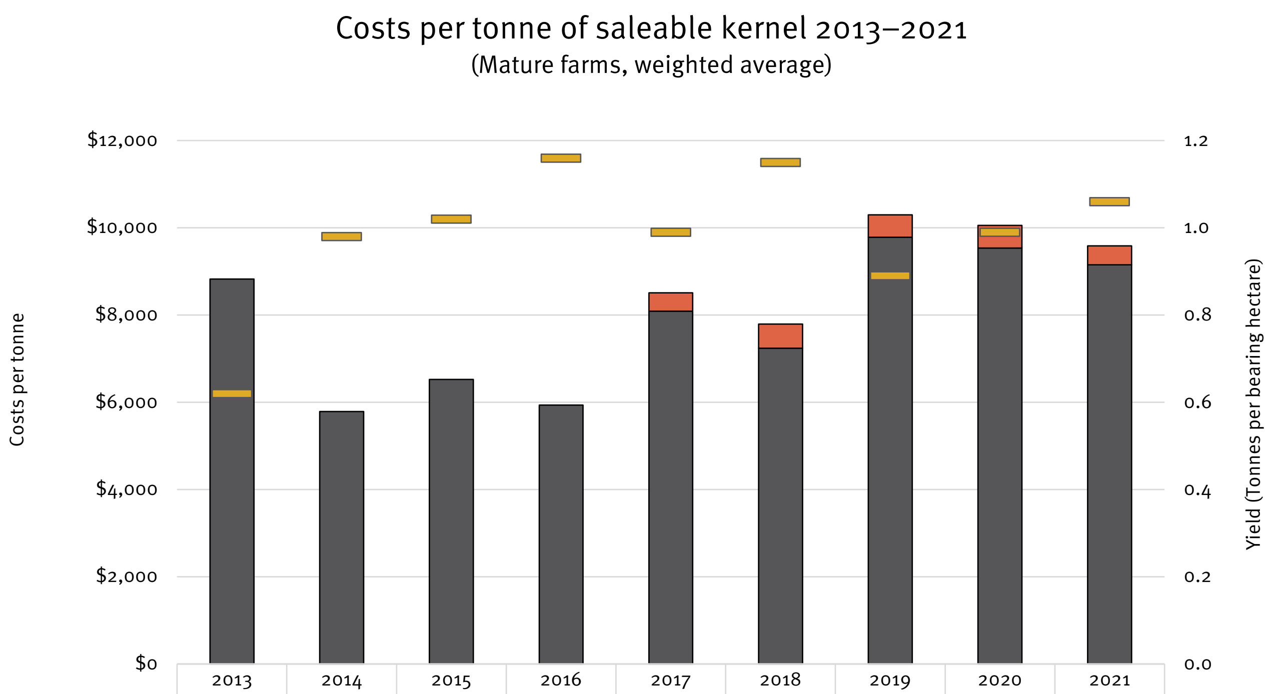
	2013	2014	2015	2016	2017	2018	2019	2020	2021
Imputed labour	$-	$-	$-	$-	$111	$187	$164	$171	$144
Cash costs	$2,559	$1,855	$2,211	$2,013	$2,712	$2,464	$3,120	$3,135	$3,054
NIS yield	2.14	3.05	3.01	3.43	2.95	3.39	2.79	3.01	3.17

Figure 33 Weighted average costs per tonne of nut-in-shell for mature farms 2013–2021

Figure 34 shows weighted average costs per tonne of saleable kernel for mature farms (10+ years old) from 2013–2021. The use of weighted averages emphasises trends associated with most of industry production.

Cash-only costs are shown from 2013–2016 (grey bars) while those from 2017 onwards also include unpaid labour (red bars), which has been imputed at $30/hour. Average SK yield is also shown for each year (gold steps).

Although average operating costs per tonne of SK have generally increased over this period, there is substantial variability in averages between seasons. Costs per tonne of SK more variable than costs per tonne of NIS due to seasonal variation in kernel recovery as well as production.



	2013	2014	2015	2016	2017	2018	2019	2020	2021
Imputed labour	$-	$-	$-	$-	$421	$550	$513	$521	$431
Cash costs	$8,824	$5,786	$6,521	$5,933	$8,089	$7,240	$9,780	$9,534	$9,151
SK yield	0.62	0.98	1.02	1.16	0.99	1.15	0.89	0.99	1.06

Figure 34 Weighted average costs per tonne of saleable kernel for mature farms 2013–2021

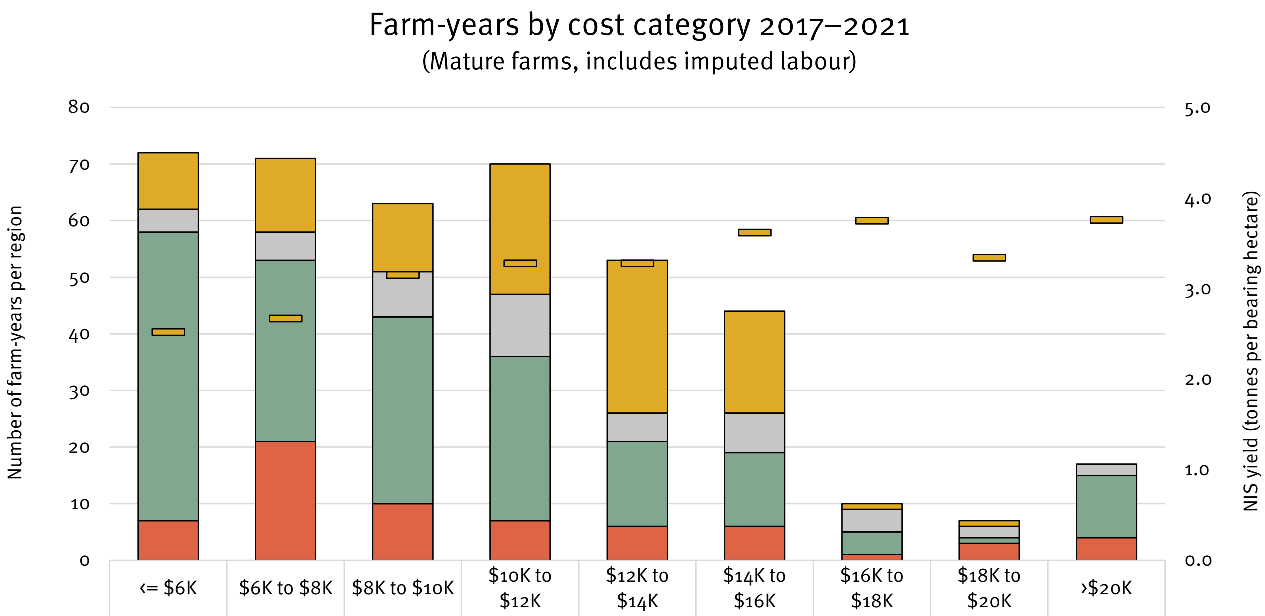
Figure 35 shows a breakdown of mature farm-years by categorised expenditure over the last five seasons. Total costs in this instance include all cash costs plus unpaid labour, which has been imputed at $30/hour. Each bar on the chart shows a regional breakdown of the number of farm-years where total expenditure per planted hectare was within a specific range during this period. The corresponding average NIS production (t/ha) is also shown for each cost category.

The most common expenditure range over the last five seasons was less than $6000/ha (72 farm-years or 18% of the sample), followed by $6000-8000/ha and $10,000-$12,000/ha (17% each). There is however wide variation in expenditure between farms and regions.

A larger proportion of NSW farms spent less than $12,000 / ha (75%) than Queensland farms (56%). Conversely, 44% of Queensland farms averaged more than $12,000 / ha compared with just 25% of NSW farms.

Costs of more than $20,000/ha were reported by 4% of farms (17 farm-years). Most farms in this category were from NRNSW and MNNSW (each 6%). Almost half of this group indicated they had undertaken orchard rejuvenation during this period.

Average NIS production generally increased with average expenditure up to around $18,000/ha during this period.



	<= $6K	$6K to $8K	$8K to $10K	$10K to $12K	$12K to $14K	$14K to $16K	$16K to $18K	$18K to $20K	>$20K
CQ	10	13	12	23	27	18	1	1	0
SEQ	4	5	8	11	5	7	4	2	2
NRNSW	51	32	33	29	15	13	4	1	11
MNNSW	7	21	10	7	6	6	1	3	4
NIS yield	2.52	2.67	3.15	3.28	3.28	3.62	3.75	3.34	3.76

Figure 35 Farms by cost category for mature farms 2017–2021

Regional results and trends

Yield and quality trends are compared in this section for each of 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).

When considering regional performance it is important to understand the underlying differences between farms in each region in terms of orchard characteristics, climate, management approach and environment. A summary of each region's characteristics is provided at the beginning of each section to provide this context.

While there has been significant recent industry expansion into new regions, such as Northern Rivers coastal flats and Clarence Valley, limited data is available for these regions at this stage. Regional divisions will continue to be reviewed as farms from these new regions reach bearing age and more data becomes available.

Central Queensland

The **Central Queensland (CQ)** region includes the significant production areas in and around Bundaberg, Childers and Maryborough. It also includes currently outlying production areas such as Mackay, Rockhampton and Emerald. A total of 88 of the 305 farms in the 2021 benchmark sample are in the CQ region, 56 of which were bearing in 2021. Almost half of these bearing farms (25) provided cost data in 2021. Most farms in this region are in and around Bundaberg and over two-thirds are managed. CQ has the youngest average tree age of all regions (16 years) and includes some young farms that are yet to reach full maturity. While CQ accounts for just 21% of bearing farms in the benchmark sample, the larger median farm size in this region (57.9 hectares) means that it represented 61% of the sample for planted area and 57% for production in 2021. The Bundaberg region is typically hotter and drier than the more southern macadamia production areas and all farms from this region within the benchmark sample are irrigated.

Figure 36 shows a summary of the 2021 season for the CQ region. Corresponding averages over multiple recent seasons are shown in brackets for comparison. In this case long-term yield and quality spans the previous five seasons (2016–2020) and long-term costs span the previous four seasons (2017–2020) to include both cash and imputed labour. All values are weighted by NIS production.

The 2021 season was generally favourable for farms in CQ, with NIS and SK consistent with the average of the last five seasons. SKR in 2021 was the highest average recorded for the region since 2009 and well above the five-year average. RKR was the lowest seasonal average recorded for the same period. Costs per hectare and per tonne of SK in 2021 were both higher than the averages of the previous four seasons.

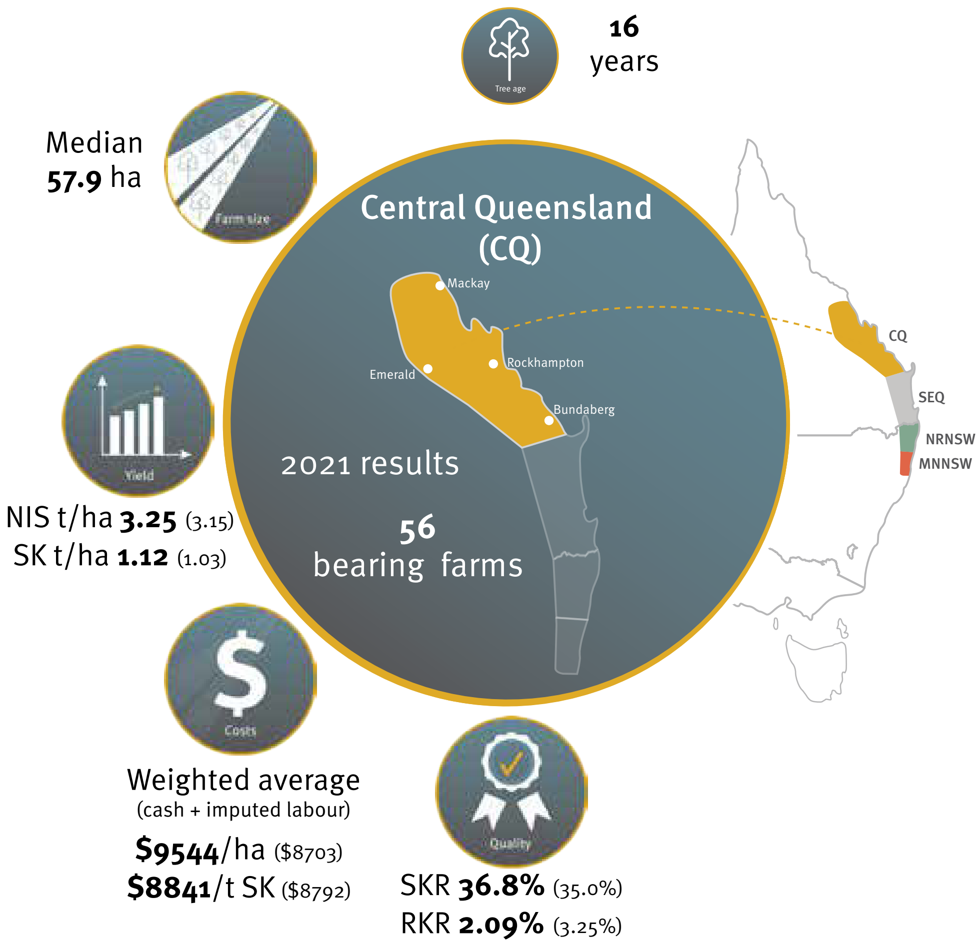
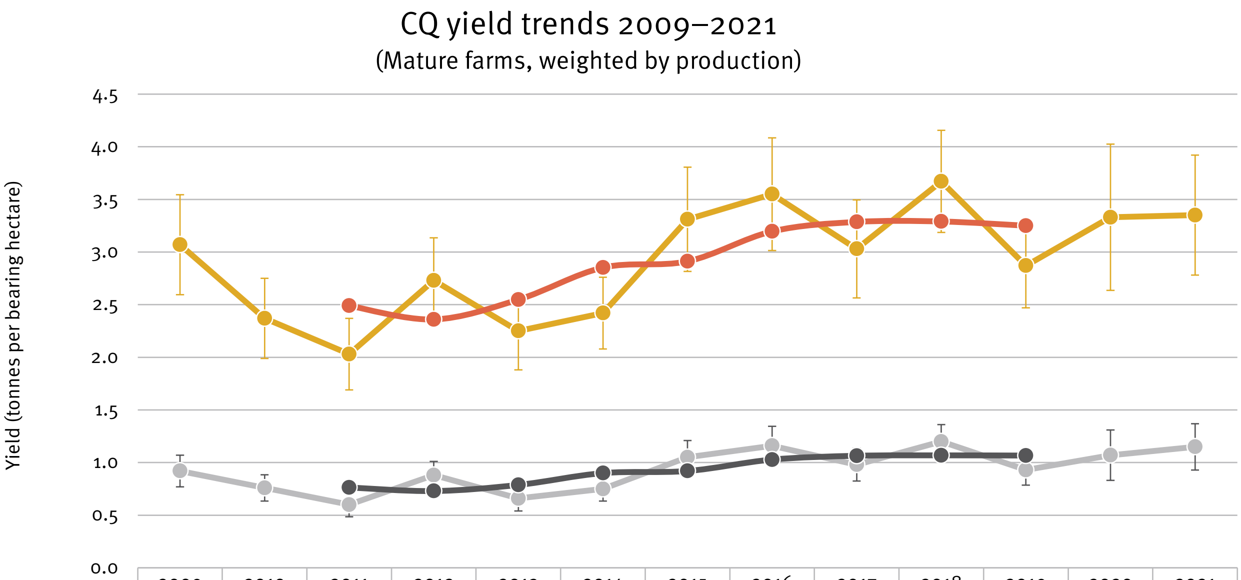


Figure 36 Summary of the 2021 season for the CQ region

Figure 37 shows seasonal trends in NIS yield per hectare (gold) and SK yield per hectare (grey) for mature farms (average age 10+ years) in the CQ region from 2009-2021. Rolling five-year averages are also shown for each (dotted lines). Averages are weighted to represent most of the production for the region. The vertical error bars show the standard deviation for each season. Larger error bars indicate higher variability between farms within the sample within a given season.

Average NIS yield in the CQ region was consistent with 2020, although higher SKR meant that average SK yield was more than 7% higher in 2021. Average NIS and SK yield in CQ in 2021 were both significantly higher than the long-term average for this region ($P<0.01$). The long-term average NIS yield and SK yield for mature farms in the CQ region are significantly higher ($P<0.01$) than the long-term averages for other regions.

Rolling five-year averages indicate that long-term NIS productivity has increased by approximately 30% and SK by more than 40% within the CQ region during the period shown.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
NIS yield	3.07	2.37	2.03	2.73	2.25	2.42	3.31	3.55	3.03	3.67	2.87	3.33	3.35
NIS Std.dev.	0.95	0.76	0.68	0.81	0.74	0.68	0.99	1.07	0.93	0.97	0.80	1.39	1.14
SK yield	0.92	0.76	0.60	0.88	0.66	0.75	1.05	1.16	0.98	1.20	0.93	1.07	1.15
SK Std.dev.	0.30	0.25	0.23	0.26	0.24	0.23	0.32	0.37	0.31	0.32	0.29	0.48	0.44
NIS 5-year avg			2.49	2.36	2.55	2.85	2.91	3.20	3.29	3.29	3.25		
SK 5-year avg			0.76	0.73	0.79	0.90	0.92	1.03	1.06	1.07	1.07		

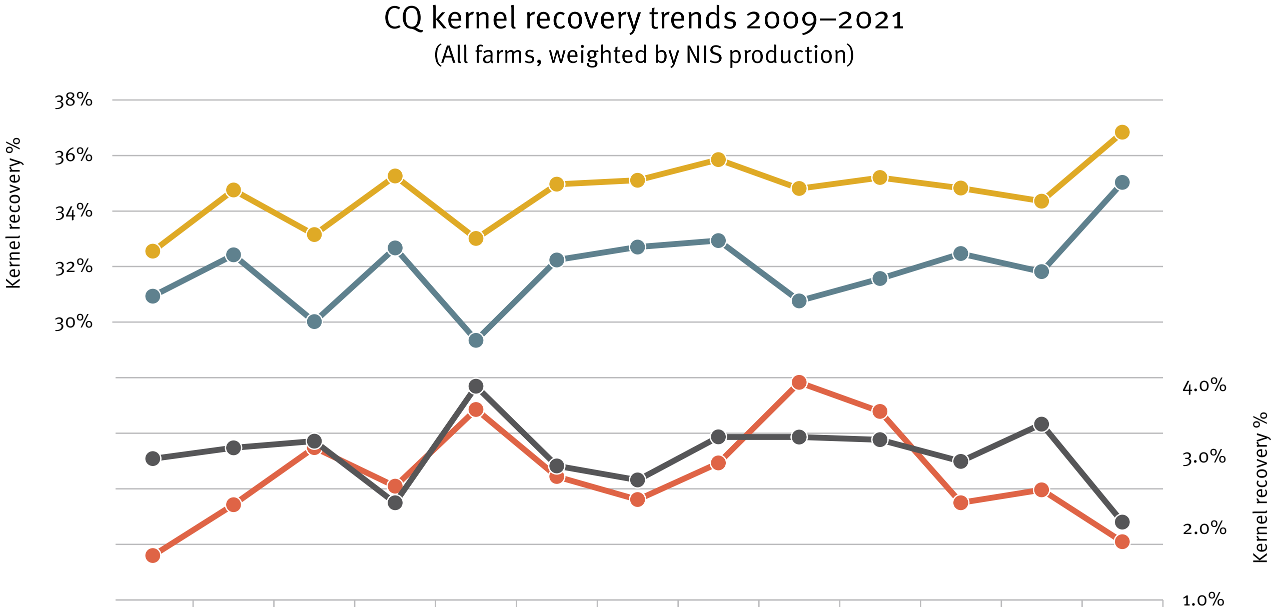
Figure 37 Weighted average NIS and SK yield trends for mature farms in CQ from 2009–2021

Figure 38 compares saleable kernel recovery (SKR), premium kernel recovery (PKR), commercial kernel recovery (CKR) and reject kernel recovery (RKR) trends for farms in the CQ region from 2009 to 2021. Averages are weighted by NIS production.

Both SKR and PKR increased significantly in 2021 compared with the previous season, reaching their highest recorded levels since 2009.

Conversely, both CKR and RKR were lower in 2021 than in the previous season, with RKR reaching its lowest recorded level since 2009.

Weather conditions were generally favourable in this region in 2021 compared with 2020, with lower average temperatures and higher rainfall during nut development.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
SKR%	32.55	34.76	33.15	35.26	33.01	34.97	35.11	35.85	34.81	35.21	34.83	34.36	36.83
PKR%	30.93	32.42	30.02	32.67	29.35	32.24	32.71	32.94	30.77	31.57	32.47	31.82	35.02
CKR%	1.62	2.33	3.13	2.59	3.67	2.73	2.40	2.92	4.05	3.64	2.36	2.54	1.81
RKR%	2.98	3.13	3.22	2.36	3.99	2.88	2.68	3.28	3.28	3.24	2.94	3.46	2.09

Figure 38 Weighted average SKR, PKR, CKR and RKR trends for CQ from 2009–2021

Figure 39 compares factory reject trends for farms in the CQ region from 2009 to 2021, weighted by NIS production.

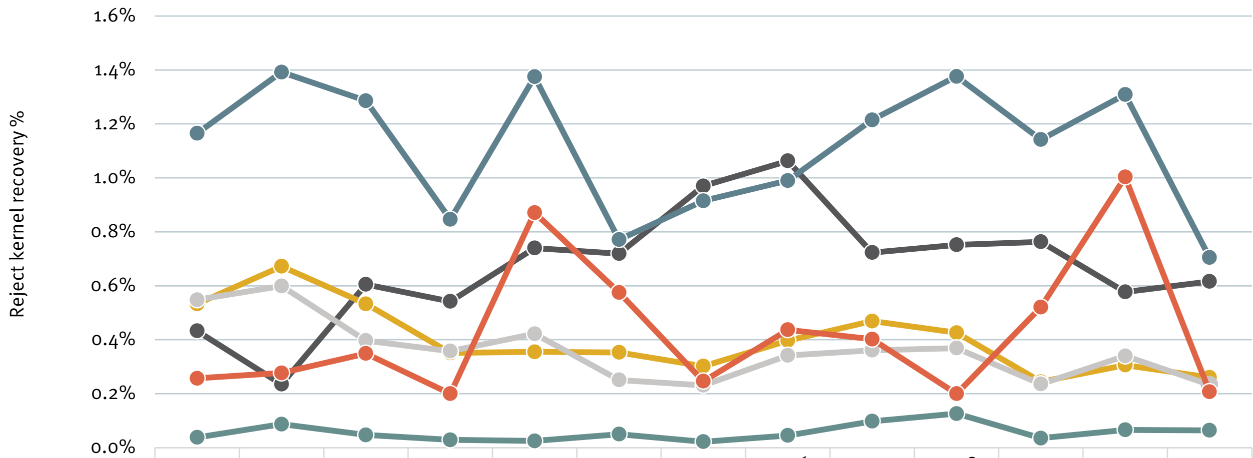
Brown centres has been the major cause of factory rejects for CQ farms in most seasons. Favourable weather conditions leading up to and during the 2021 harvest saw average brown centres levels drop significantly compared with 2020.

Favourable weather conditions also resulted in a significant reduction in immaturity within the region, with record high levels in 2020 declining to near record low levels in 2021.

Insect damage remains a significant cause of factory rejects in CQ, although farms in this region have maintained lower average levels than the whole benchmark sample in most seasons since 2009.

CQ reject trends 2009–2021

(All farms, weighted by NIS production)

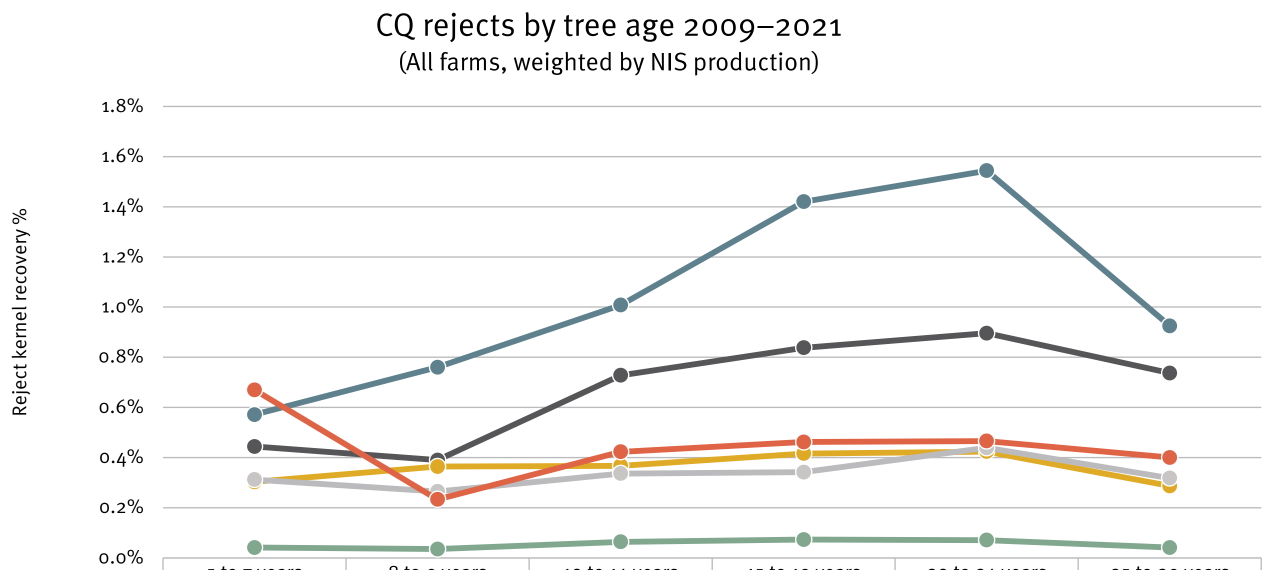


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Insect	0.43	0.24	0.61	0.54	0.74	0.72	0.97	1.06	0.72	0.75	0.76	0.58	0.62
Mould	0.53	0.67	0.53	0.35	0.36	0.35	0.30	0.40	0.47	0.43	0.24	0.31	0.26
Discoloured	0.55	0.60	0.40	0.36	0.42	0.25	0.23	0.34	0.36	0.37	0.24	0.34	0.23
Brown centres	1.17	1.39	1.29	0.85	1.38	0.77	0.92	0.99	1.22	1.38	1.14	1.31	0.71
Immaturity	0.26	0.28	0.35	0.20	0.87	0.58	0.25	0.44	0.40	0.20	0.52	1.00	0.21
Germination	0.04	0.09	0.05	0.03	0.03	0.05	0.02	0.05	0.10	0.13	0.04	0.07	0.06

Figure 39 Weighted average factory reject trends for CQ 2009–2021

Figure 40 shows factory reject trends by tree age for farms in the CQ region from 2009 to 2021. Rejects are shown as a percentage of reject kernel recovery and are weighted by NIS production. Average tree ages are weighted by the number of trees planted.

Brown centres is generally the major cause of factory rejects for farms in the CQ region for most age groups. The chart shows that the incidence of brown centres significantly increases with tree age up to 24 years ($P<0.01$). Factory insect damage followed a similar trend, with a significant positive correlation up to 24 years ($P<0.05$). Both brown centres and insect damage rejects declined above this age, although it should be noted that there are fewer farms in the 25 to 29 years category in the CQ region than in younger age categories.



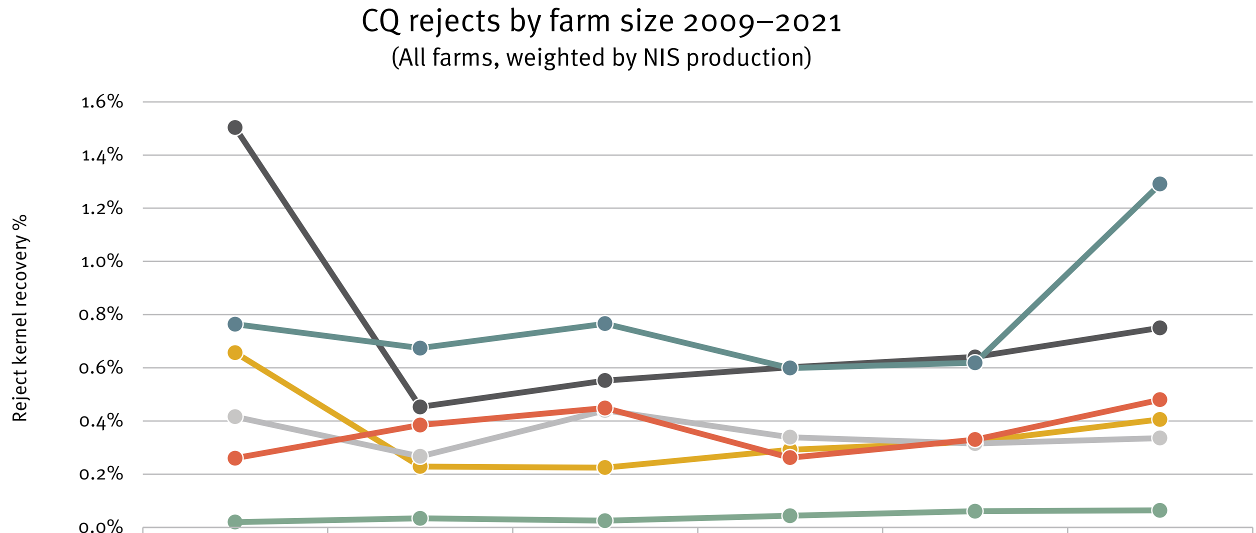
	5 to 7 years	8 to 9 years	10 to 14 years	15 to 19 years	20 to 24 years	25 to 29 years
Insect	0.44	0.39	0.73	0.84	0.90	0.74
Mould	0.30	0.36	0.37	0.42	0.42	0.29
Discolouration	0.31	0.27	0.34	0.34	0.44	0.32
Brown centres	0.57	0.76	1.01	1.42	1.54	0.93
Immaturity	0.67	0.23	0.42	0.46	0.47	0.40
Germination	0.04	0.04	0.06	0.07	0.07	0.04

Figure 40 Weighted average factory rejects by tree age for CQ farms from 2009–2021

Figure 41 shows a breakdown of long-term average factory rejects by farm size for CQ farms from 2009–2021.

Farms larger than 100 hectares had significantly higher average rejects due to brown centres compare with all other farm sizes ($P<0.01$). Farms less than 10 hectares had significantly higher average insect damage than all other farm sizes ($P<0.01$). Farms less than 10 hectares and greater than 100 hectares also had significantly higher average mould levels than other farm sizes ($P<0.05$).

There was no correlation between farm size and other factory reject categories such as discolouration, immaturity and germination.



	Less than 10 ha	10 to 20 ha	20 to 30 ha	30 to 50 ha	50 to 100 ha	Greater than 100 ha
Insect	1.50	0.45	0.55	0.60	0.64	0.75
Mould	0.66	0.23	0.23	0.29	0.32	0.41
Discolouration	0.42	0.27	0.44	0.34	0.32	0.34
Brown centres	0.76	0.67	0.77	0.60	0.62	1.29
Immaturity	0.26	0.39	0.45	0.26	0.33	0.48
Germination	0.02	0.03	0.03	0.04	0.06	0.06

Figure 41 Weighted average factory rejects by farm size for CQ farms 2009–2021

South East Queensland

The **South East Queensland (SEQ)** region represents 17% of the benchmark sample by number of farms, 11% of planted area and 16% of production in 2021. A total of 52 bearing farms participated from the SEQ region in 2021. The region includes the two main production areas of the Glass House Mountains (24 farms) and Gympie (28 farms). Only 11 of the 52 farms in SEQ contributed cost data in 2021.

Approximately 85% of participating farms in SEQ are owner-operated and the region has the oldest average tree age in the benchmark sample (26 years). Approximately one third of farms in this region are not irrigated, most of which are in the Glass House Mountains area. Annual rainfall has been somewhat unreliable in this region in recent years, resulting in challenging conditions in some seasons.

Figure 42 shows a summary of the 2021 season for the SEQ region. Corresponding averages over multiple recent seasons are shown in brackets for comparison. Long-term yield and quality spans the previous five seasons (2016–2020), while long-term costs span the previous four seasons (2017–2020) to include both cash and imputed labour. All values are weighted by NIS production.

The 2021 season was generally favourable for farms in SEQ, with NIS and SK yield both above the average of the last five seasons. In 2021 both PKR and SKR were higher than the previous two seasons and also slightly higher than the five-year average. RKR was lower than the 2020 season and also lower than the long-term average. Weighted average costs per hectare and per tonne of SK in 2021 were both lower than the average of the previous four seasons. High productivity and average expenditure in 2021 meant that SEQ recorded the lowest cost per tonne of SK of all major production regions.

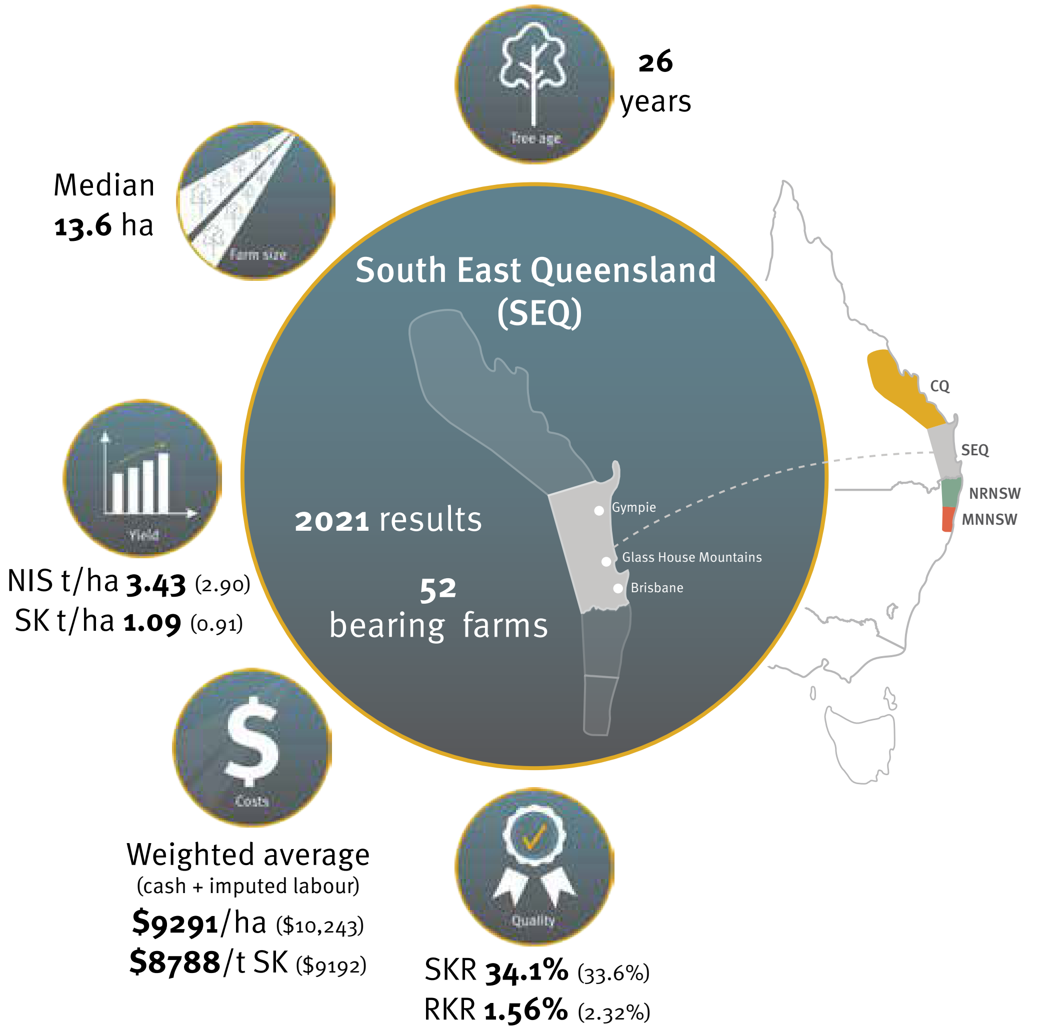
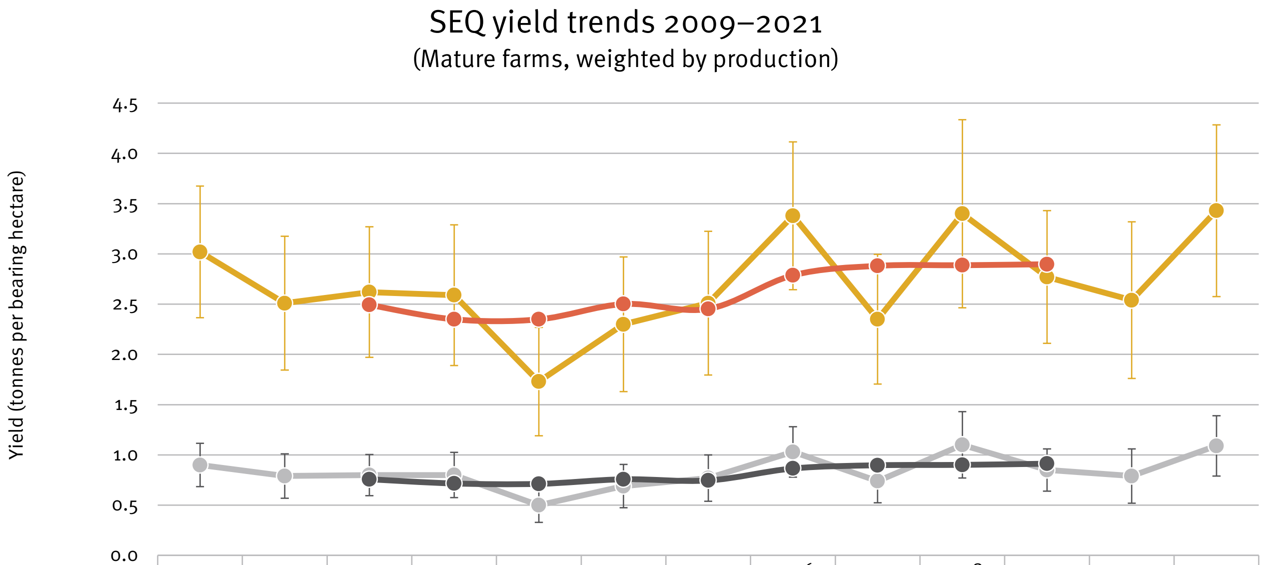


Figure 42 Summary of the 2021 season for the SEQ region

Figure 43 shows seasonal trends in NIS yield per hectare (gold) and SK yield per hectare (grey) for mature farms (average age 10+ years) in the SEQ region from 2009-2021. Rolling five-year averages are also shown for each (dotted lines). Averages are weighted to represent most of the production for the region. The vertical error bars show the standard deviation for each season. Larger error bars indicate higher variability between farms within the sample within a given season.

Average NIS yield for mature farms in the SEQ region was higher than both 2020 and the long-term average, although higher SKR meant that average SK yield was more than 7% higher in 2021. Rolling five-year averages indicate that long-term NIS productivity has increased by approximately 16% and SK by almost 20% within the SEQ region during the period shown.

The long-term average NIS yield in SEQ is similar to NRNSW (P>0.05), significantly greater than MNNSW (P<0.01) and significantly lower than CQ (P<0.01). The long-term average SK yield in SEQ is significantly lower than CQ (P<0.01) but similar to NRNSW and MNNSW (P>0.05).



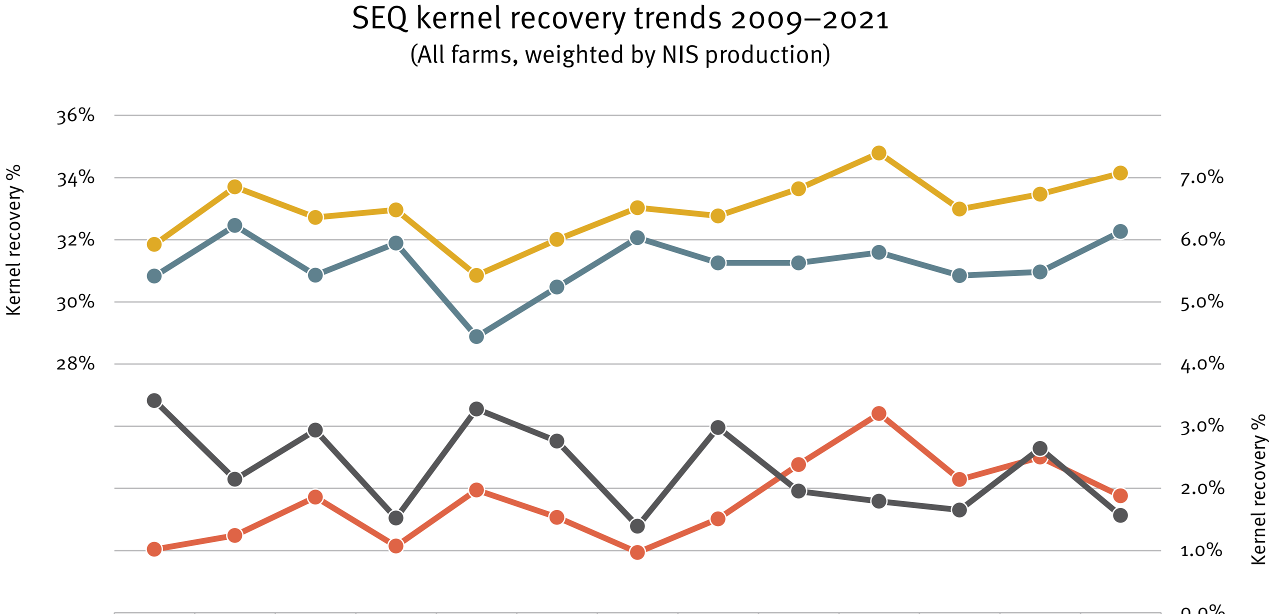
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
NIS yield	3.02	2.51	2.62	2.59	1.73	2.30	2.51	3.38	2.35	3.40	2.77	2.54	3.43
NIS Std.dev.	1.31	1.33	1.30	1.40	1.08	1.34	1.43	1.47	1.29	1.87	1.32	1.56	1.71
SK yield	0.90	0.79	0.80	0.80	0.50	0.69	0.77	1.03	0.74	1.10	0.85	0.79	1.09
SK Std.dev.	0.43	0.44	0.41	0.45	0.34	0.43	0.46	0.50	0.43	0.66	0.42	0.54	0.60
NIS 5-year avg			2.49	2.35	2.35	2.50	2.45	2.79	2.88	2.89	2.90		
SK 5-year avg			0.76	0.72	0.71	0.76	0.75	0.87	0.90	0.90	0.91		

Figure 43 Weighted average NIS and SK yield trends for mature farms in SEQ from 2009–2021

Figure 44 compares saleable kernel recovery (SKR), premium kernel recovery (PKR), commercial kernel recovery (CKR) and reject kernel recovery (RKR) trends for farms in the SEQ region from 2009 to 2021. Averages are weighted by NIS production.

Both SKR and PKR increased in 2021 compared with the previous two seasons, reaching their second highest recorded levels (after 2018) since data collection commenced.

Conversely, both CKR and RKR were lower in 2021 than in the previous season. Weather conditions in 2021 were generally more favourable when compared to recent seasons, with higher rainfall and lower average temperatures, particularly during nut development.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
SKR%	31.85	33.70	32.72	32.96	30.85	32.01	33.03	32.77	33.64	34.79	32.99	33.47	34.14
PKR%	30.83	32.46	30.86	31.89	28.88	30.48	32.06	31.26	31.26	31.59	30.85	30.96	32.27
CKR%	1.02	1.24	1.86	1.07	1.97	1.53	0.97	1.51	2.38	3.20	2.14	2.50	1.88
RKR%	3.41	2.15	2.94	1.52	3.28	2.76	1.39	2.98	1.95	1.79	1.65	2.64	1.56

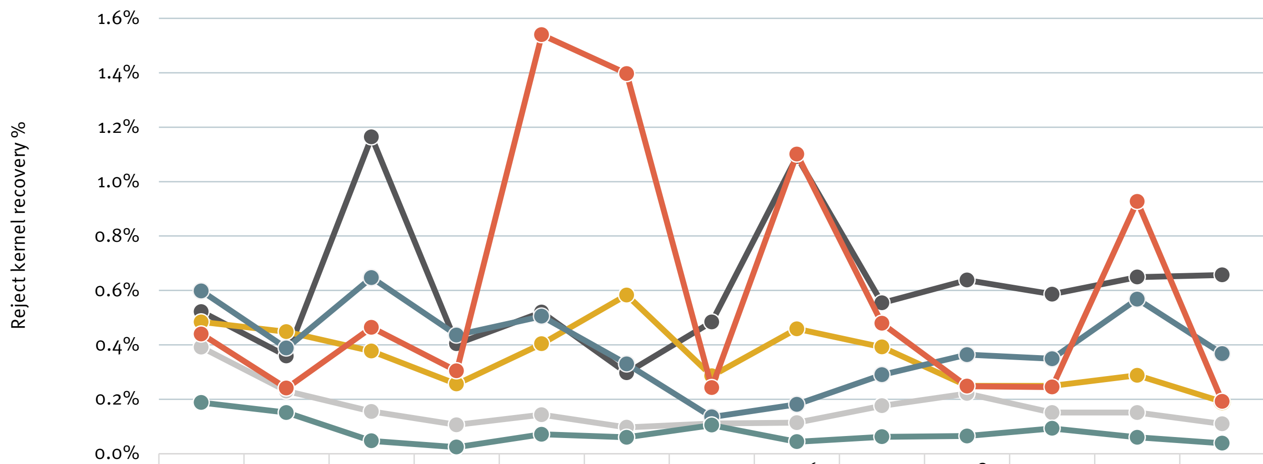
Figure 44 Weighted average SKR, PKR, CKR and RKR trends for SEQ from 2009–2021

Figure 45 compares factory reject trends for farms in the SEQ region from 2009 to 2021, weighted by NIS production.

Insect damage has been the leading cause of factory rejects for farms in SEQ in more than half of the seasons during this period. Insect damage levels in 2021 were comparable with the long-term average (0.64%).

Immaturity has been a significant cause of rejects within the SEQ region in hot and dry seasons, particularly for non-irrigated farms. Favourable rainfall leading into the 2021 season resulted in a significant reduction in immaturity levels compared with the 2020 season.

SEQ reject trends 2009–2021
(All farms, weighted by NIS production)



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Insect	0.52	0.36	1.16	0.40	0.52	0.30	0.48	1.09	0.55	0.64	0.59	0.65	0.66
Mould	0.48	0.45	0.38	0.26	0.40	0.58	0.29	0.46	0.39	0.25	0.25	0.29	0.19
Discoloured	0.39	0.23	0.16	0.11	0.14	0.10	0.11	0.11	0.18	0.22	0.15	0.15	0.11
Brown centres	0.60	0.39	0.65	0.44	0.51	0.33	0.14	0.18	0.29	0.36	0.35	0.57	0.37
Immaturity	0.44	0.24	0.46	0.30	1.54	1.40	0.24	1.10	0.48	0.25	0.25	0.93	0.19
Germination	0.19	0.15	0.05	0.02	0.07	0.06	0.11	0.04	0.06	0.07	0.09	0.06	0.04

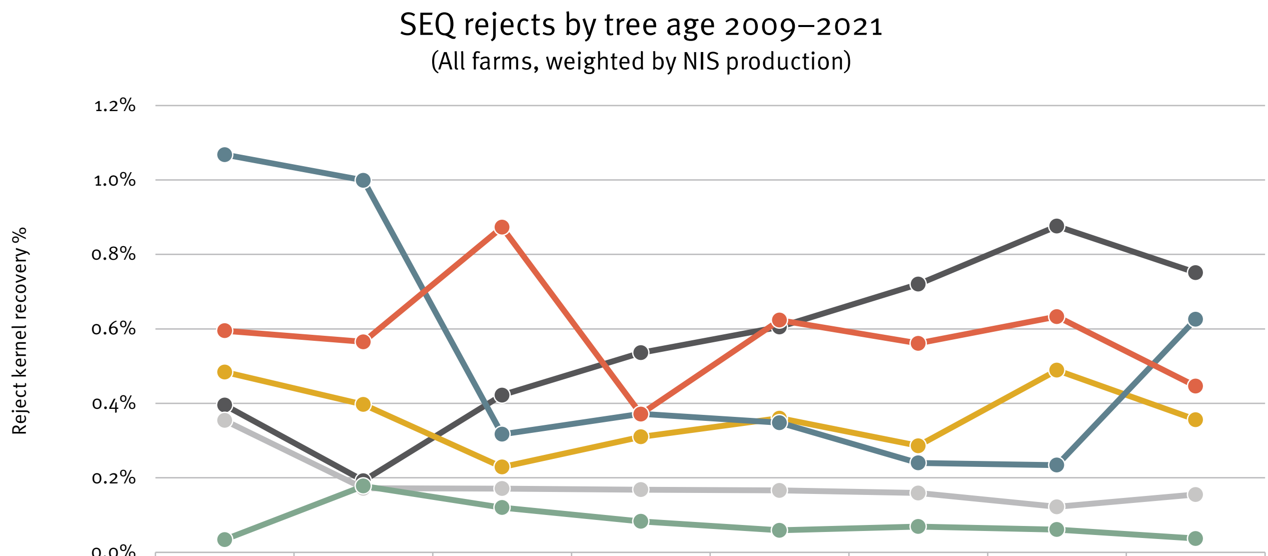
Figure 45 Weighted average factory reject trends for SEQ 2009–2021

Figure 46 shows factory reject trends by tree age for farms in the SEQ region from 2009 to 2021. Rejects are shown as a percentage of reject kernel recovery and are weighted by NIS production. Average tree ages are weighted by the number of trees planted.

Insect damage and immaturity have both been significant causes of factory rejects for many farms in the SEQ region. The chart shows that the incidence of insect damage significantly increased with tree age from 8 to 34 years (P<0.01). It should be noted that there are fewer farms aged 35+ in the sample than in younger age categories.

Immaturity was prevalent across all age categories and particularly in the 10 to 14 years age group. Immaturity levels in SEQ vary significantly between years and have been particularly prevalent in hot and dry seasons.

The incidence of brown centres was highest for farms with an average tree age of less than nine years and significantly higher than farms with older trees up to 34 years (P<0.01).

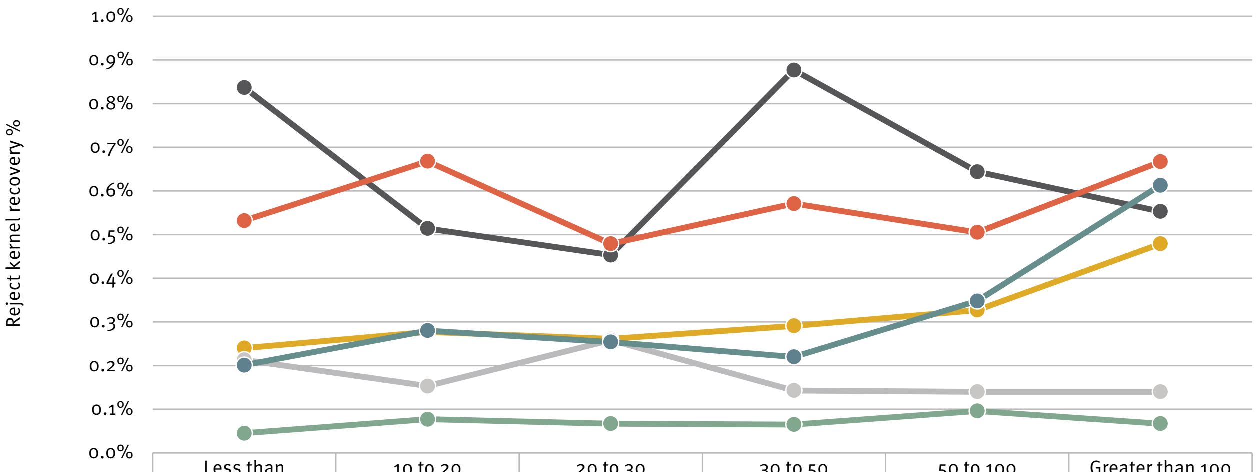


	5 to 7 years	8 to 9 years	10 to 14 years	15 to 19 years	20 to 24 years	25 to 29 years	30 to 34 years	35+ years
Insect	0.40	0.19	0.42	0.54	0.61	0.72	0.88	0.75
Mould	0.48	0.40	0.23	0.31	0.36	0.29	0.49	0.36
Discolouration	0.35	0.17	0.17	0.17	0.17	0.16	0.12	0.16
Brown centres	1.07	1.00	0.32	0.37	0.35	0.24	0.23	0.63
Immaturity	0.60	0.57	0.87	0.37	0.62	0.56	0.63	0.45
Germination	0.03	0.18	0.12	0.08	0.06	0.07	0.06	0.04

Figure 46 Weighted average factory rejects by tree age for SEQ farms 2009–2021

Figure 47 shows a breakdown of long-term average factory rejects by farm size for SEQ farms from 2009–2021. It should be noted that there are relatively few farms in the sample for this region above 50 hectares, with most farms less than 20 hectares.

Insect damage levels were highest for farms less than 10 hectares and farms between 30 and 50 hectares. Brown centres levels were significantly higher for large farms (> 50 hectares) compared with smaller farms (P < 0.01). Rejects due to mould also increased significantly as farm size increases (P<0.01).



	Less than 10 ha	10 to 20 ha	20 to 30 ha	30 to 50 ha	50 to 100 ha	Greater than 100 ha
Insect	0.84	0.51	0.45	0.88	0.64	0.55
Mould	0.24	0.28	0.26	0.29	0.33	0.48
Discolouration	0.21	0.15	0.26	0.14	0.14	0.14
Brown centres	0.20	0.28	0.25	0.22	0.35	0.61
Immaturity	0.53	0.67	0.48	0.57	0.51	0.67
Germination	0.05	0.08	0.07	0.07	0.10	0.07

Figure 47 Weighted average factory rejects by farm size for SEQ farms from 2009–2021

Northern Rivers of NSW

Northern Rivers (NRNSW) in the north-east of New South Wales includes the Alstonville Plateau and surrounding towns such as Lismore, Clunes, Newrybar and Knockrow. This region comprises the largest proportion of the benchmark sample by number of farms (136 farms, 45%). Median farm size (17.6 ha) is significantly smaller than the CQ region, so despite its relatively large number of farms NRNSW represented just 23% of the benchmark sample by production in 2021. Approximately 80% of farms in the region are owner-operated, with an average tree age of 25 years. Less than 7% of participating farms from this region are irrigated as average rainfall has historically been sufficient to support production without widespread reliance on irrigation. Approximately 30% of participating farms in NRNSW (38) provided cost data in 2021.

Figure 48 shows a summary of the 2021 season for the NRNSW region. Corresponding averages over multiple recent seasons are shown in brackets for comparison. Long-term yield and quality spans the previous five seasons (2016–2020). Long-term costs span the previous four seasons (2017–2020) to include both cash and imputed labour. All values are weighted by NIS production.

Average NIS yield in 2021 was below the long-term average. Lower average kernel recovery in 2021 also meant that saleable kernel production per hectare was lower than both 2020 and the long-term average. RKR in 2021 was the lowest recorded average for the region since 2009. Weighted average expenditure per hectare was more than 10% higher in 2021 than the average of the previous four seasons. Lower average SK yield in 2021 meant that expenditure per tonne of SK was over 25% higher in that season when compared to the 2017-2020 average.

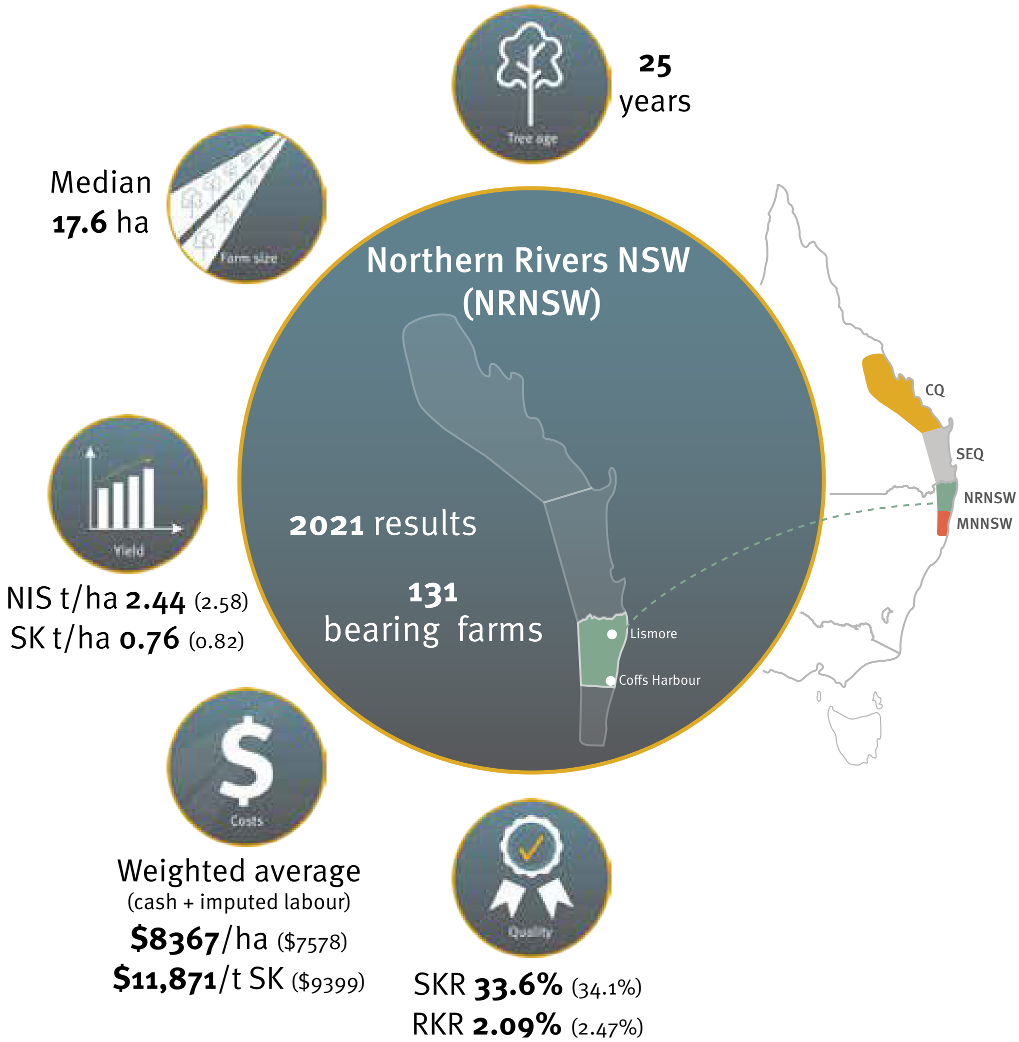


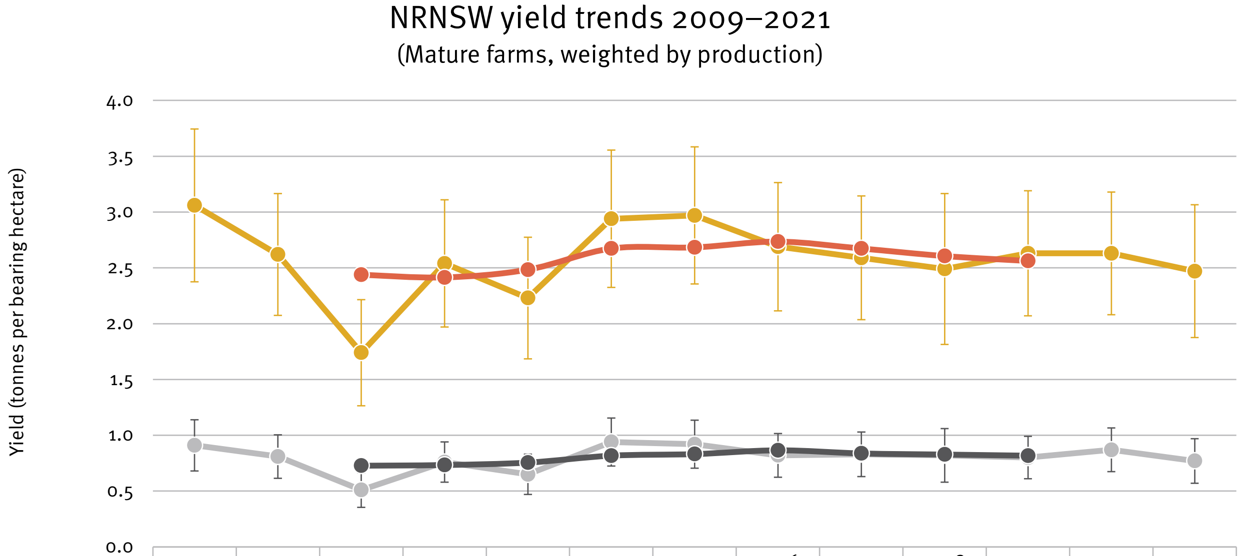
Figure 48 Summary of the 2021 season for the NRNSW region

Figure 49 shows seasonal trends in NIS yield per hectare (gold) and SK yield per hectare (grey) for mature farms (average age 10+ years) in the NRNSW region from 2009-2021. Rolling five-year averages are also shown for each (dotted lines). Averages are weighted to represent most of the production for the region. The vertical error bars show the standard deviation for each season. Larger error bars indicate higher variability between farms within the sample within a given season.

Average NIS yield in the NRNSW region was lower than both 2020 and the long-term average. Lower SKR meant that average SK yield was also lower in 2021 than the long-term average.

Rolling five-year averages indicate that long-term NIS productivity has increased by less than 5% and SK by approximately 12% within the NRNSW region during the period shown.

Weather conditions in 2021 were generally more favourable when compared to recent seasons, however some farms reported lasting impacts from reduced rainfall over the previous two seasons, which may have affected average productivity and SKR in 2021.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
NIS yield	3.06	2.62	1.74	2.54	2.23	2.94	2.97	2.69	2.59	2.49	2.63	2.63	2.47
NIS Std.dev.	1.37	1.09	0.95	1.14	1.09	1.23	1.23	1.15	1.11	1.35	1.12	1.10	1.19
SK yield	0.91	0.81	0.51	0.76	0.65	0.94	0.92	0.82	0.83	0.82	0.80	0.87	0.77
SK Std.dev.	0.46	0.39	0.31	0.36	0.36	0.43	0.43	0.39	0.40	0.48	0.38	0.39	0.40
NIS 5-year avg			2.44	2.41	2.48	2.67	2.68	2.74	2.67	2.61	2.56		
SK 5-year avg			0.73	0.73	0.76	0.82	0.83	0.87	0.84	0.83	0.82		

Figure 49 Weighted average NIS and SK yield trends for mature farms in NRNSW from 2009–2021

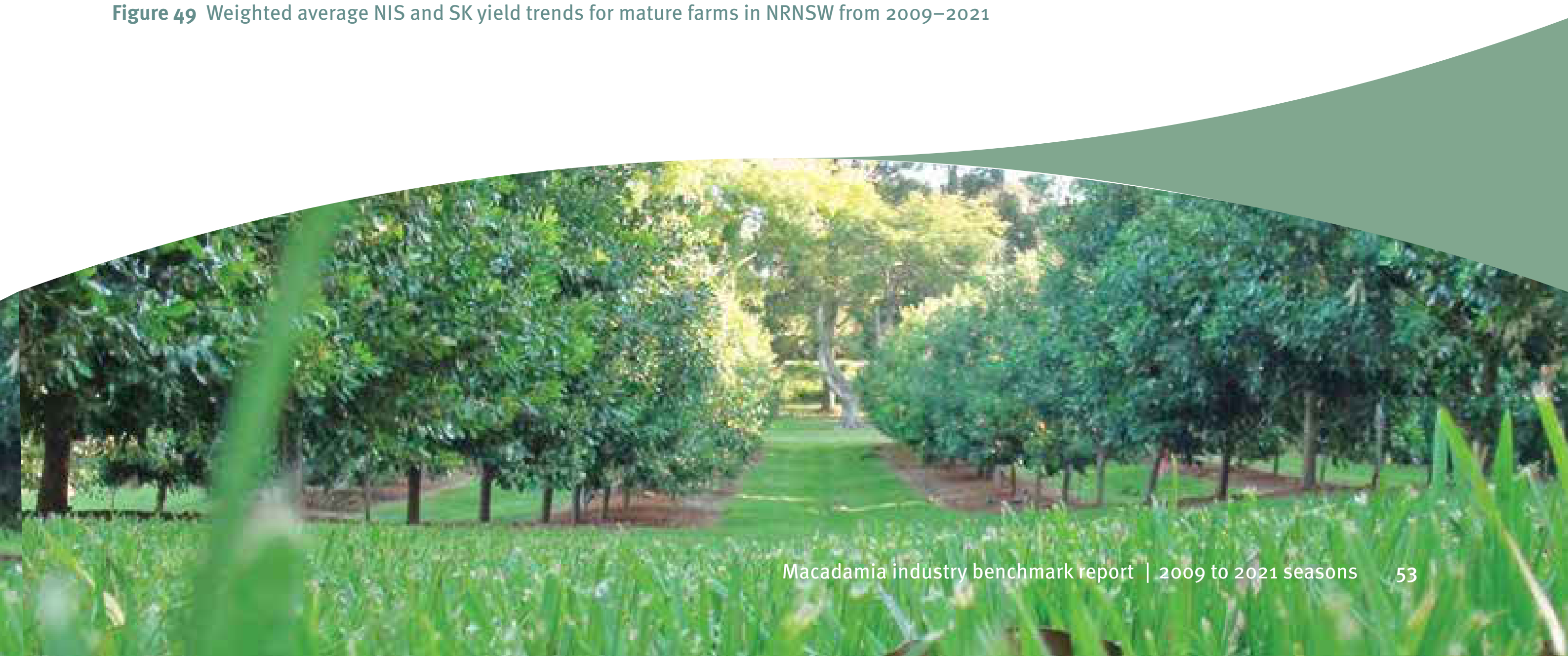
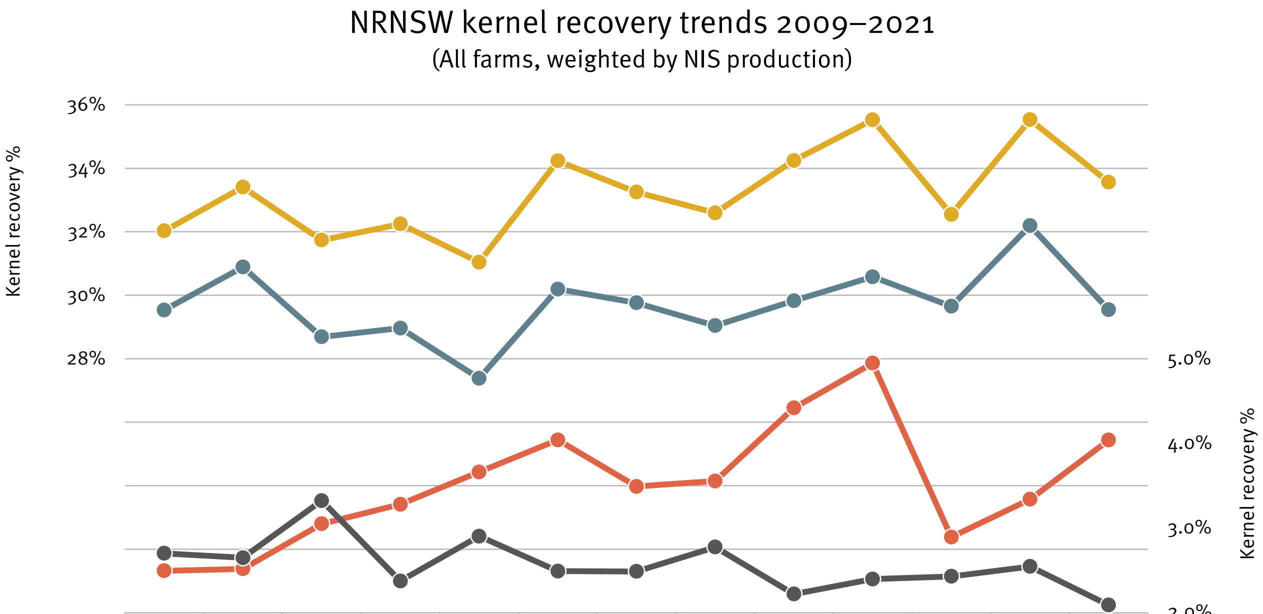


Figure 50 compares saleable kernel recovery (SKR), premium kernel recovery (PKR), commercial kernel recovery (CKR) and reject kernel recovery (RKR) trends for farms in the NRNSW region from 2009 to 2021. Averages are weighted by NIS production.

Average SKR, PKR and RKR were all lower in 2021 than the previous season, while CKR was higher than the previous two seasons. Despite seasonal fluctuations in kernel recovery, over the long term there is a general trend of increasing PKR, SKR and CKR as well as a slight reduction in RKR in the NRNSW region.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
SKR%	32.03	33.40	31.74	32.24	31.04	34.23	33.25	32.60	34.24	35.53	32.55	35.53	33.56
PKR%	29.53	30.89	28.69	28.96	27.38	30.19	29.76	29.04	29.83	30.58	29.65	32.19	29.54
CKR%	2.49	2.52	3.05	3.28	3.66	4.04	3.49	3.56	4.42	4.95	2.89	3.34	4.04
RKR%	2.70	2.65	3.32	2.37	2.90	2.49	2.49	2.77	2.22	2.40	2.43	2.55	2.09

Figure 50 Weighted average SKR, PKR, CKR and RKR trends for NRNSW from 2009–2021

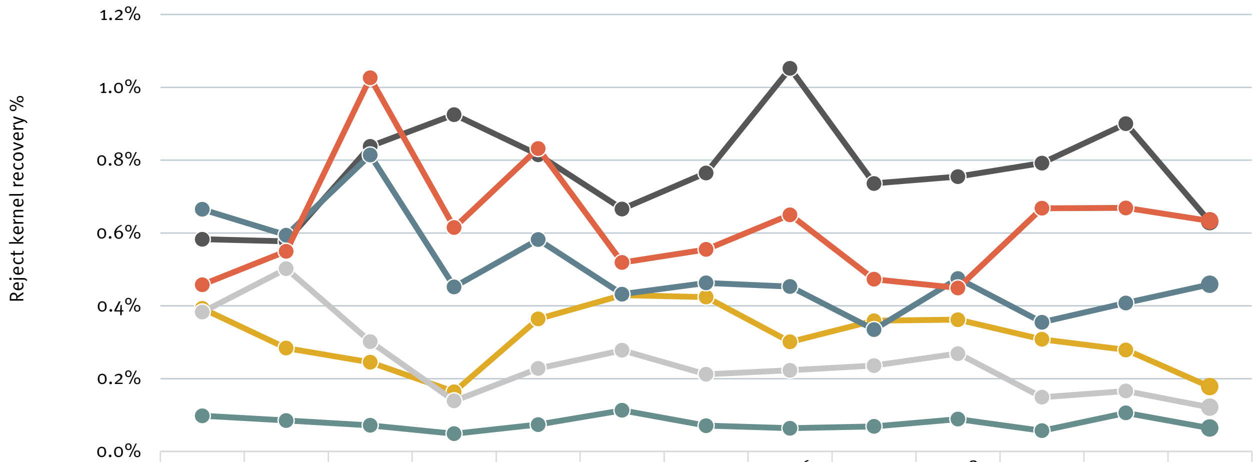
Figure 51 compares factory reject trends for farms in the NRNSW region from 2009 to 2021, weighted by NIS production.

Insect damage has been the leading cause of factory rejects for farms in NRNSW in most seasons. Despite lower-than-average insect rejects in 2021 (0.63%) there has been no evidence of significant decline in insect damage levels over the long term (average 0.78%).

Immaturity has been another significant cause of rejects within the NRNSW region with no evidence of significant improvement in the long-term average (0.61%).

NRNSW has the second highest long-term average levels of brown centres, after the CQ region. Although the incidence of brown centres has increased slightly in recent seasons levels have mostly remained below the long-term regional average of 0.48%.

NRNSW reject trends 2009–2021
(All farms, weighted by NIS production)



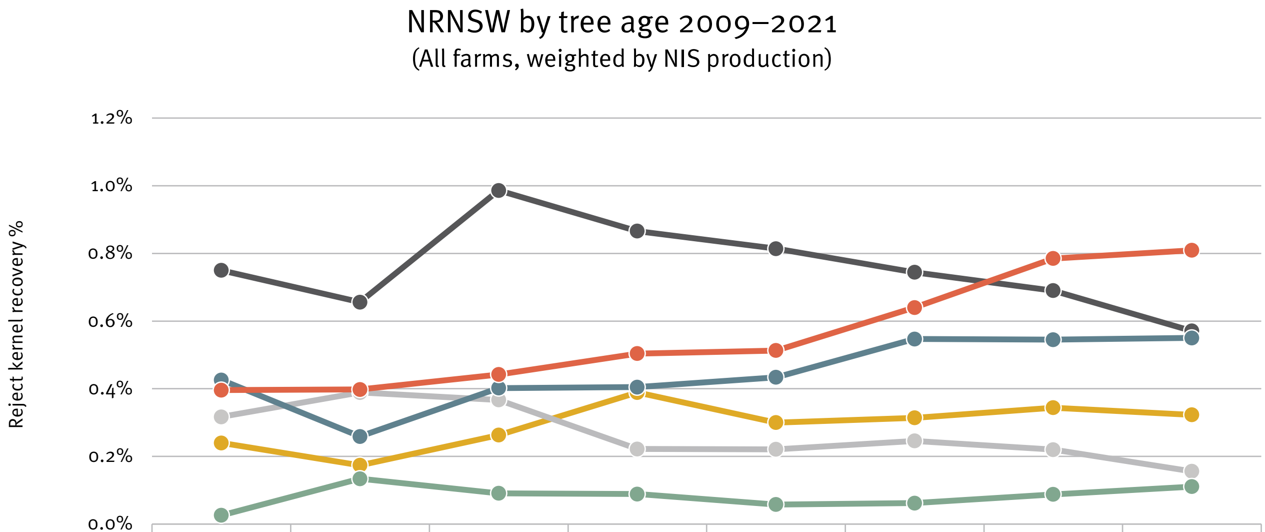
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Insect	0.58	0.58	0.84	0.93	0.82	0.67	0.77	1.05	0.74	0.76	0.79	0.90	0.63
Mould	0.39	0.28	0.25	0.16	0.36	0.43	0.42	0.30	0.36	0.36	0.31	0.28	0.18
Discoloured	0.38	0.50	0.30	0.14	0.23	0.28	0.21	0.22	0.24	0.27	0.15	0.17	0.12
Brown centres	0.67	0.59	0.81	0.45	0.58	0.43	0.46	0.45	0.34	0.48	0.36	0.41	0.46
Immaturity	0.46	0.55	1.03	0.62	0.83	0.52	0.56	0.65	0.47	0.45	0.67	0.67	0.63
Germination	0.10	0.09	0.07	0.05	0.07	0.11	0.07	0.06	0.07	0.09	0.06	0.11	0.06

Figure 51 Weighted average factory reject trends for NRNSW from 2009–2021

Figure 52 shows factory reject trends by tree age for farms in the NRNSW region from 2009 to 2021. Rejects are shown as a percentage of reject kernel recovery and are weighted by NIS production. Average tree ages are weighted by the number of trees planted.

Insect damage and immaturity have both been significant causes of factory rejects for most tree age groups in the NRNSW region. The highest average levels of insect damage were evident on farms with an average tree age of 10 to 14 years although insect damage levels were not statistically different across each of these age categories.

Rejects due to immaturity increased significantly with tree age (P<0.01) and was most prevalent in farms aged 30 years or more. Rejects due to brown centres also generally increased with tree age, with farms aged 25 years or more having significantly higher levels than other farm ages (P<0.05).

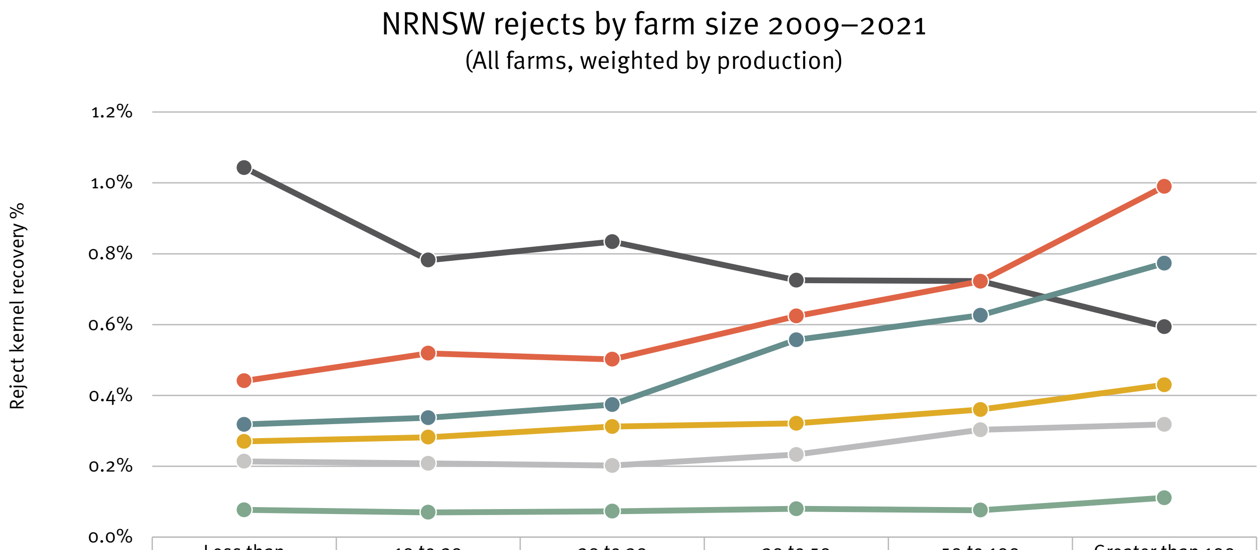


	5 to 7 years	8 to 9 years	10 to 14 years	15 to 19 years	20 to 24 years	25 to 29 years	30 to 34 years	35+ years
Insect	0.75	0.66	0.99	0.87	0.81	0.74	0.69	0.57
Mould	0.24	0.17	0.26	0.39	0.30	0.31	0.34	0.32
Discolouration	0.32	0.39	0.37	0.22	0.22	0.25	0.22	0.16
Brown centres	0.43	0.26	0.40	0.41	0.43	0.55	0.55	0.55
Immaturity	0.40	0.40	0.44	0.50	0.51	0.64	0.79	0.81
Germination	0.03	0.13	0.09	0.09	0.06	0.06	0.09	0.11

Figure 52 Weighted average factory rejects by tree age for NRNSW farms from 2009–2021

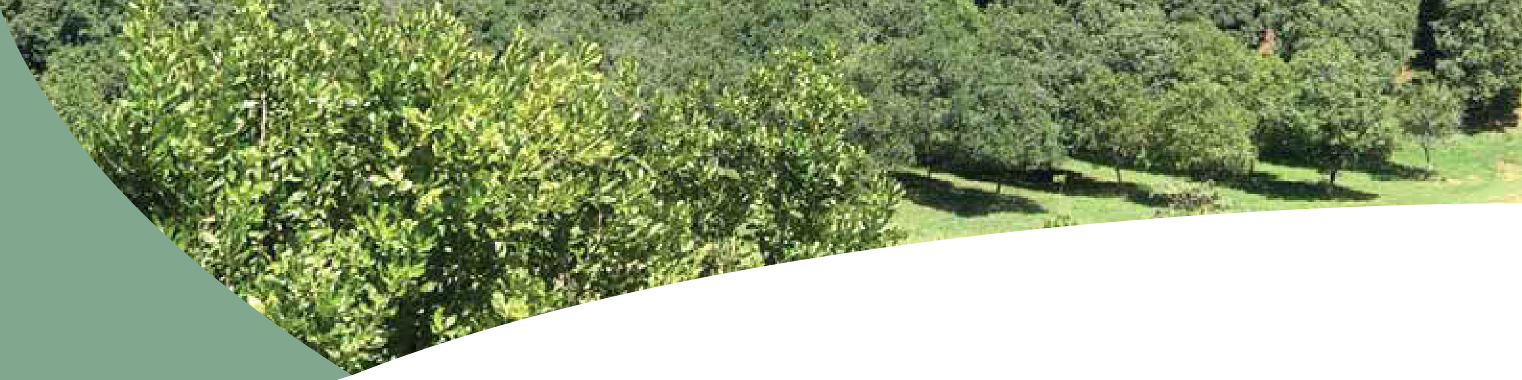
Figure 53 shows a breakdown of long-term average factory rejects by farm size for NRNSW farms from 2009–2021. It should be noted that almost two-thirds of farms in the sample from this region are less than 20 hectares and there are relatively few farms above 50 hectares.

Insect damage levels were significantly higher for farms less than 10 hectares ($P<0.01$) compared to all other farm sizes. Immaturity and brown centres also significantly increased with farm size ($P<0.01$), particularly for farms greater than 30 hectares ($P<0.05$). Mould and discolouration also increased with farm size ($P<0.01$), while there was no significant relationship between germination levels and farm size ($P>0.05$).



	Less than 10 ha	10 to 20 ha	20 to 30 ha	30 to 50 ha	50 to 100 ha	Greater than 100 ha
Insect	1.04	0.78	0.83	0.73	0.72	0.59
Mould	0.27	0.28	0.31	0.32	0.36	0.43
Discolouration	0.21	0.21	0.20	0.23	0.30	0.32
Brown centres	0.32	0.34	0.37	0.56	0.63	0.77
Immaturity	0.44	0.52	0.50	0.62	0.72	0.99
Germination	0.08	0.07	0.07	0.08	0.08	0.11

Figure 53 Weighted average factory rejects by farm size for NRNSW farms from 2009–2021



Mid North Coast of NSW

The **Mid North Coast NSW (MNNSW)** region includes areas in and around Valla, Nambucca Heads, Macksville and Yarrahapinni. This region is relatively smaller than others in terms of the number of farms participating (29 farms, 9% of sample), median farm size (14.1 ha) and production (4% of sample). The average age of trees planted in this region is 21 years. A relatively high proportion of "A" series varieties in this region contributes to higher average kernel recovery than other regions.

Approximately 60% of farms in this region are owner-operated and most are not irrigated. Like NRNSW, this region usually receives sufficient rainfall to support production without widespread use of irrigation. Over 50% of participating farms in MNNSW (13) provided cost data in 2021.

Figure 54 shows a summary of the 2021 season for the MNNSW region. Corresponding averages over multiple recent seasons are shown in brackets for comparison. Long-term yield and quality spans the previous five seasons (2016–2020). Long-term costs span the previous four seasons (2017–2020) to include both cash and imputed labour. All values are weighted by NIS production.

PKR levels have generally declined over the long term. CKR levels have fluctuated substantially between seasons and have generally increased over the long term. The net result is a slight increase in SKR over the long term. Average NIS and SK productivity in 2021 were above the average for the previous two seasons but consistent with long-term averages.

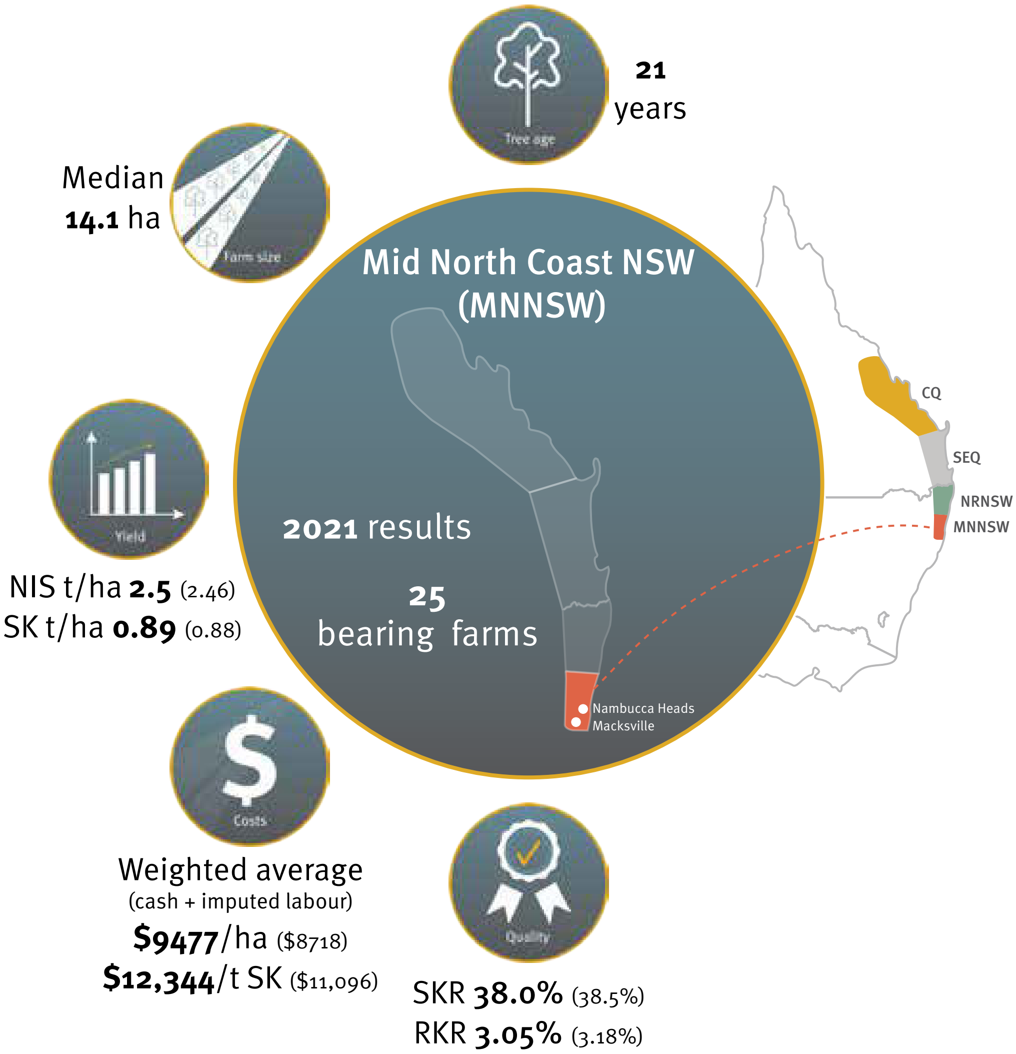
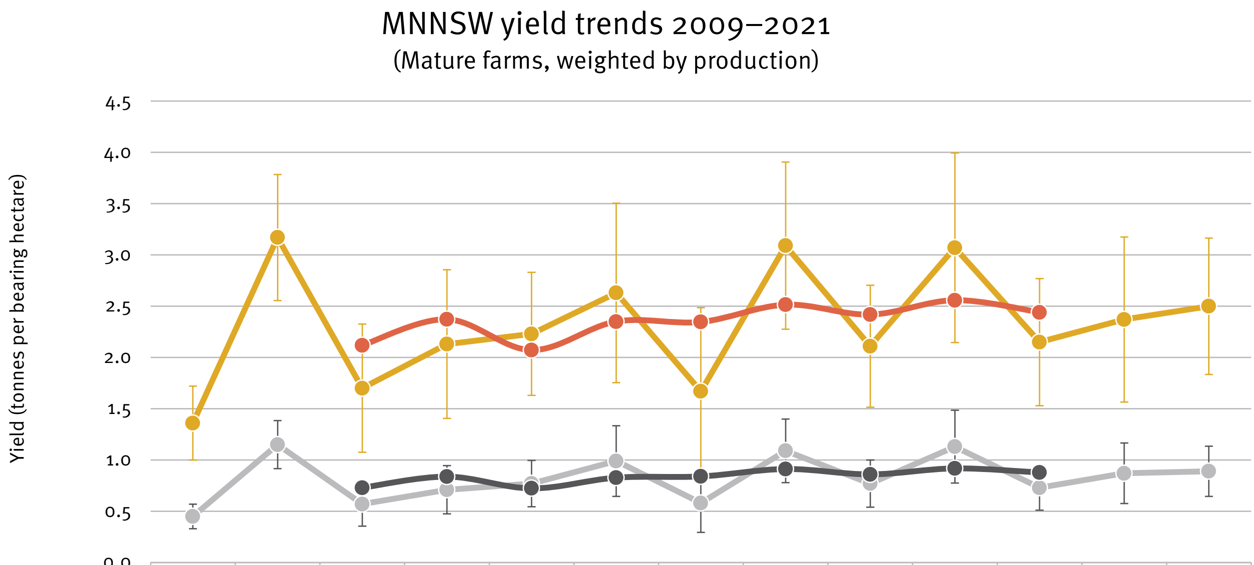


Figure 54 Summary of the 2021 season for the MNNSW region

Figure 55 shows seasonal trends in NIS yield per hectare (gold) and SK yield per hectare (grey) for mature farms (average age 10+ years) in the MNNSW region from 2009-2021. Rolling five-year averages are also shown for each (dotted lines). Averages are weighted to represent most of the production for the region. The vertical error bars show the standard deviation for each season. Larger error bars indicate higher variability between farms within the sample within a given season.

Average NIS and SK yield in the MNNSW region was higher than the previous two seasons and also the long-term average. Rolling five-year averages indicate that long-term NIS productivity has increased by approximately 15% and SK by approximately 20% within the NRNSW region during the period shown. The long-term average NIS yield for MNNSW is significantly lower than all other regions (P<0.01).

Weather conditions in 2021 were generally comparable to recent seasons, however high rainfall during nut development and early harvest may have impacted some farms.



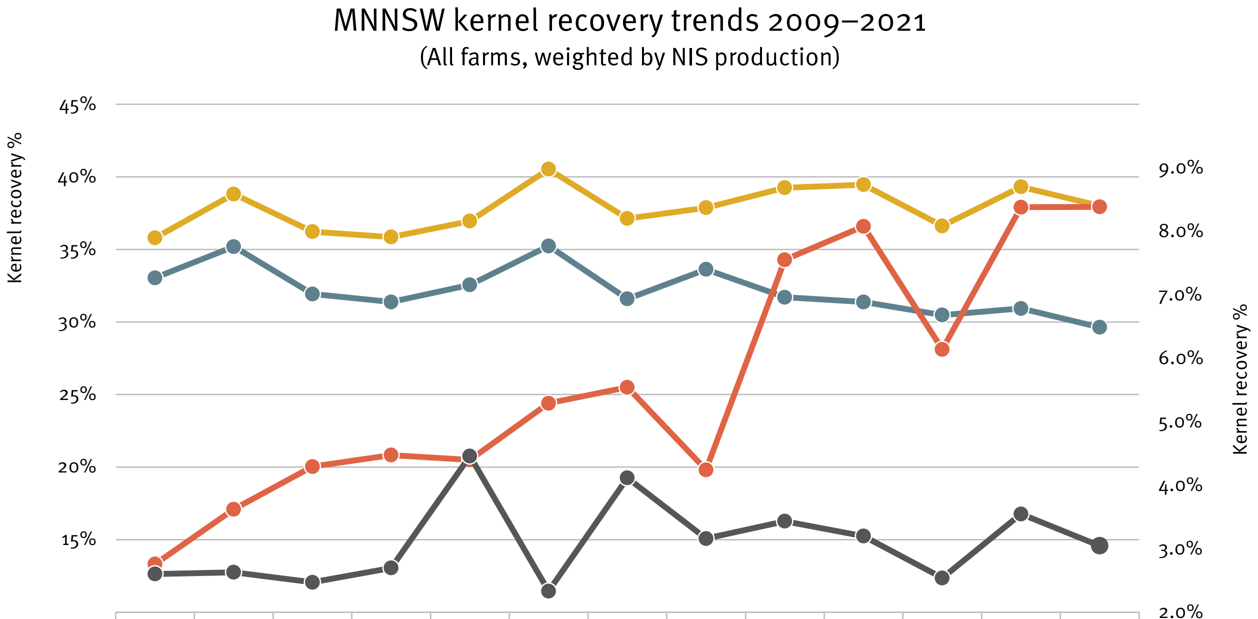
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
NIS yield	1.36	3.17	1.70	2.13	2.23	2.63	1.67	3.09	2.11	3.07	2.15	2.37	2.50
NIS Std.dev.	0.72	1.23	1.25	1.45	1.20	1.75	1.63	1.63	1.19	1.85	1.24	1.61	1.33
SK yield	0.45	1.15	0.57	0.71	0.77	0.99	0.58	1.09	0.77	1.13	0.73	0.87	0.89
SK Std.dev.	0.24	0.47	0.43	0.47	0.45	0.69	0.57	0.62	0.46	0.71	0.44	0.59	0.49
NIS 5-year avg			2.12	2.37	2.07	2.35	2.35	2.51	2.42	2.56	2.44		
SK 5-year avg			0.73	0.84	0.72	0.83	0.84	0.91	0.86	0.92	0.88		

Figure 55 Weighted average NIS and SK yield trends for mature farms in MNNSW from 2009–2021

Figure 56 compares saleable kernel recovery (SKR), premium kernel recovery (PKR), commercial kernel recovery (CKR) and reject kernel recovery (RKR) trends for farms in the MNNSW region from 2009 to 2021. Averages are weighted by NIS production.

Average SKR, PKR and RKR were all lower in 2021 than the previous season, while CKR was slightly higher than the previous season.

Despite seasonal fluctuations in kernel recovery there is a general trend of slightly increasing SKR and RKR, and slightly decreasing PKR in the MNNSW region over the long term. CKR levels have increased significantly over the long term, with average levels in 2021 reaching more than three times average levels in 2009.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
SKR%	35.80	38.82	36.23	35.85	36.96	40.53	37.13	37.87	39.26	39.46	36.62	39.31	38.01
PKR%	33.04	35.20	31.93	31.38	32.56	35.24	31.59	33.63	31.70	31.38	30.48	30.93	29.63
CKR%	2.76	3.62	4.29	4.48	4.40	5.29	5.54	4.24	7.55	8.08	6.14	8.38	8.39
RKR%	2.60	2.63	2.47	2.70	4.46	2.33	4.12	3.16	3.43	3.20	2.54	3.55	3.05

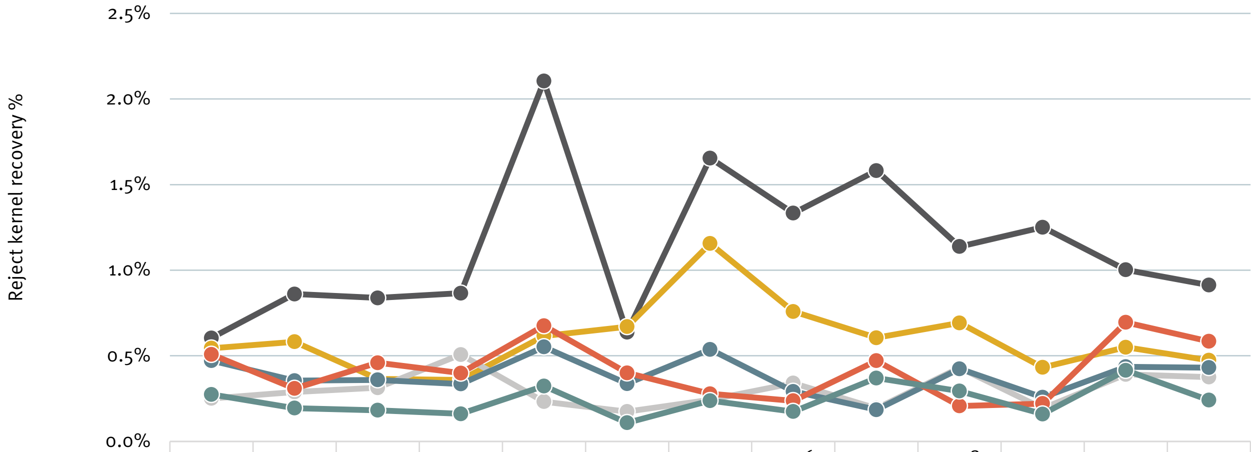
Figure 56 Weighted average SKR, PKR, CKR and RKR trends for MNNSW from 2009–2021

Figure 57 compares factory reject trends for farms in the MNNSW region from 2009 to 2021, weighted by NIS production.

Insect damage has been the leading cause of factory rejects for farms in MNNSW in most seasons. Despite a general trend of decreasing insect damage levels over the last six seasons, there has been no significant decline over the longer term (average 1.15%).

Mould was the next most significant cause of long-term factory rejects (average 0.6%). As with insect damage, mould levels have generally decreased over the last six seasons, although there has been no significant reduction over the longer term (P>0.05).

MNNSW reject trends 2009–2021
(All farms, weighted by NIS production)

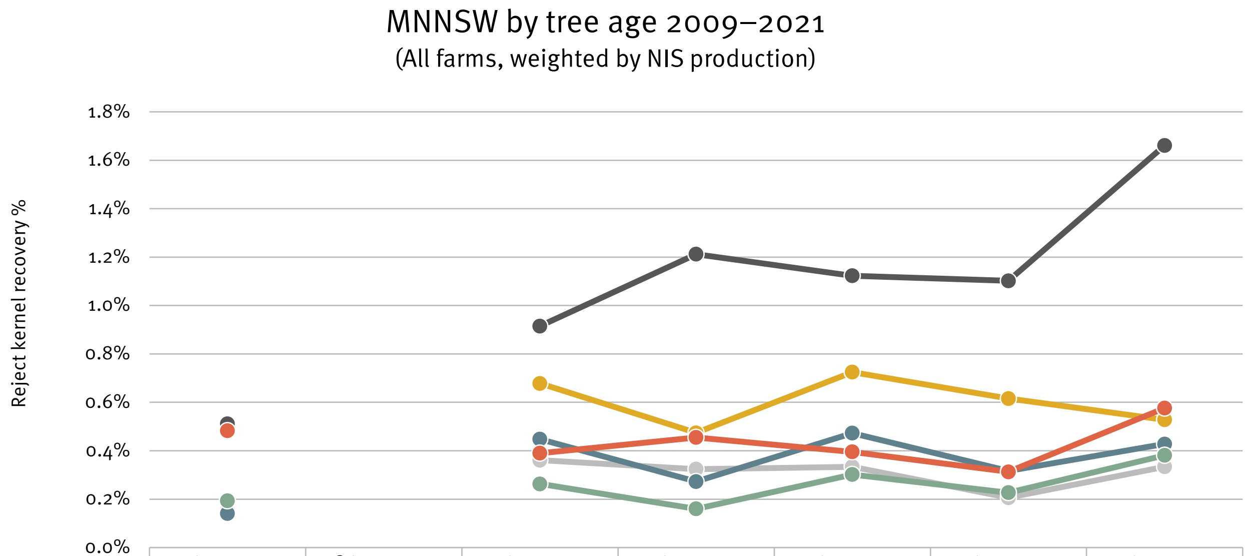


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Insect	0.60	0.86	0.84	0.87	2.11	0.64	1.66	1.33	1.58	1.14	1.25	1.00	0.91
Mould	0.54	0.58	0.37	0.36	0.62	0.67	1.16	0.76	0.61	0.69	0.43	0.55	0.47
Discoloured	0.25	0.29	0.31	0.51	0.23	0.17	0.24	0.34	0.19	0.43	0.19	0.39	0.38
Brown centres	0.47	0.36	0.36	0.34	0.55	0.34	0.54	0.29	0.19	0.42	0.26	0.44	0.43
Immaturity	0.51	0.31	0.46	0.40	0.68	0.40	0.28	0.24	0.47	0.21	0.22	0.70	0.58
Germination	0.27	0.19	0.18	0.16	0.32	0.11	0.24	0.17	0.37	0.29	0.16	0.42	0.24

Figure 57 Weighted average factory reject trends for MNNSW from 2009–2021

Figure 58 shows factory reject trends by tree age for farms in the MNNSW region from 2009 to 2021. Rejects are shown as a percentage of reject kernel recovery and are weighted by NIS production. Average tree ages are weighted by the number of trees planted. Insufficient farms were available to provide data for the 8-to-9 and 35+ age groups.

Insect damage has been the major cause of factory rejects across all age groups in the MNNSW sample. The highest average levels of insect damage were evident on farms with an average tree age of 30 to 34 years. It should be noted that there are relatively fewer farms in the 30+ years age categories than in younger age categories.



	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
Insect	0.51	–	0.92	1.21	1.12	1.10	1.66
Mould	0.17	–	0.68	0.47	0.73	0.62	0.53
Discolouration	0.15	–	0.36	0.32	0.33	0.21	0.33
Brown centres	0.14	–	0.45	0.27	0.47	0.32	0.43
Immaturity	0.48	–	0.39	0.46	0.40	0.31	0.58
Germination	0.19	–	0.26	0.16	0.30	0.23	0.38

Figure 58 Weighted average factory rejects by tree age for MNNSW farms from 2009–2021

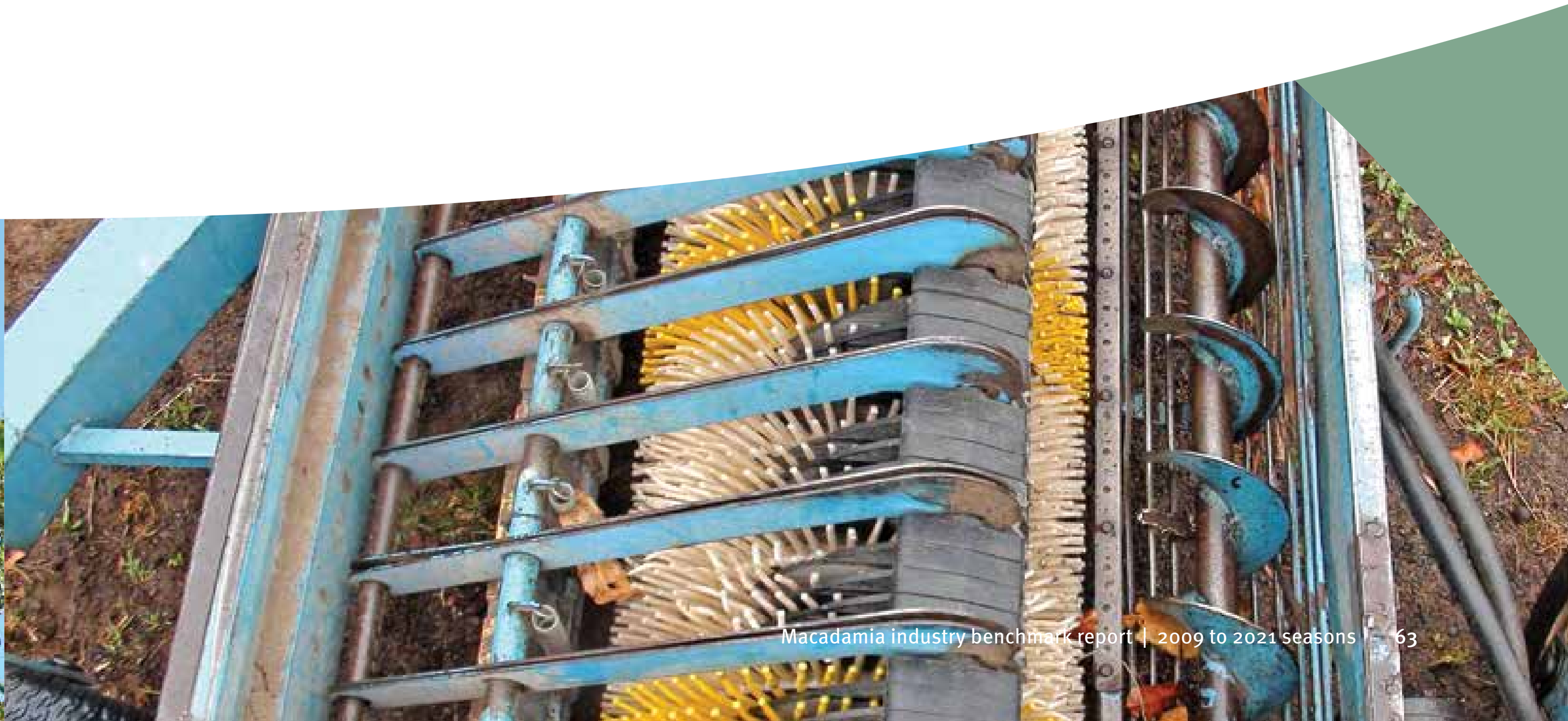
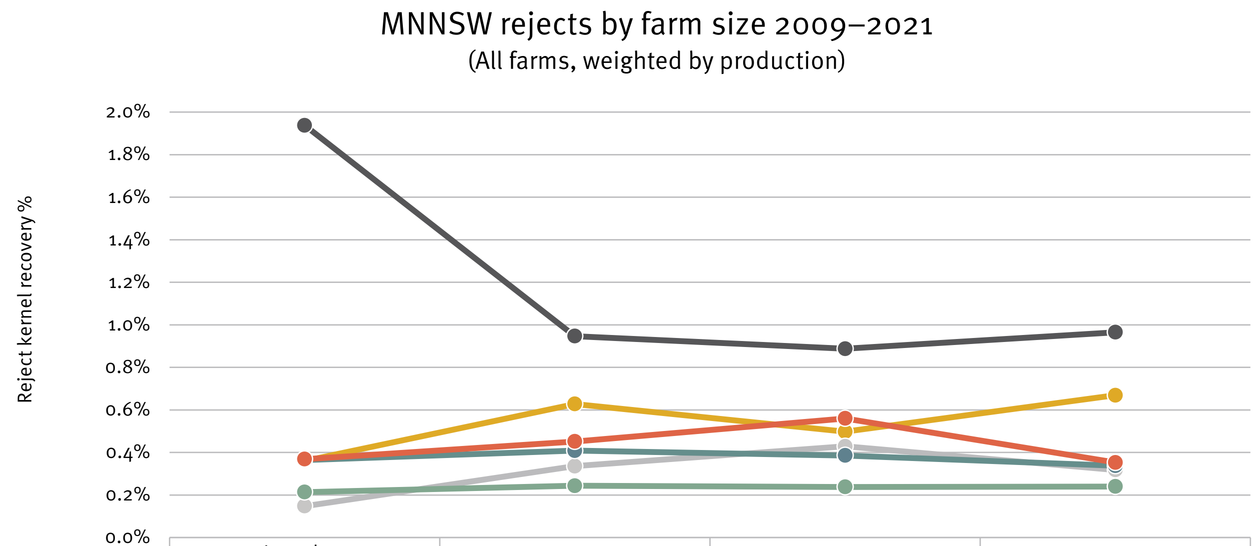


Figure 59 shows a breakdown of long-term average factory rejects by farm size for MNNSW farms from 2009–2021. It should be noted that more than half of farms in the sample from this region are less than 10 hectares and there are relatively few farms in the 20 to 30 hectares category. There were insufficient farms greater than 50 hectares to be included in the chart.

Farms less than 10 hectares had significantly higher levels of factory rejects due to insect damage ($P<0.05$). This is similar to the CQ and NRNSW regions.

There are no significant correlations between farm size and other reject categories for MNNSW given the limited sample size for this region.



	Less than 10 ha	10 to 20 ha	20 to 30 ha	30 to 50 ha
Insect	1.94	0.95	0.89	0.97
Mould	0.36	0.63	0.50	0.67
Discolouration	0.15	0.34	0.43	0.32
Brown centres	0.37	0.41	0.39	0.34
Immaturity	0.37	0.45	0.56	0.35
Germination	0.21	0.24	0.24	0.24

Figure 59 Weighted average factory rejects by farm size for MNNSW farms from 2009–2021

What you need to know about the data

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

Farms and plantings

- The term farm-year is used to describe data for an individual farm for a given year.
- Plantings less than five years of age are generally excluded from estimates of bearing hectares. This is important for consistency across the benchmark sample.

Averages

- 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.
- Unless otherwise stated, averages presented are unweighted. This means that all farms in the sample exert an equal influence on the average regardless of their size.
- All weights presented are based on the industry standard moisture content of 10% for nut-in-shell and 1.5% for kernel.
- Averages that span multiple seasons are derived from all available seasons unless otherwise specified.
- Where potential for significant skewing of a data occurs (e.g., seasonal costs) medians rather than averages may be presented to provide an understanding of the mid-point of the sample.
- Some averages may be based on subsets of all available data. Atypical or non-representative data may be excluded from some analyses to avoid adversely skewing averages. Where this has occurred, it will be indicated in results (e.g. mature farms only).

Factory rejects

- The sum of reject kernel category values presented equates to the total reject kernel recovery percentage, rather than totalling 100%. This standard is applied for consistency across the benchmark study.
- Widely recognised terms are used wherever possible to describe kernel recovery and reject analysis categories, although some processors may use different terminology to describe similar reject categories or have their own additional reject categories.

Costs

- Cost data reported for any given season includes all expenditure incurred in the preceding financial year (e.g., 2012/13 financial year for 2013 production season).
- Costs such as capital expenditure, depreciation and taxation are excluded from this study.
- Unpaid labour hours have been collected since 2017. The value of this labour is imputed at a nominal rate of $30 per hour to derive a more complete picture of labour costs, particularly for owner-operated farms. See Analyses and methods for more information.
- All farm costs per hectare are based on total planted hectares unless otherwise stated. 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 based on a standard chart of accounts, developed in conjunction with accountants and financial advisors. This is used to ensure consistent interpretation of costs across multiple farm businesses.

Analyses and methods

Median

The median value of a data set represents the middle (or 50%) point in the data. In comparison the average or mean is the sum of all values divided by the total number of data points. The average is very useful for understanding a given set of data when that data is normally distributed, however if data is skewed by extreme or outlying values these can influence the mean. For example, one very large farm in a region of otherwise small farms could raise the sample average above what is characteristic of most farms in that region. As the median comes from the middle point in a data set it is not influenced by such outlying or extreme data.

Percentiles

A percentile is a statistical measure indicating the value below which a given percentage of observations in a sample fall. For example, the 25th percentile in a data sample is the value below which 25% of the observations may be found. The 25th percentile is also known as the first quartile. Percentiles have been included in this report to identify differences between the top 25%, average and bottom 25% of farms or farm years. For ease of understanding and to minimise skewing due to individual farm results, percentile groups used in this report are based on relatively uniform sample sizes. A standard approach was used to identify these groups.

The following example shows how this process works on a 100-point data sample:

The sample is ranked according to a dependent variable such as tonnes of saleable kernel per bearing hectare. A marker is placed on the 25th data point and its value is identified. Adjoining points in both directions within the sample are iteratively compared with the current marker point to determine the nearest data point whose value is different to the current marker. If required, the marker is moved to reflect the closest unique data value (i.e. its value is different to at least one adjoining point). This becomes the cut point for the 75th percentile.

The above process is repeated on the 75th data point to determine a similar unique cut point for the 25th percentile. Values that fall above the cut point for the 75th percentile are grouped to form the top 25% and those that fall below the 25th percentile form the bottom 25%. As a result, the number of data points in each quartile is not always the same.

Standard deviation

Standard deviation provides a measure of the amount of variation around the average or mean for a set of data. A low standard deviation means that most of the numbers in that set are very close to the average. A high standard deviation means that the numbers are spread out. Standard deviation provides an important measure of the amount of variability within the benchmark sample. For example, it is useful to know the average productivity for all farms in each region or season, but the standard deviation of that average provides additional insight into how uniform productivity is among those farms and therefore how well the average represents the sample.

Statistical comparisons

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% ($P<0.05$).

Unpaid labour and imputed labour rate

Unpaid labour is time spent working on a farm for which no payment was received. This is mostly undertaken by farm owners who work on their farm without drawing a wage from the business. This can create inconsistencies when comparing costs with farms where all labour is costed within the business. To minimise the impact of unpaid labour, benchmark participants are asked to estimate all unpaid work hours on their farm, which is then imputed at a standard hourly rate to estimate the equivalent cash value. Unless otherwise specified a standard rate of $30/hour is applied to unpaid labour. This rate is not intended to replicate an expected wage for an owner or manager, nor include higher-level management activities or decision-making. It is intended to cover unpaid daily farm activities that would otherwise be undertaken by a paid employee, working under the direction of a manager or foreperson. Examples of typical activities include tractor driving, mowing, harvesting, servicing machinery, fertiliser spreading and pest and disease control. The applied hourly rate is consistent with, or slightly above, rates specified within the Australian Horticulture award (www.fairwork.gov.au).

Weighted and unweighted averages

Unweighted averages or arithmetic means are used in most of the descriptive and statistical analyses throughout this report. Unweighted averages result in each farm in the data sample exerting equal influence on the average. In other words, the data for a 10-hectare farm will have just as much effect on the average as that of a 200-hectare farm.

For weighted averages each item is multiplied by a number (weight) based on the item's relative importance. All results are then totalled and divided by the sum of the weights. For example, to calculate average rejects weighted by production individual reject results are multiplied by production for each farm. The sum of these results is then divided by the sum or production for all farms to derive a weighted average. This means that some farms will have more influence on the average than others based on the weighting factor used. In this example farms with more production have a bigger influence on the average. This approach is important analysing results and trends on a whole industry or a whole region basis.

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