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AUSTRALIAN WALNUT INDUSTRY BENCHMARK REPORT

2019

MD LANG
TREE NUTS PLUS

Contents

Acknowledgements

This report has been produced as a 'Benchmarking the walnut industry in Australia' project. This is an initiative of the Australian Walnut Industry Association Inc (AWIA) in association with the AWIA membership, AWIA Industry Development Officer (IDO) and Tree Nuts Plus. The project has been funded by AWIA.

Disclaimer

Results presented in this report are based on data provided by industry participants to the AWIA IDO. To ensure the confidentiality of individual farm data, this report includes Australian and region averages. Figures presented are based on summary statistics using underlying data that is not included in the report.

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About the benchmarking project

The AWIA promotes the improved productivity and profitability of the Australian walnut industry. To support this, benchmarking data has been collected annually from AWIA member walnut farms since 2015. This information has been provided directly to the AWIA Industry Development Officer (IDO) on a confidential basis.

The first benchmarking project, 'AWIA Statistical analysis of 2015 Industry Survey', provided trends on crop production, planting information and orchard operations. The 2015 Production Survey Report is available to the AWIA membership at www.walnut.net.au/members/industry-data/

The 2015 Production Survey Report focussed on:

1) Volume of product,
2) Numbers of trees,
3) Major cultivars, and
4) Future trends.

The 2019 walnut industry benchmark survey builds on the 2015 report.

Analysis and interpretation of data

Data were supplied to Tree Nuts Plus as an Excel (Microsoft Corporation) workbook with confidential identifiers specified for each orchard.

The project reports averages and ranges for individual regions (NSW, SA, TAS, VIC, WA), and for combined regions (Australia), and summarises information so that individual orchard data remains confidential.

In this project, data from enterprises with multiple orchards was analysed as individual orchards.

Incomplete data sets limited analysis and interpretation of crop production, planting information and orchard operations in many regions. Data collection methodology did not enable crop production forecasts from 2020 onwards to be estimated.

Summary of key findings

Project coverage

- The submitted data represented 90% of the total area, and total number of walnut trees in Australia and represents more than 94% of the total area and trees within AWIA membership.

Production by tree age and year

- Dry weight yield (in-shell) increased nearly 10-fold between 2010 (1,371 tonnes) and 2017 (12,623 tonnes) and exceeded 10,000 tonnes in 2018 and 2019. Production from NSW was the largest component of total crop yield, followed by TAS and then VIC.
- Crop yield was greatest in trees aged between 12-20 years (4.3 t/ha), followed by 20-30 years (1.9 t/ha) and 8-12 years (1.0 t/ha). Other tree ages yielded less than 1.0 t/ha in-shell.

Hectares and tree numbers planted

- Over 4,000 ha of walnuts, and circa 1,188,000 trees are planted in Australia. The largest area planted and tree numbers by region is in NSW (2,841 ha; 833,250 trees), followed by VIC (629 ha; 165,000 trees) and TAS (466 ha; 161,500 trees). Smaller plantings occur in WA (60 ha; 21,900 trees). SA and the ACT total less than 26 ha and 6,500 trees.
- New plantings (< 4 years) are present in NSW and VIC, mature plantings (4-20 years) in all regions, older plantings (20-30 years) in NSW, TAS and VIC and original plantings (> 30 years) in VIC only. Trees between 12-20 years represent most plantings in NSW, TAS and SA whereas new plantings (< 4 years) are greatest in NSW.
- Five cultivars represent more than 83% of all hectares planted to walnut in Australia i.e., Chandler (28%), Howard (18%), Vina (15%), Lara (13%) and Tulare (9%). Of these cultivars, Chandler and Howard account for 46% of all planted area.

Orchard size and planting density

- Over 60% of walnut orchards in Australia are less than 10 ha and are predominantly located in VIC. Medium size orchards (11-50 ha) are reported in VIC only, whereas large orchards (≥51 ha) are reported in NSW, TAS and WA.
- Mean planting density in Australian orchards is 296 trees per hectare, although minimum and maximum density ranges greatly within and between regions.

Processing capability and quality assurance programmes

- The greatest processing volume is in NSW; however, the number of processing and value adding facilities in VIC account for nearly 50%, or more, of all facilities in Australia.
- Quality assurance programmes were diverse amongst regions; however, HACCP, GLOBAL G.A.P., BRC, WQA and Certified organic cover 88-89% of total planted area in Australia.

Product sales

- Retail and wholesale sales account for nearly 50% and 60% of enterprises and volume, respectively. Exports represent 8 and 39% of enterprises and volume, respectively. Farm gate and farmers markets account for a near 30% of enterprises but only 0.3% of total volume.

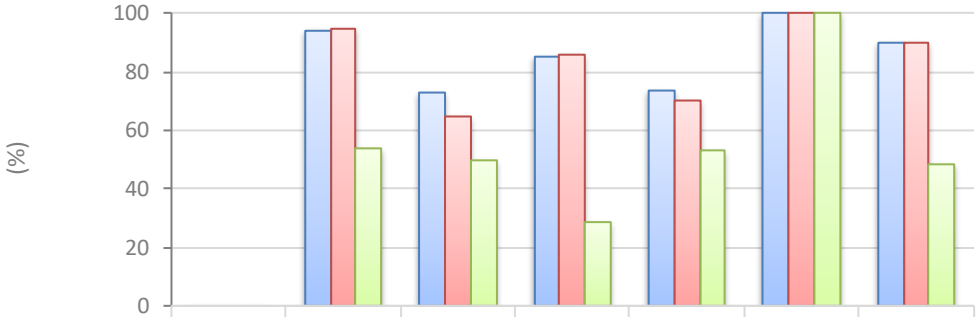
Factors limiting production

- Premature fruit drop reduced potential revenue by $21,835,000 (2016), $4,850,000 (2017), $7,700,000 (2018) and $8,700,000 (2019). Losses from abiotic (frost, hail damage, drought) and biotic (bird damage, walnut blight, nut quality) factors was less severe.

Scope and coverage

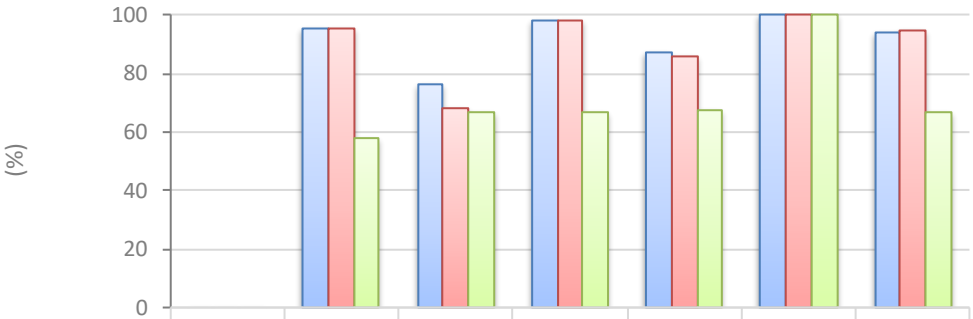
A total of 37 farms submitted data in 2019 (5 farms from NSW, 2 from SA, 4 from TAS, 24 from VIC, 2 from WA). The data represents 90% of the total area, and total number of walnut trees planted in Australian orchards (Figure 1).

A total of 67% of AWIA growers participated in the survey with 58 (NSW), 67 (SA, TAS), 68 (VIC) and 100% (WA) of growers submitting data (Figure 2). The data represents 95% of the total area and trees within the AWIA membership.



	ACT	NSW	SA	TAS	VIC	WA	Grand Total
Hectares	0	94	73	85	73	100	90
Trees	0	95	65	86	70	100	90
Respondents	0	54	50	29	53	100	49

Figure 1: Walnut plantings by hectares and trees and percent growers participating (respondents) in the AWIA benchmarking survey, as a percentage of the total plantings and growers within the walnut industry in Australia in 2019.



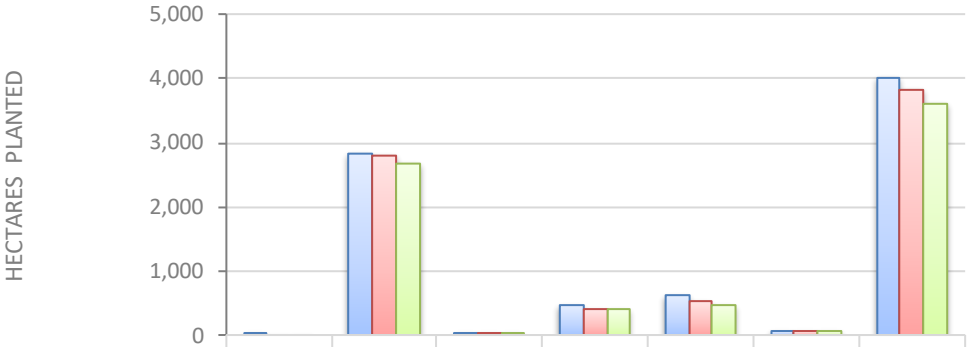
	ACT	NSW	SA	TAS	VIC	WA	Grand Total
Hectares	0	95	77	98	87	100	94
Trees	0	96	68	98	86	100	95
Respondents	0	58	67	67	68	100	67

Figure 2: Walnut plantings by hectares and trees and percent growers participating (respondents) in the AWIA benchmarking survey, as a percentage of walnut plantings and growers within the AWIA membership in 2019.

Plantings

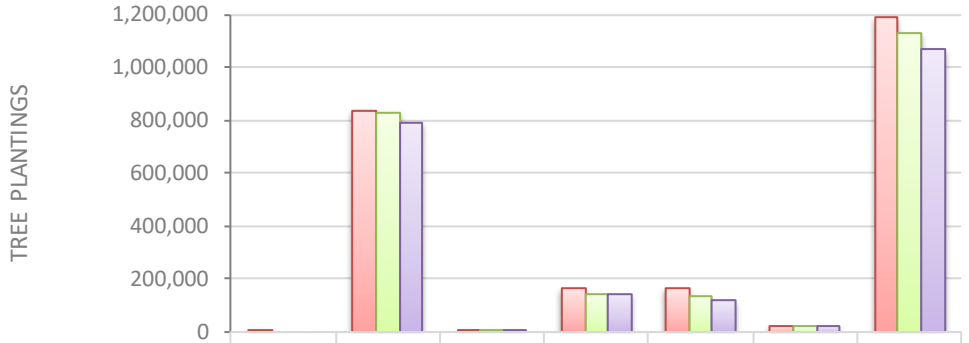
Over 4,000 ha of walnuts are planted in Australia (Figure 3). The AWIA membership and survey respondents account for circa 3,800 and 3,600 ha respectively. The largest area planted by region is in NSW (2,841 ha), followed by Victoria (629 ha) and Tasmania (466 ha). Smaller plantings occur in WA (60 ha), SA (22 ha) and the ACT (4 ha).

Circa 1,188,000 walnut trees are planted in Australian orchards (Figure 4). The AWIA membership and survey respondents account for over 1,000,000 of these trees. Greater number of trees are planted in NSW (circa 833,250 trees), followed by Victoria (164,000 trees), Tasmania (161,500 trees) and WA (22,000 trees). SA and the ACT combined total less than 6,500 trees.



	ACT	NSW	SA	TAS	VIC	WA	TOTAL
Walnut industry	4	2,841	22	466	629	60	4,021
AWIA membership	0	2,813	21	404	531	60	3,829
AWIA survey	0	2,683	16	396	462	60	3,617

Figure 3: Walnut plantings (hectares) within the walnut industry in Australia, AWIA membership and growers participating in the AWIA benchmarking survey in 2019.

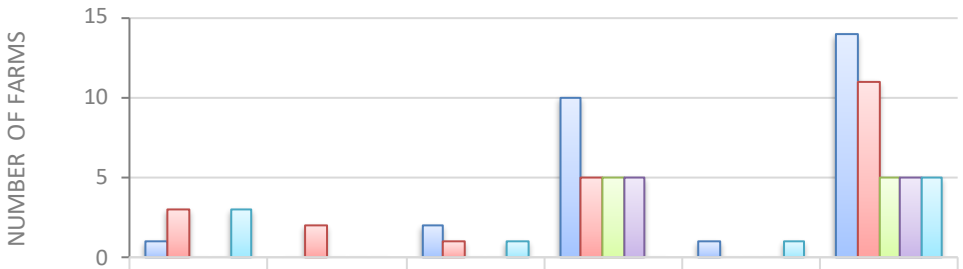


	ACT	NSW	SA	TAS	VIC	WA	TOTAL
Walnut industry	400	833,261	5,943	161,487	165,018	21,900	1,188,009
AWIA membership	0	825,521	5,628	140,973	135,737	21,900	1,129,759
AWIA survey	0	790,386	3,843	138,690	116,257	21,900	1,071,076

Figure 4: Walnut plantings (tree numbers) within the walnut industry in Australia, AWIA membership and AWIA growers participating in the AWIA benchmarking survey in 2019.

Orchard size

A near 2/3rd (25 of 40 orchards) of AWIA orchards are less than 10 ha (Figure 5). Of these orchards VIC has the greatest representation (15) followed by NSW (4), TAS (3), SA (2) and WA (1). Medium size orchards (11-25 ha and 26-50 ha) are reported in VIC only (10 orchards). Large orchards (≥51 ha) are reported in NSW (3), TAS (1) and WA (1).

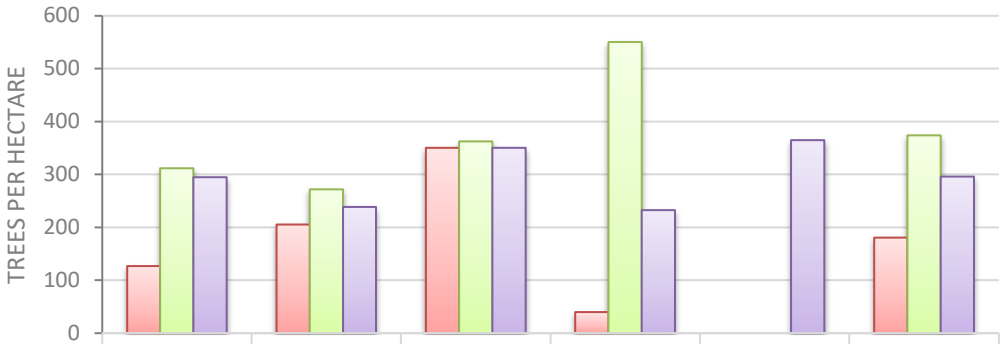


	NSW	SA	TAS	VIC	WA	TOTAL
≤5 ha	1	0	2	10	1	14
6-10 ha	3	2	1	5	0	11
11-25 ha	0	0	0	5	0	5
26-50 ha	0	0	0	5	0	5
≥51 ha	3	0	1	0	1	5

Figure 5: The number of small (≤5 ha, 6-10 ha), medium (11-25 ha, 26-50 ha) and large (≥51 ha) walnut orchards in Australia in 2019.

Planting density

Mean planting density in Australia was 296 trees per hectare, and within region ranged from 232 (VIC) to 365 (WA) trees per hectare (Figure 6). Minimum and maximum densities varied greatly between regions; VIC (minimum = 40 trees per ha; maximum = 550 trees per ha), NSW (127;311), SA (205;272) and TAS (350;363).



	NSW	SA	TAS	VIC	WA	ALL REGIONS
Min.	127	205	350	40		181
Max.	311	272	363	550		374
Mean	295	239	350	232	365	296

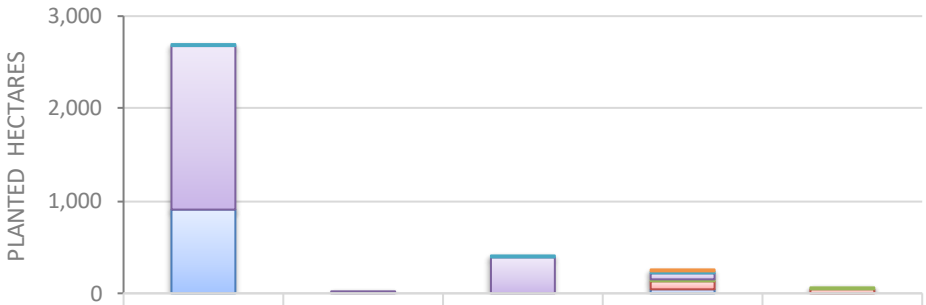
Figure 6: Minimum, maximum, and mean planting density (trees per hectare) of walnut orchards in Australia in 2019. A blank cell indicates that data could not be analysed for that region.

Tree age

Tree age varied between regions with new plantings (< 4 years) in NSW and VIC, mature plantings (4-20 years) in all regions, older plantings (20-30 years) in NSW, TAS and VIC and original plantings (> 30 years) in VIC only (Figure 7).

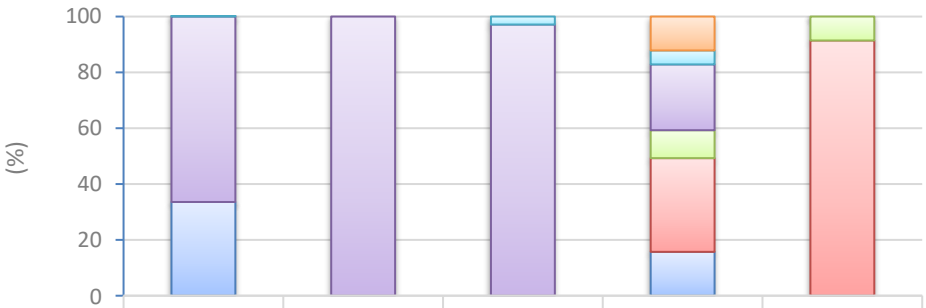
Trees between 12-20 years represent most plantings in NSW (1,783 ha), TAS (384 ha) and SA (16 ha) with 66, 97 and 100% of all plantings, respectively (Figures 7 and 8). New plantings (< 4 years) are greatest in NSW (899 ha). Bearing trees between 4-8 and 8-12 years are greatest in VIC and WA with 44 (115 ha) and 100% (60 ha) of plantings, respectively.

Plantings in WA are younger than other regions with all trees less than 12 years (Figure 8). In contrast, trees in SA and TAS are 12-20 and 12-30 years, respectively. VIC has plantings in each age category.



	NSW	SA	TAS	VIC	WA
> 30	0	0	0	31	0
20 to 30	1	0	12	14	0
12 to 20	1,783	16	384	63	0
8 to 12	0	0	0	25	5
4 to 8	0	0	0	90	55
< 4	899	0	0	42	0

Figure 7: Total hectares of walnut orchards by tree age category (years) within regions in 2019.



	NSW	SA	TAS	VIC	WA
> 30	0	0	0	12	0
20 to 30	0	0	3	5	0
12 to 20	66	100	97	24	0
8 to 12	0	0	0	10	8
4 to 8	0	0	0	34	92
< 4	34	0	0	16	0

Figure 8: Percent orchard area by tree age category (years) within regions in 2019.

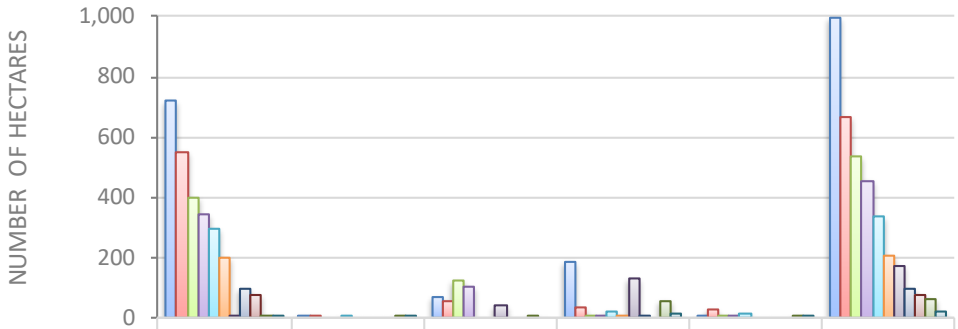
Cultivars – hectares

Five cultivars represent more than 83% of all hectares planted to walnut in Australia: Chandler (28%), Howard (18%), Vina (15%), Lara (13%) and Tulare (9%) (Table 1). Of these cultivars, Chandler and Howard account for 46% of all planted area.

The greatest area planted per cultivar in Australia is Chandler (995 ha), followed by Howard (666 ha), Vina (533 ha), Lara (451 ha), Tulare (340 ha) and Serr (207 ha) (Figure 9). Within each region the greatest area per cultivar differed with more Chandler in NSW (720 ha), VIC (186 ha) and SA (8 ha), Vina in TAS (126 ha) and Howard in WA (27 ha).

Table 1: Mean percent hectares of walnuts by cultivar and region in 2019.

CULTIVAR	NSW	SA	TAS	VIC	WA	TOTAL
Chandler	26.8	50.1	17.7	40.2	17.8	27.5
Howard	20.4	15.9	13.6	7.4	45.0	18.4
Vina	14.7	0.0	31.9	2.1	2.3	14.7
Lara	12.8	0.0	26.3	0.8	1.7	12.5
Tulare	11.1	30.4	0.0	4.2	27.8	9.4
Serr	7.5	0.0	0.0	1.2	0.0	5.7
Mixed	0.0	0.0	10.4	29.1	0.0	4.9
Ashley	3.6	0.0	0.0	0.2	0.0	2.7
Livermore	2.8	0.0	0.0	0.0	0.0	2.1
Franquette	0.2	2.8	0.1	11.4	0.5	1.7
Other	0.0	0.8	0.0	3.2	5.0	0.5



	NSW	SA	TAS	VIC	WA	TOTAL
Chandler	720	8	70	186	11	995
Howard	548	3	54	34	27	666
Vina	396	0	126	10	1	533
Lara	342	0	104	4	1	451
Tulare	298	5	0	20	17	340
Serr	201	0	0	6	0	207
Mixed	0	0	41	135	0	176
Ashley	95	0	0	1	0	96
Livermore	75	0	0	0	0	75
Franquette	6	0	0	53	0	60
Other	2	1	0	14	3	19

Figure 9: Number of hectares of walnuts by cultivar and region in 2019.

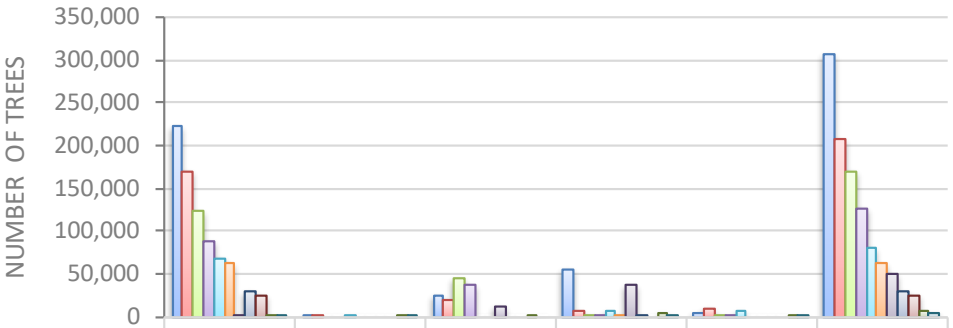
Cultivars – tree numbers

Most trees per cultivar in Australia are Chandler (29%) followed by Howard (19%), Vina (16%), Lara (12%) and Tulare (8%) (Table 2). Of these cultivars Chandler and Howard account for 48% of all planted trees.

A near 307,000 Chandler are planted in Australia, followed by Howard (circa 207,000 trees), Vina (170,000) and Lara (126,500) (Figure 10). All other cultivars have less than 100,000 trees. Within each region the greatest number of trees per cultivar differed with more Chandler in NSW (circa 223,000), VIC (54,500) and SA (1,800), with more Vina in TAS (45,000) and Howard in WA (10,000).

Table 2: Mean percent walnut trees by cultivar and region in 2019.

CULTIVAR	NSW	SA	TAS	VIC	WA	TOTAL
Chandler	28.2	46.2	17.7	46.8	16.0	28.7
Howard	21.5	13.6	13.7	6.3	45.7	19.3
Vina	15.7	0	32.5	0.9	1.8	15.9
Lara	11.2	0	26.7	0.5	1.8	11.8
Tulare	8.6	36.4	0	5.3	29.2	7.6
Serr	7.9	0	0	1.0	0	6.0
Mixed	0	0	9.4	31.8	0	4.7
Ashley	3.8	0	0	0.3	0	2.8
Livermore	3.0	0	0	0	0	2.2
Franquette	0.1	2.4	0.1	4.4	0.5	0.6
Other	0	1.3	0	2.5	5.0	0.4



	NSW	SA	TAS	VIC	WA	TOTAL
Chandler	222,743	1,776	24,520	54,456	3,500	306,995
Howard	170,196	524	19,000	7,381	10,000	207,101
Vina	123,756	0	45,050	1,058	400	170,264
Lara	88,559	0	37,000	639	400	126,598
Tulare	67,828	1,400	0	6,143	6,400	81,771
Serr	62,768	0	0	1,190	0	63,958
Mixed	84	0	13,000	37,000	0	50,084
Ashley	29,872	0	0	383	0	30,255
Livermore	23,569	0	0	0	0	23,569
Franquette	865	93	120	5,123	100	6,201
Other	146	50	0	2,882	1,100	4,278

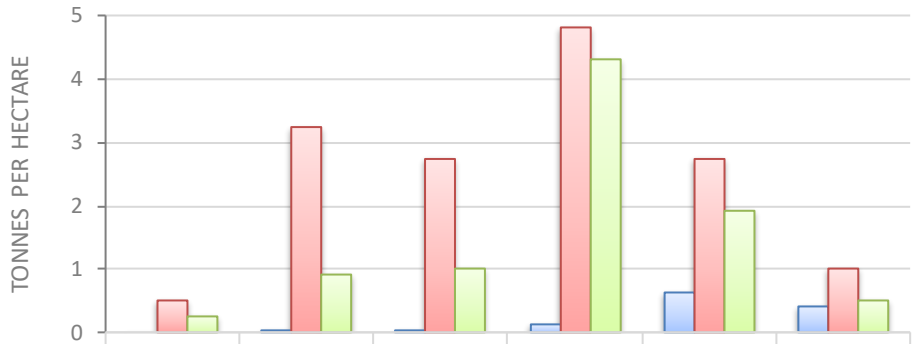
Figure 10: Number of walnut trees by cultivar and region in 2019.

Crop yield

Mean crop yield (in-shell) varied with tree age, with the greatest yield in trees between 12-20 years (4.3 t/ha), followed by 20-30 years (1.9 t/ha) and 8-12 years (1.0 t/ha) (Figure 11). Other years yielded less than 1.0 t/ha in-shell.

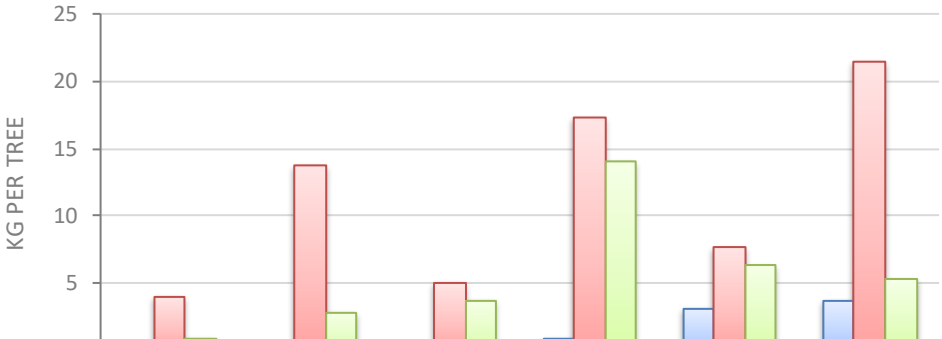
Crop yield per tree was greatest in trees between 12-20 years (14.0 kg/tree) followed by 20-30 years (6.3 kg/tree) and >30 years (5.3 kg/tree) (Figure 12). Trees younger than 12 years yielded less than 3.7 kg/tree.

Production varied greatly within and between tree age and may reflect abiotic (environment), biotic (disease), cultural (planting density) and systematic (sampling bias) factors associated with crop yield.



	< 4	4 to 8	8 to 12	12 to 20	20 to 30	> 30
Min.	0.0	0.0	0.0	0.1	0.6	0.4
Max.	0.5	3.2	2.7	4.8	2.8	1.0
Mean	0.2	0.9	1.0	4.3	1.9	0.5

Figure 11: Minimum, maximum and mean in-shell (dry weight) yield (t/ha) by tree year in 2019.



	< 4	4 to 8	8 to 12	12 to 20	20 to 30	> 30
Min.	0.0	0.1	0.3	0.9	3.1	3.7
Max.	4.0	13.7	5.0	17.4	7.7	21.4
Mean	0.9	2.8	3.7	14.0	6.3	5.3

Figure 12: Minimum, maximum and mean in-shell (dry weight) yield (kg/tree) by tree year in 2019.

Processing of walnuts

Processing and value adding facilities in VIC account for a near 50%, or more, of all facilities in Australia: hull removal (8 VIC, 14 TOTAL), drying (10 VIC, 20 TOTAL), sizing (6 VIC, 15 TOTAL), shelling (5 VIC, 11 TOTAL), packaging (9 VIC, 18 TOTAL), value adding (3 VIC, 5 TOTAL) (Table 3). The greatest processing volume was in NSW, followed by TAS and VIC.

Table 3: Total number of processing and value adding facilities, and the mean and range of volume (tonnes) processed per day by region in 2019. A dash indicates that data for that operation was not provided.

REGION	FACILITIES	HULL REMOVAL	DRYING	SIZING	SHELLING	PACKAGING	VALUE ADDING
NSW	Number	3	4	3	2	3	1
	Mean (t/day)	100	65	27	13	27	0.005
	Range (t/day)	1.3 - 200	0.04 - 160	0.02 - 80	0.02 - 25	0.02 - 80	-
SA	Number	0	2	2	0	2	0
	Mean (t/day)	-	2.0	3.5	-	1.8	-
	Range (t/day)	-	2.0 - 2.0	2.0 - 5.0	-	1.5 - 2.0	-
TAS	Number	1	2	2	2	2	1
	Mean (t/day)	60	81	41	13	40	0.05
	Range (t/day)	-	1.2 - 160	1.2 - 80	0.2 - 25	0.4 – 80	-
VIC	Number	8	10	6	5	9	3
	Mean (t/day)	3.7	3.7	4.6	2.5	3.3	0.4
	Range (t/day)	0.02 - 10	0.02 - 10	0.35 - 10	1.0 - 4.0	0.02 – 10	0.01 - 0.8
WA	Number	2	2	2	2	2	0
	Mean (t/day)	-	-	-	-	-	-
	Range (t/day)	-	-	-	-	-	-
ALL REGIONS	Number	14	20	15	11	18	5

Quality assurance

Uptake of quality assurance programmes was diverse amongst regions with greater representation of FRESHCARE in VIC (60% of enterprises), HACCP in SA (67%), GLOBAL G.A.P in NSW (29%), BRC in NSW (21%) and OTHER in NSW (WQA, 21%) and WA (Certified organic, 100%) (Table 4).

HACCP, GLOBAL G.A.P., BRC and OTHER (WQA and Certified organic) covered 88-89% of the total area of walnut plantings in Australia, with 96 and 99% of plantings in NSW and TAS respectively (Table 5).

Table 4: Mean percent walnut enterprises with quality assurance programmes by region in 2019.

REGION	FRESHCARE	HACCP[Z]	GLOBAL G.A.P.	BRC[Y]	OTHER[X]
NSW	7	21	29	21	21
SA	33	67	0	0	0
TAS	20	20	20	20	20
VIC	60	0	20	0	20
WA	0	0	0	0	100
ALL REGIONS	21.3	19.8	19.8	19.8	19.3

[Z] HACCP = Hazard Analysis and Critical Control Point; [Y] BRC = BRC Global Standard; [X] Other = WQA (Woolworth Quality Assurance Standard) (NSW, TAS), Certified organic (VIC, WA).

Table 5: Mean percent area of walnut plantings with quality assurance programmes by region in 2019.

REGION	FRESHCARE	HACCP[Z]	GLOBAL G.A.P.	BRC[Y]	OTHER[X]
NSW	0.1	99	99	99	99
SA	50	100	0	0	0
TAS	1.0	96	96	96	96
VIC	30	0	8	0	8
WA	0	0	0	0	8
ALL REGIONS	3.0	88.4	88.9	87.9	88.8

[Z] HACCP = Hazard Analysis and Critical Control Point; [Y]BRC = BRC Global Standard; [X] Other = WQA (Woolworth Quality Assurance Standard) (NSW, TAS), Certified organic (VIC, WA).

Biosecurity programmes

Biosecurity programmes are used by 43% of farms, with 71% in NSW and 50% in SA and TAS (Table 6). Programmes cover a total of 3,223 ha (range: 8 - 2,669 ha) and 93% (range 50 - 100%) of total area.

Table 6: Number and percent, and hectares and percent area covered, of enterprises with biosecurity programmes by region in 2019.

REGION	PARTICIPANTS		AREA COVERED	
	NUMBER	PERCENT	HECTARES	PERCENT
NSW	5	71	2,669	99
SA	1	50	8	50
TAS	2	50	388	98
VIC	9	36	158	53
WA	0	0	0	0
ALL REGIONS	17	42.5	3,223	93.3

Sale outlets and volumes

Retail and wholesale sales account for 40 farms (22 retailers, 18 wholesale) and a near 6,000 tonnes (4,799 tonnes retail, 1,182 tonnes wholesale) (Tables 7 and 8). Exports are represented by seven farms and 3,964 tonnes. Farm gate and farmer markets represent 24 farms and 30 tonnes.

On a percentage basis, retail and wholesale sales account for a near 50% of farms (26% retail, 21% wholesale) and a near 60% of volume (47% retail, 12% wholesale) (Tables 9 and 10). Exports represent 8 and 39% of farms and volume, respectively. Farm gate and farmers markets account for a near 30% of farms but only 0.3% of total volume.

Table 7: Number of farms participating in sales by outlet and region in 2019.

REGION	FARM GATE	FARMER MARKET	PROCESSOR	WHOLESALE	RETAIL	EXPORT
NSW	3	2	1	4	5	4
SA	2	1	1	3	2	1
TAS	1	1	2	2	2	1
VIC	8	6	9	7	11	1
WA	0	0	0	2	2	0
ALL REGIONS	14	10	13	18	22	7

Table 8: Volume (tonnes) of dry weight in-shell equivalent sales by outlet and region in 2019.

REGION	FARM GATE	FARMERS MARKET	PROCESSOR	WHOLESALE	RETAIL	EXPORT
NSW	1.1	0.2	0	833.0	4,165.8	3,332.0
SA	1.0	0	0	16.0	3.0	0
TAS	0.9	1.5	24.0	212.0	568.8	631.8
VIC	5.3	20.6	161.5	48.9	59.1	0
WA	0	0	0	72.3	2.8	0
ALL REGIONS	8	22	186	1,182	4,799	3,964

Table 9: Percentage of enterprises participating in sales by outlet and region in 2019.

REGION	FARM GATE	FARMERS MARKET	PROCESSOR	WHOLESALE	RETAIL	EXPORT
NSW	3.6	2.4	1.2	4.8	6.0	4.8
SA	2.4	1.2	1.2	3.6	2.4	1.2
TAS	1.2	1.2	2.4	2.4	2.4	1.2
VIC	9.5	7.1	10.7	8.3	13.1	1.2
WA	0.0	0.0	0.0	2.4	2.4	0.0
ALL REGIONS	16.7	11.9	15.5	21.4	26.2	8.3

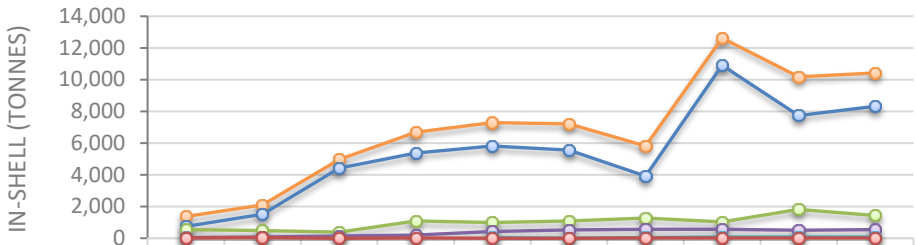
Table 10: Percent dry weight in-shell equivalent sales by outlet and region in 2019.

REGION	FARM GATE	FARMERS MARKET	PROCESSOR	WHOLESALE	RETAIL	EXPORT
NSW	0.0	0.0	0.0	8.2	41.0	32.8
SA	0.0	0.0	0.0	0.2	0.0	0.0
TAS	0.0	0.0	0.2	2.1	5.6	6.2
VIC	0.1	0.2	1.6	0.5	0.6	0.0
WA	0.0	0.0	0.0	0.7	0.0	0.0
ALL REGIONS	0.1	0.2	1.8	11.6	47.2	39.0

Estimated seasonal yield

Total dry weight (in-shell) yield increased nearly 10-fold between 2010 and 2017 (1,371 and 12,623 tonnes respectively) and exceeded 10,000 tonnes in 2018 and 2019 (Figure 13).

Production from NSW was the largest component of total crop yield between 2010-2019 (751-8,332 tonnes) followed by TAS (559-1,439 tonnes) and VIC (44-559 tonnes); these yields represent 55-89% (NSW), 8-41% (TAS) and 3-10% (VIC) of total production in Australia, depending upon year (Figure 13, Table 11). Production from WA and SA reached a maximum of 75 (2017-19) and 36 (2011) tonnes, respectively.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
TOTAL	1,371	2,112	4,981	6,695	7,296	7,210	5,827	12,623	10,179	10,425
NSW	751	1,513	4,419	5,367	5,811	5,554	3,913	10,914	7,747	8,332
TAS	559	488	398	1,086	997	1,100	1,281	1,038	1,831	1,439
VIC	44	75	154	209	437	530	574	578	506	559
WA					37	12	45	75	75	75
SA	17	36	11	33	14	14	15	17	20	20

Figure 13: Estimated dry weight (in-shell) yield in Australia (total) and region, by year. A blank cell indicates that data could not be estimated for that region and year.

Table 11: Estimated dry weight (in-shell) yield, as a percent of the total dry weight (in-shell) yield in Australia, by region and year.

REGION	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NSW	55	72	89	80	80	77	67	86	76	80
TAS	41	23	8	16	14	15	22	8	18	14
VIC	3	4	3	3	6	7	10	5	5	5
WA	0	0	0	0	1	0	1	1	1	1
SA	1	2	0	0	0	0	0	0	0	0

Seasonal crop loss

Non-pollination-drop and pistillate flower abortion reduced potential revenue by $21,835,000 (2016), $4,850,000 (2017), 7,700,000 (2018) and $8,700,000 (2019) (Table 12). The greatest loss was in NSW (range: $4,400,000 - $21,150,000) followed by TAS (range: $450,000 - $1,000,000).

Total revenue loss from abiotic and biotic factors, other than premature fruit drop, ranged between $240,000 (2017) and $2,200 (2019) (Table 13). Most revenue loss was associated with frost (VIC, 2017, $237,500), hail damage (NSW, 2016, $50,000; VIC, 2015, $16,000) and drought (TAS, 2016, $35,000). Mechanical failure of drying bins reduced nut quality in VIC (2018, $30,000). Walnut blight reduced revenue in VIC (2016, $10,000) and NSW (2015, $1,750).

Bird damage reduced potential total revenue from $3,500 (2015) to $21,500 (2019) (Table 14). The largest loss was in NSW (2019, $15,000), followed by VIC (2016, $12,000) and TAS (2017, $7,000).

Table 12: Revenue loss ($) from premature fruit drop by region and year.

REGION	2015	2016	2017	2018	2019
NSW	-	21,150,000	4,400,000	7,700,000 [Z]	7,700,000 [Y]
SA	-	-	0	-	-
TAS	-	675,000	450,000	-	1,000,000 [Y]
VIC	0	10,000	0	-	-
WA	-	-	-	-	-
TOTAL ($)	0	21,835,000	4,850,000	7,700,000	8,700,000
RESPONDENTS	1	4	5	2	3

[Z] non-pollination-drop; [Y] pistillate flower abortion

Table 13: Revenue loss ($) from abiotic and biotic factors, other than premature fruit drop, by region and year.

REGION	2015	2016	2017	2018	2019
NSW	1,750 [Z]	50,000 [Y]	3,000 [W]	-	-
SA	-	-	0	-	-
TAS	-	35,000 [X]	-	2,200 [U]	2,200 [U]
VIC	16,000 [Y]	10,000 [Z]	237,500 [YV]	30,000 [V]	-
WA	0	0	-	-	-
TOTAL ($)	17,750	95,000	240,500	32,200	2,200
RESPONDENTS	5	8	10	1	3

[Z] walnut blight; [Y] hail damage; [X] drought; [W] frost; [V] reduced nut quality (excess moisture); [U] tree death

Table 14: Revenue loss ($) from bird damage by region and year.

REGION	2015	2016	2017	2018	2019
NSW	3,500	0	3,000	5,000	15,000
SA	-	-	-	-	-
TAS	-	0	7,000	6,000	6,000
VIC	0	12,000	6,000	0	500
WA	-	-	-	-	-
TOTAL ($)	3,500	12,000	16,000	11,000	21,500
RESPONDENTS	3	6	7	5	7