Department of Agriculture and Fisheries

Integrated Pest Management Project

MC16005

September 2020

Macadamia benchmark summary

Productivity and reject trends

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2009-2019

MC16005 IPM project

DAF Queensland

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Introduction

This report has been prepared for IPM program Entomologists as part of the "*IPM program for the macadamia industry – DAF*" project (MC16005).

It summarises key findings relating to productivity and insect damage from the macadamia benchmarking study (MC18002). This study spans 11 seasons (2009 to 2019) and comprises yield, quality and planting data for 264 bearing farms (57% of industry by production) in 2019.

The following analyses show insect damage and productivity trends within each of the major macadamia production regions. Additional analyses of insect damage by farm size and tree age are also included.

Industry reject trends

The total value of factory losses across the benchmark sample for 2009–2019 was calculated from the annual weight of rejects and historical NIS prices @ 33% SKR. Figure 1 shows the estimated value of factory reject losses by category over this period.

Although reject percentages have remained relatively stable over the last decade, the value of those rejects has increased substantially with both expanded production and significant increases in NIS prices. The estimated value of factory reject losses across the benchmark sample has increased from $2.38 million in 2009 (@$1.90/kg NIS) to almost $10.1 million in 2019 (@ $5.40/kg NIS).

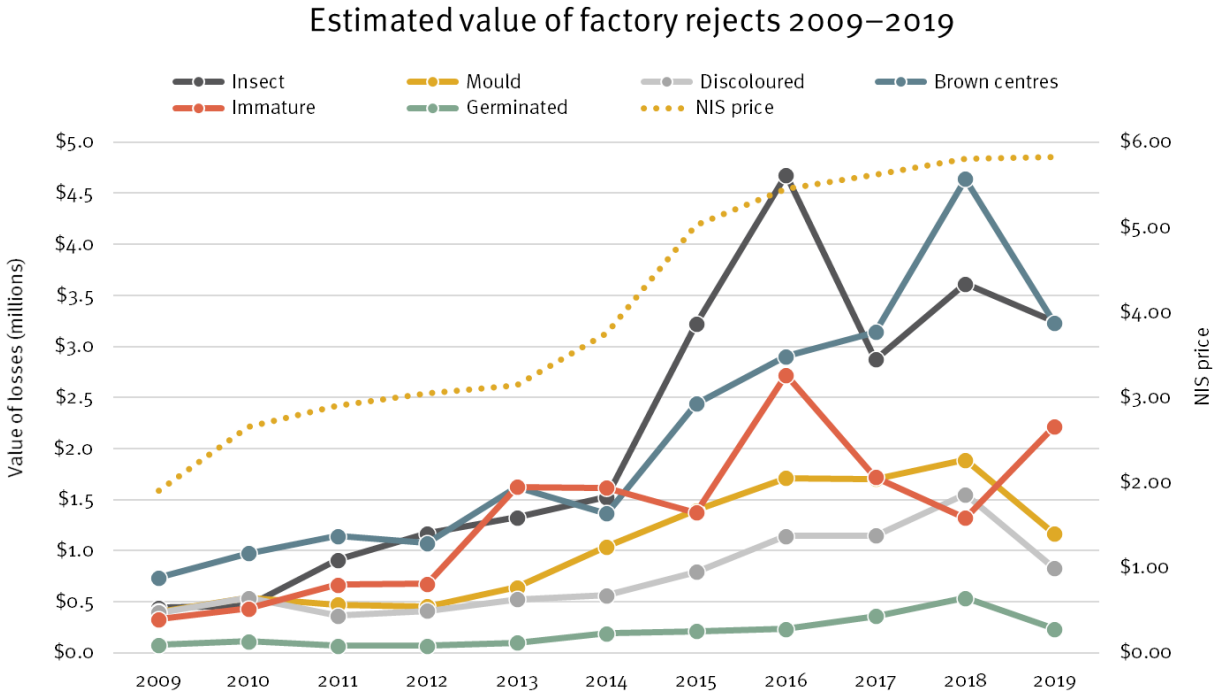


Figure 1: Estimated value of factory rejects for farms in the benchmark sample (2009-2019)

Table 1 shows the cumulative weight and estimated value of factory rejects for the benchmark sample from 2009–2019. The most significant factory losses by weight over this period were due to brown centres (5307 tonnes) followed by insect damage (5118 tonnes). The economic value of these losses was also estimated according to seasonal NIS prices. Based on seasonal fluctuations in NIS price insect damage had the highest economic value over this period ($23.2m), followed by brown centres ($23m). The combined value of all factory rejects from 2009–2019 is estimated at $82.4m.

Cumulative weight and estimated value of factory rejects 2009–2019							
	Insect	Mould	Discoloured	Brown centres	Immaturity	Germination	Total
Weight (tonnes)	5118	2626	1965	5307	3420	493	18,929
Estimated value ($millions)	$23.2	$11.3	$8.2	$23.0	$14.5	$2.2	$82.4

Table 1: Cumulative weight and estimated value of factory rejects for farms in the benchmark sample from 2009–2019

The value of losses due to factory reject in 2019 was estimated for all farms in the benchmark sample. Figure 2 shows a breakdown of those estimated losses per 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. Values were then derived using an average price of $5.50 per kilogram of NIS @ 10% moisture content.

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

The average total value of factory losses in 2019 due to reject kernel for all farms participating in benchmarking was approximately $1,049 per bearing hectare. This equates to a total value of approximately $10.3 million for all farms in the benchmark sample, based on 9817 bearing hectares.

The most significant loss was due to late insect damage ($3.06m), followed by brown centres ($3.04m), immaturity ($2.01m) and mould ($1.1m). Discolouration and germination accounted for relatively smaller losses at $0.78m and $0.22m respectively.

In 2019 the benchmark sample represented approximately 57% of the industry's total production of 46,600 tonnes of NIS. By extrapolating benchmark sample losses according to this proportion, the estimated total value of factory losses across industry in 2019 is approximately $18 million.

It's important to note that these estimates exclude the weight of nuts lost or rejected on farm, which may also significantly contribute to total rejects. They also exclude handling or disposal costs incurred by processors or growers.

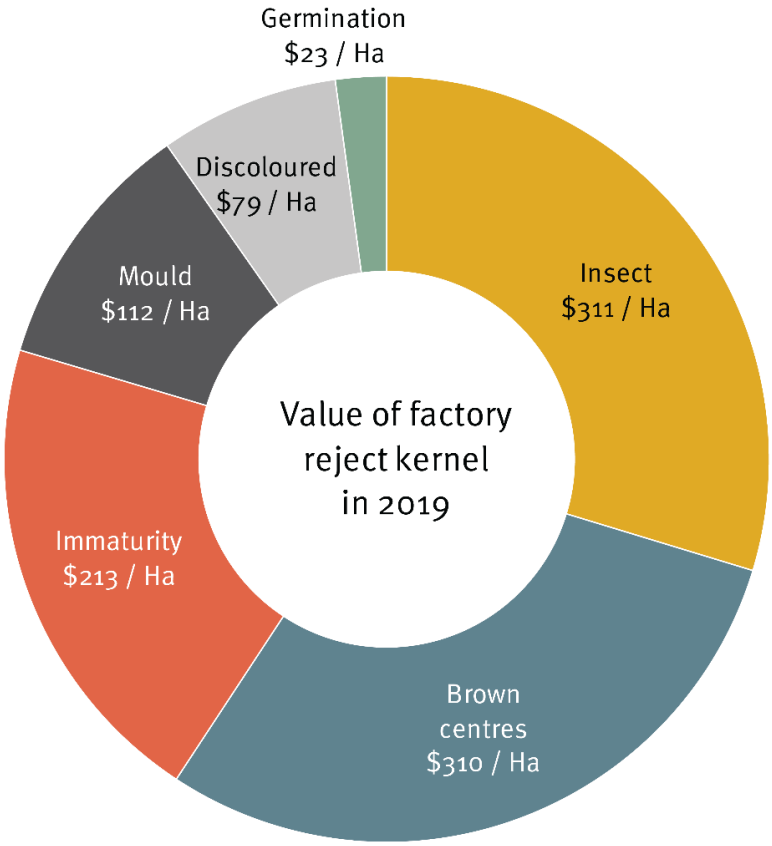
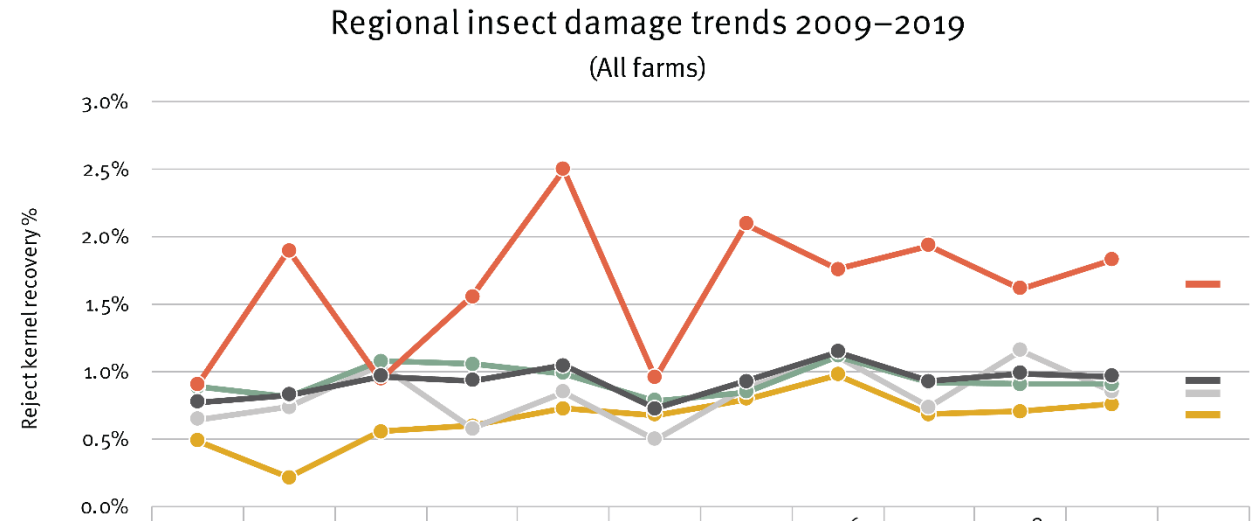


Figure 2: Estimated value per hectare of factory reject kernel for all farms in the benchmark sample in 2019

Insect damage summary by region

Figure 3 shows average factory rejects due to insect damage for participating farms in each of the four major production regions from 2009–2019.

Average insect damage levels were significantly higher in MNNSW (1.65%) than in all other regions over the 2009–2019 period (P<0.01). Long-term insect damage levels were similar in NRNSW and SEQ (0.94% and 0.84% respectively). The CQ region had the lowest long-term average insect damage levels over this period (0.69%).

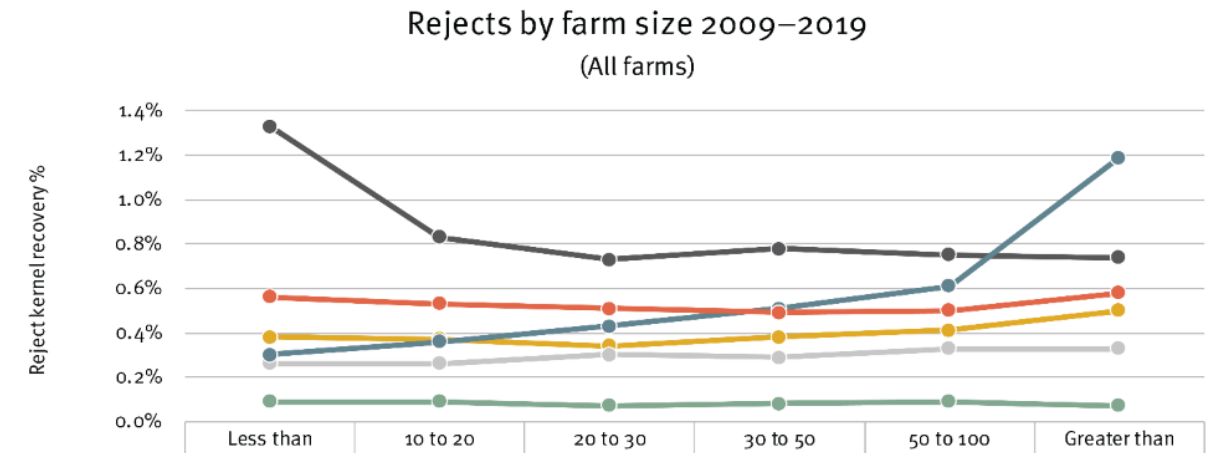


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	09–19
CQ	0.49	0.22	0.56	0.60	0.73	0.68	0.80	0.98	0.69	0.71	0.76	0.69
SEQ	0.65	0.74	1.05	0.58	0.85	0.50	0.88	1.12	0.74	1.16	0.86	0.84
NRNSW	0.89	0.82	1.08	1.06	0.99	0.79	0.85	1.12	0.92	0.91	0.91	0.94
MNNSW	0.91	1.90	0.95	1.56	2.50	0.96	2.10	1.76	1.94	1.62	1.83	1.65
All regions	0.78	0.83	0.97	0.94	1.05	0.73	0.93	1.15	0.93	0.99	0.97	0.94

Figure 3: Regional insect damage rejects (2009–2019)

Insect damage by farm size

Figure 4 shows a breakdown of long-term average factory rejects by farm size for 2009–2019.
Rejects due to insect damage were inversely correlated with farm size (P<0.01), with significantly higher average insect rejects on farms less than 10 hectares than all other farm sizes (P<0.01).

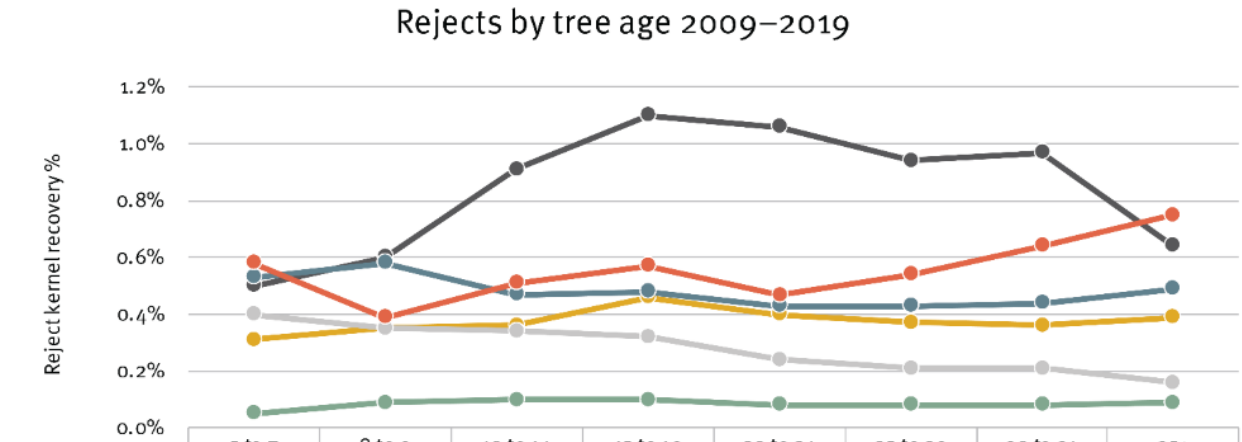


	Less than 10 ha	10 to 20 ha	20 to 30 ha	30 to 50 ha	50 to 100 ha	Greater than 100 ha
Insect	1.33	0.83	0.73	0.78	0.75	0.74
Mould	0.38	0.37	0.34	0.38	0.41	0.50
Discolouration	0.26	0.26	0.30	0.29	0.33	0.33
Brown centres	0.30	0.36	0.43	0.51	0.61	1.19
Immaturity	0.56	0.53	0.51	0.49	0.50	0.58
Germination	0.09	0.09	0.07	0.08	0.09	0.07

Figure 4: Factory rejects by farm size 2009–2019

Insect damage by tree age

Figure 5 shows a breakdown of individual factory reject categories by tree age from 2009–2019.
Insect damage was the major reject category for most age groups. Average insect damage levels were highest among farms aged 15 to 19 years, although analysis of rejects by farm size revealed that most small farms fall within this age group, which may be a contributing factor to these high levels of damage.



	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	0.50	0.60	0.91	1.10	1.06	0.94	0.97	0.64
Mould	0.31	0.35	0.36	0.46	0.40	0.37	0.36	0.39
Discolouration	0.40	0.35	0.34	0.32	0.24	0.21	0.21	0.16
Brown centres	0.53	0.58	0.47	0.48	0.43	0.43	0.44	0.49
Immaturity	0.58	0.39	0.51	0.57	0.47	0.54	0.64	0.75
Germination	0.05	0.09	0.10	0.10	0.08	0.08	0.08	0.09

Figure 5: Reject kernel recovery by reject category and tree age 2009–2019

Crop protection expenditure

Figure 6 shows trends in average crop protection expenditure. Crop protection includes fungicide, insecticide, rodenticide and herbicide. Average crop protection expenditure for all regions combined has increased by 48% between 2013 and 2019. Seasonal fluctuations in crop protection expenditure is evident in all regions with environmental conditions influencing pets and disease pressure.

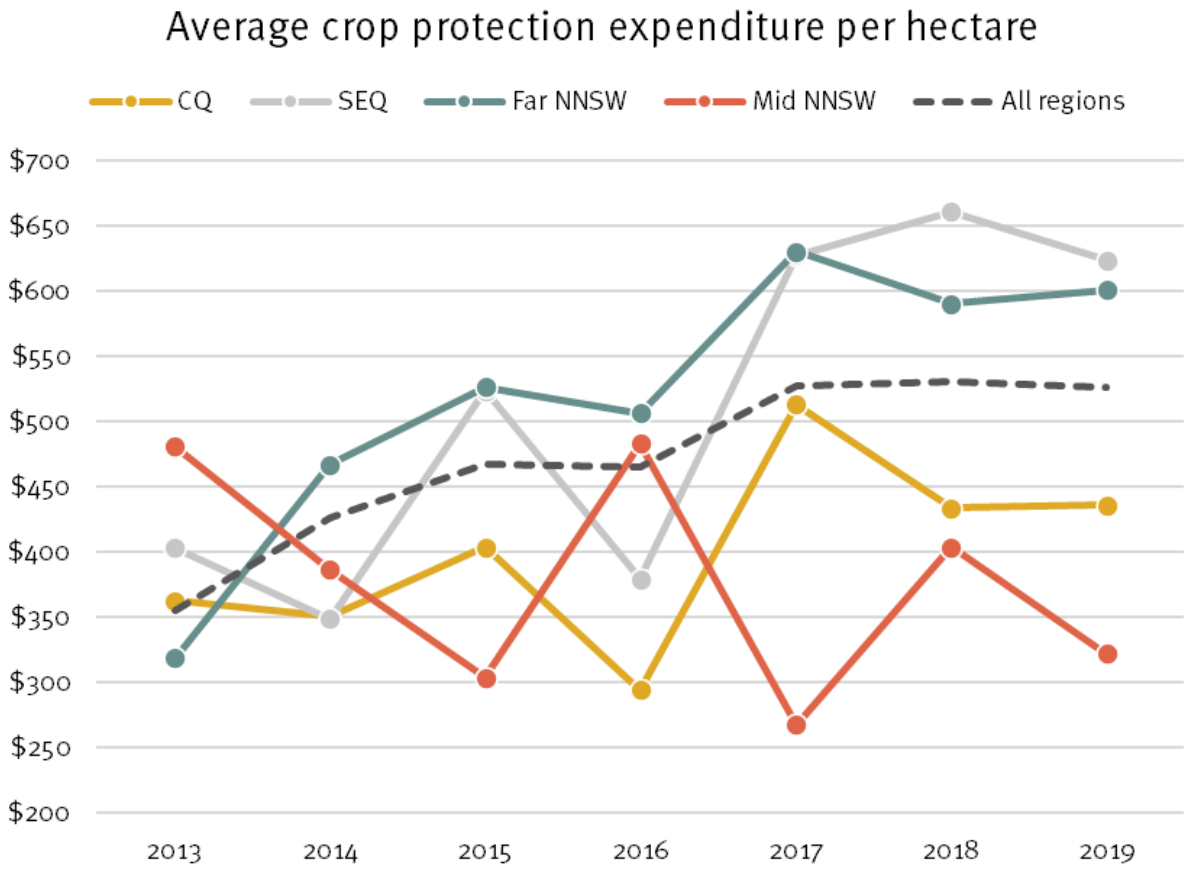


Figure 6: Average spend per hectare on crop protection for farms in the benchmark sample.

Factors limiting production for the 2019 season

Since 2017 benchmark participants have been asked to rank the major limiting factors affecting production on their farm based on their observations during the season. An average of 212 farms per season have provided these observations since 2017. Participants are asked to rank their top 3 limitations for the season in three categories including general factors, pests and diseases. Figure 7 shows the major limiting factors reported in 2019 for each region as well as all regions combined. These are ranked according to how many times they were listed among the top 3 limitations in all regions for that season.

Across all regions hot or dry weather was the dominant limiting factor reported, accounting for 39% of responses. This was followed by **pests (18%)**, wet weather (12%), disease and soil/tree health (each 8%). A smaller number of farms also reported other limiting factors such as tree/limb removal (5%) storm/hail (4%), other (3%). Just 2% of respondents reported no major seasonal limitations.

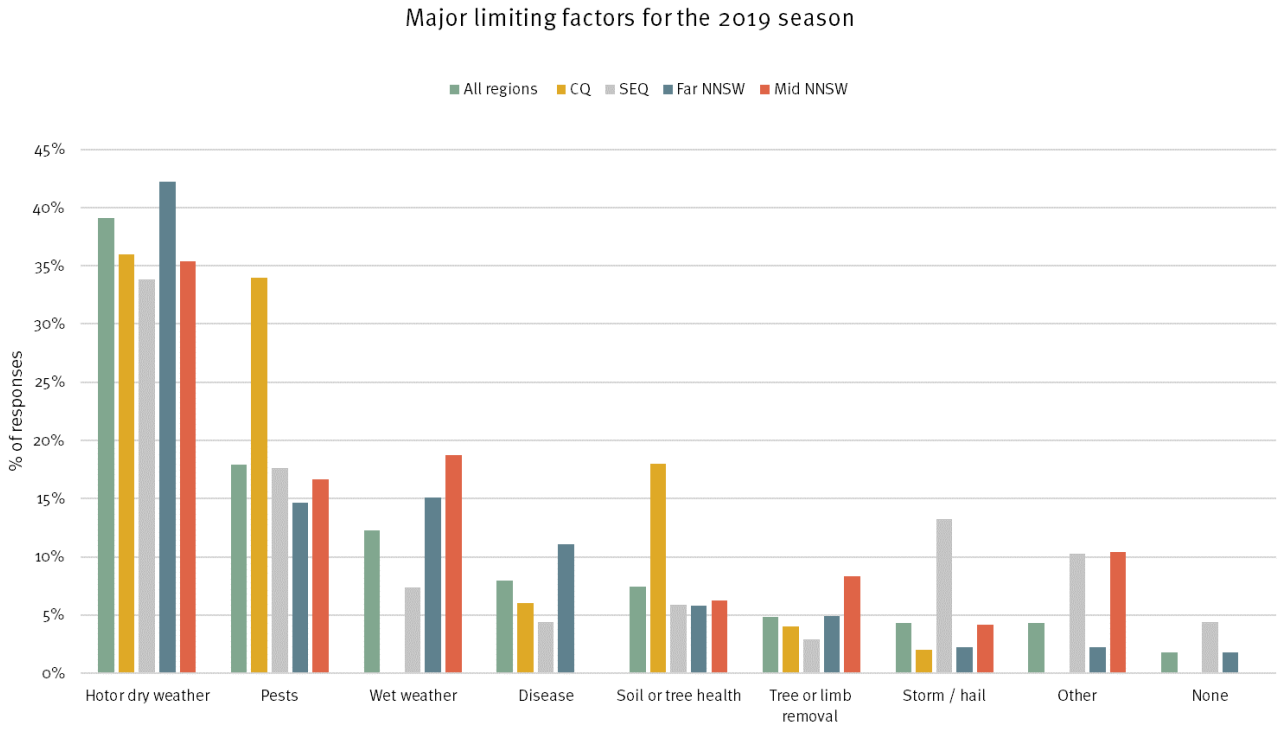


Figure 7 - Major limiting factors for the 2019 season

Pest limitations

Figure 8 shows a total of 210 responses that were received across all regions in relation to pest limitations for the 2019 season (CQ - 46, SEQ - 28, NRNSW - 116 and MNNSW - 20)

Fruit spotting bug was the most commonly reported pest limiting production across all regions (31%). This was followed by rats (22%), Macadamia seed weevil (12%, NRNSW only), birds (11%), Macadamia nut borer (8%), Lace bug (6%) and Flower caterpillar (4%).

Bark beetle and Leptocoris were reported as a limitation for a small proportion of farms (each 1%) while 4% of responses were for "Other" pests. Descriptions for these included Green vegetable bug, thrips and mites, wild deer, Hairyline blue butterfly, pine hole borer, thrips (at flowering) and feral pigs. Although feral pigs were not widely reported across the sample, substantial production losses were reported in some cases where these were present.

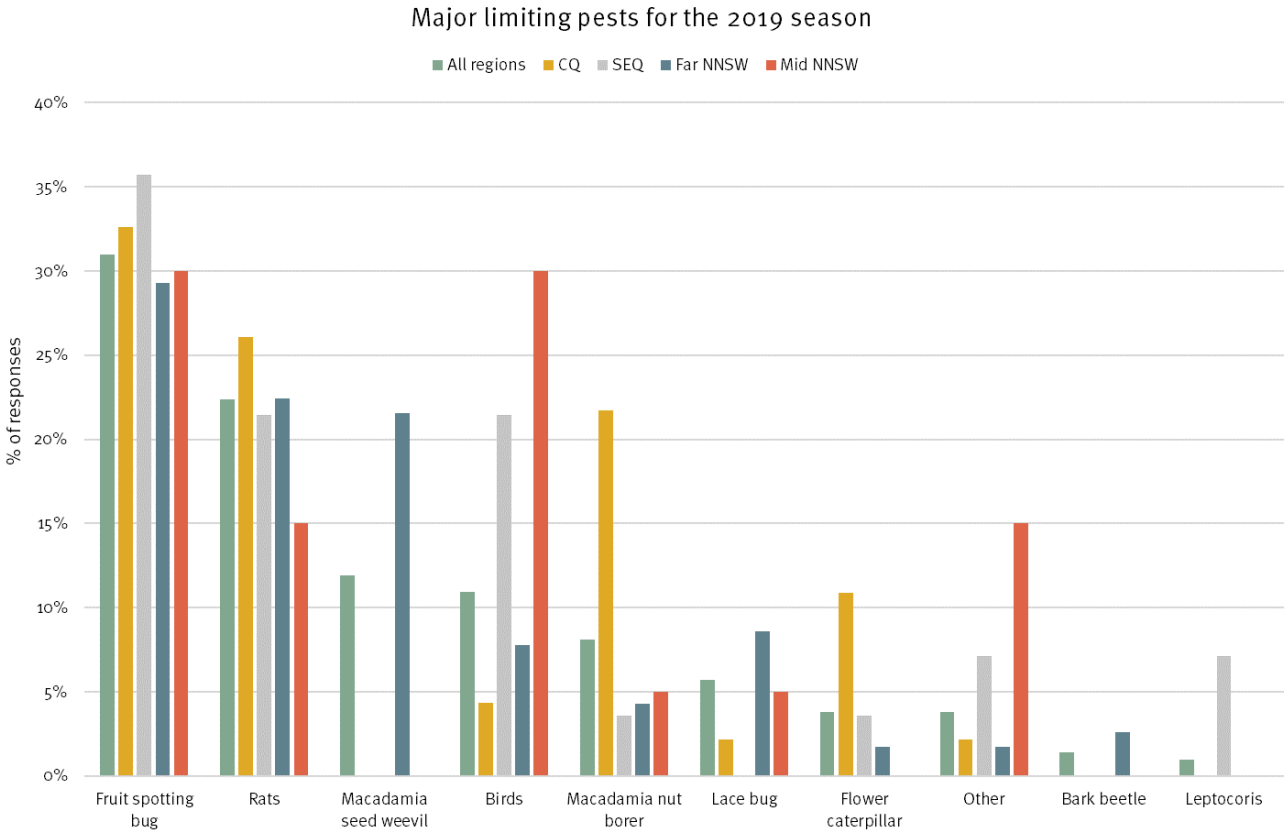


Figure 8 - Major limiting factors for the 2019 season

Disease limitations

Figure 9 shows a total of 115 responses that were received in relation to disease limitations in 2019 (CQ – 26, SEQ – 9, NRNSW – 65 and MNNSW – 15). The disease most reported as limiting production across all regions was Phytophthora (35%), followed by flower diseases (21%), branch or tree dieback (20%) and husk spot (17%). A smaller number of responses indicated other disease limitations including Abnormal Vertical Growth (3%) husk rot (2%) and "Other" (2%).
In some cases branch or tree dieback can be associated with bark beetles. Increased bark beetle activity has been observed on some farms over the last few seasons, including 2019.

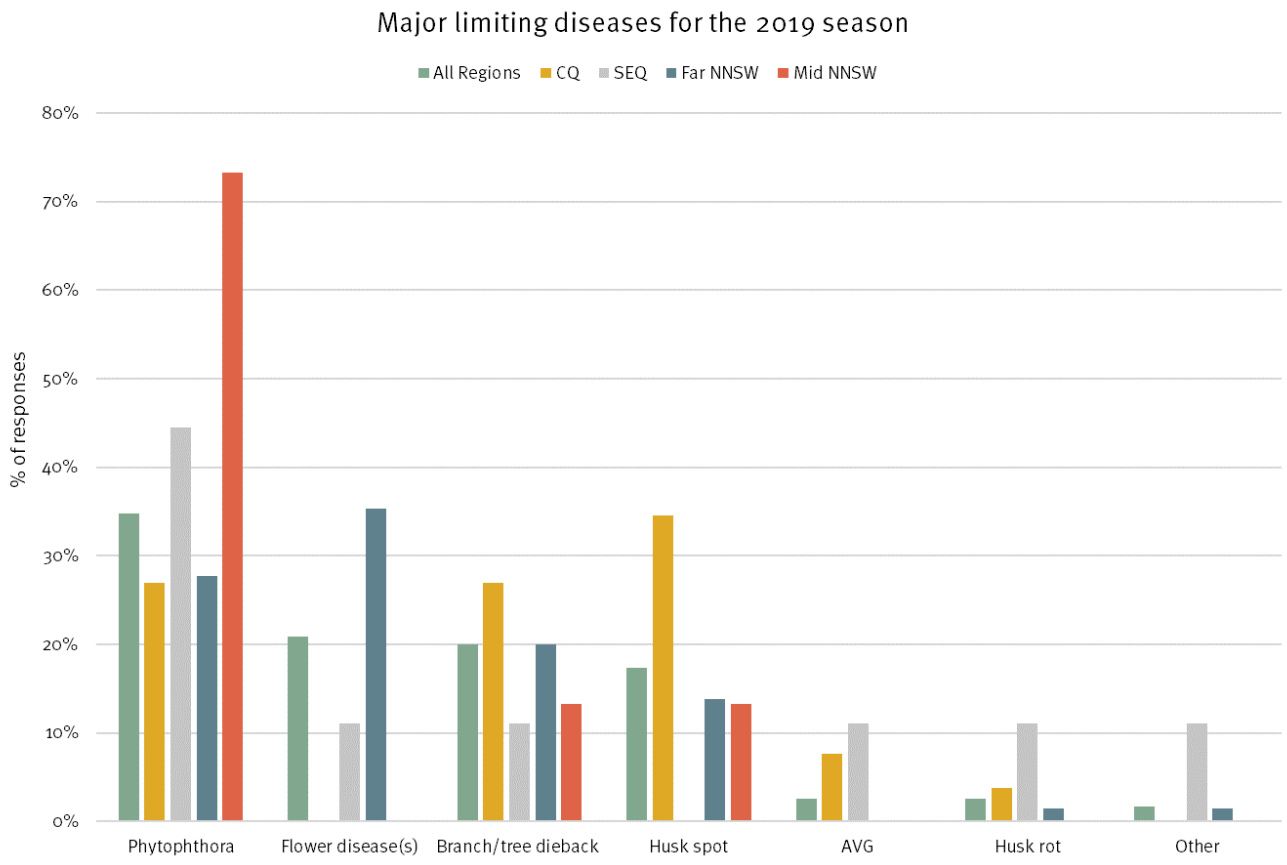


Figure 9 - Major limiting factors for the 2019 season