



The Australian Wine
Research Institute

Irrigation Efficiency and Practice Change Survey

March 2021

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ACKNOWLEDGEMENT OF COUNTRY

We acknowledge the Traditional Owners of the Country that we work on throughout Australia and recognise their continuing connection to land, waters and culture. We pay our respects to their Elders past, present and emerging and the Elders of other Aboriginal and Torres Strait Islander communities. Moreover, we express gratitude for the knowledge and insight that Traditional Owner and other Aboriginal and Torres Strait Islander people contribute to our shared work.

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Survey Introduction

AWRI Irrigation Efficiency and Practice Change Survey

This report presents the results from the AWRI Irrigation Efficiency and Practice Change Survey conducted in 2020. The purpose of the survey was to provide information on current wine-grape irrigation practices in the inland irrigated regions of Australia and, to help inform the AWRI in the design and delivery of a range of extension and support services for wine-grape growers, in collaboration with the inland wine regions and Wine Australia.

Survey questions refer to grapes grown in the 2019/20 season for the 2020 vintage (unless otherwise stated), and survey results are reported as a proportion of the responses per region rather than an aggregate of all the responses (unless otherwise stated).

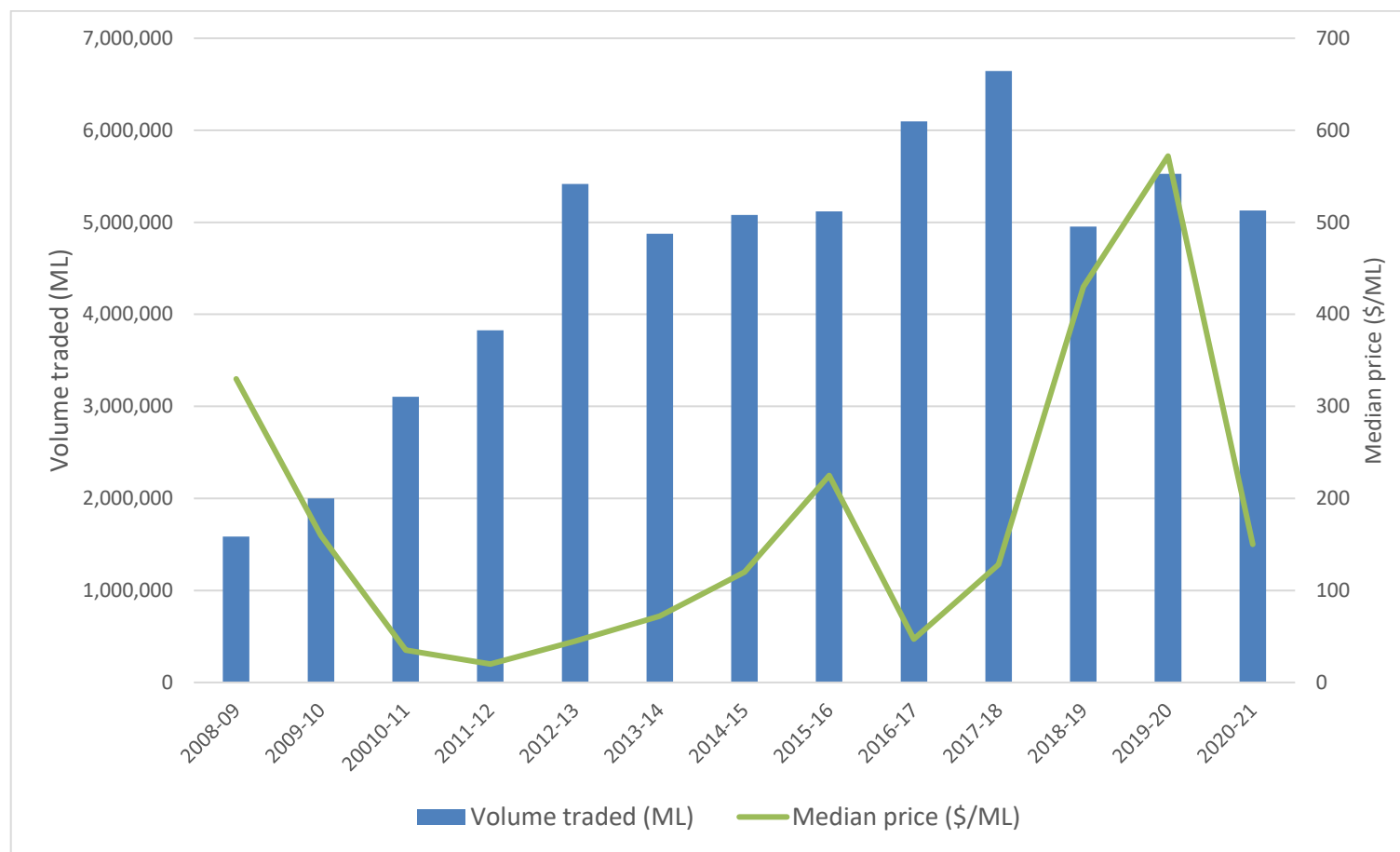
The findings from the survey informed three facilitated workshops in the Riverland, Sunraysia and Riverina in December 2020. RMCG contributed to the design of the survey and facilitated the ensuing workshops.

The AWRI is indebted to the many grapegrowers who took the time to fill out the web-based survey. The AWRI also thanks the Riverina Wine Grapes Marketing Board, Murray Valley Wine Growers Inc, Riverland Wine, CCW Co-operative Ltd and Agriculture Victoria for their help with survey distribution.

This project is supported by Australia's grapegrowers and winemakers through their investment body Wine Australia.



1. Water price



The median water allocation trade price for the Southern Murray-Darling Basin steadily increased from 2016-17 to 2019-20.

Figure 1. Southern Murray–Darling Basin historical water allocation volume traded and median price
(sourced from <http://www.bom.gov.au/water/dashboards/#/water-markets/mdb/at>)

Note 1. A water allocation is the right to access a volume of water for use or trade in the water year. The transfer of water allocation is commonly referred to as ‘temporary’ trade. The Inland irrigated wine grape growing regions included in this survey (Riverland, Riverina, Murray Darling NSW and VIC and Swan Hill) all source water from the Southern Murray-Darling Basin.

2. Irrigation Efficiency Survey response rate

Table 1. Response rate relative to ABS data

Region	Responses (n)	ABS (n)	% Growers
Riverland	70	711	9.8%
Murray Darling/Swan Hill	58	427	13.6%
Riverina	52	341	15.2%
Total	180	1,479	12.2%

*180 responses
(12% of growers from
the inland irrigated
regions).*

Note 2. Australian Bureau of Statistics (ABS) data from 1329.0.55.002, 2014-2015. All respondents completed all of the survey

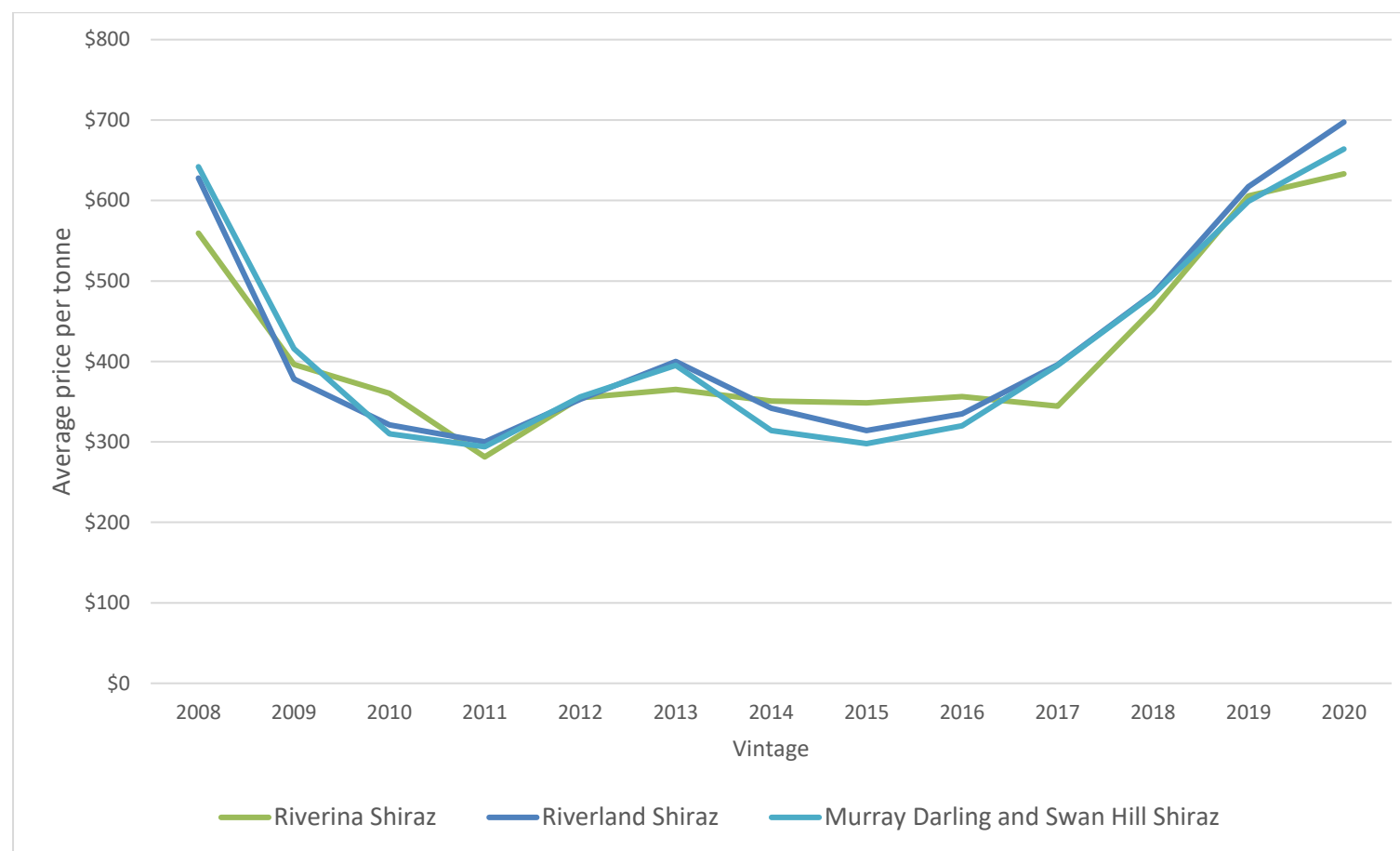
Table 2. Response rate relative to Wine Australia grape crush data

Region	Responses (ha)	Wine Australia (ha)	% Area	Responses (T)	Wine Australia (T)	% Tonnes
Riverland	1,921	21,816	8.8%	39,332	461,385	8.5%
Murray Darling/Swan Hill	1,861	15,577	11.9%	46,918	350,443	13.4%
Riverina	2,550	17,248	14.8%	37,317	268,547	13.9%
Total	6,332	54,641	11.6%	123,567	1,080,375	11.4%

*123,567 tonnes
(11.4% of grapes
crushed in the inland
irrigated regions in
the 2019/20 season).*

Note 3. Wine Australia data sourced from Wine Australia (2020) National Vintage Report 2020 accessed from <https://www.wineaustralia.com/market-insights/national-vintage-report>

3. Grape prices



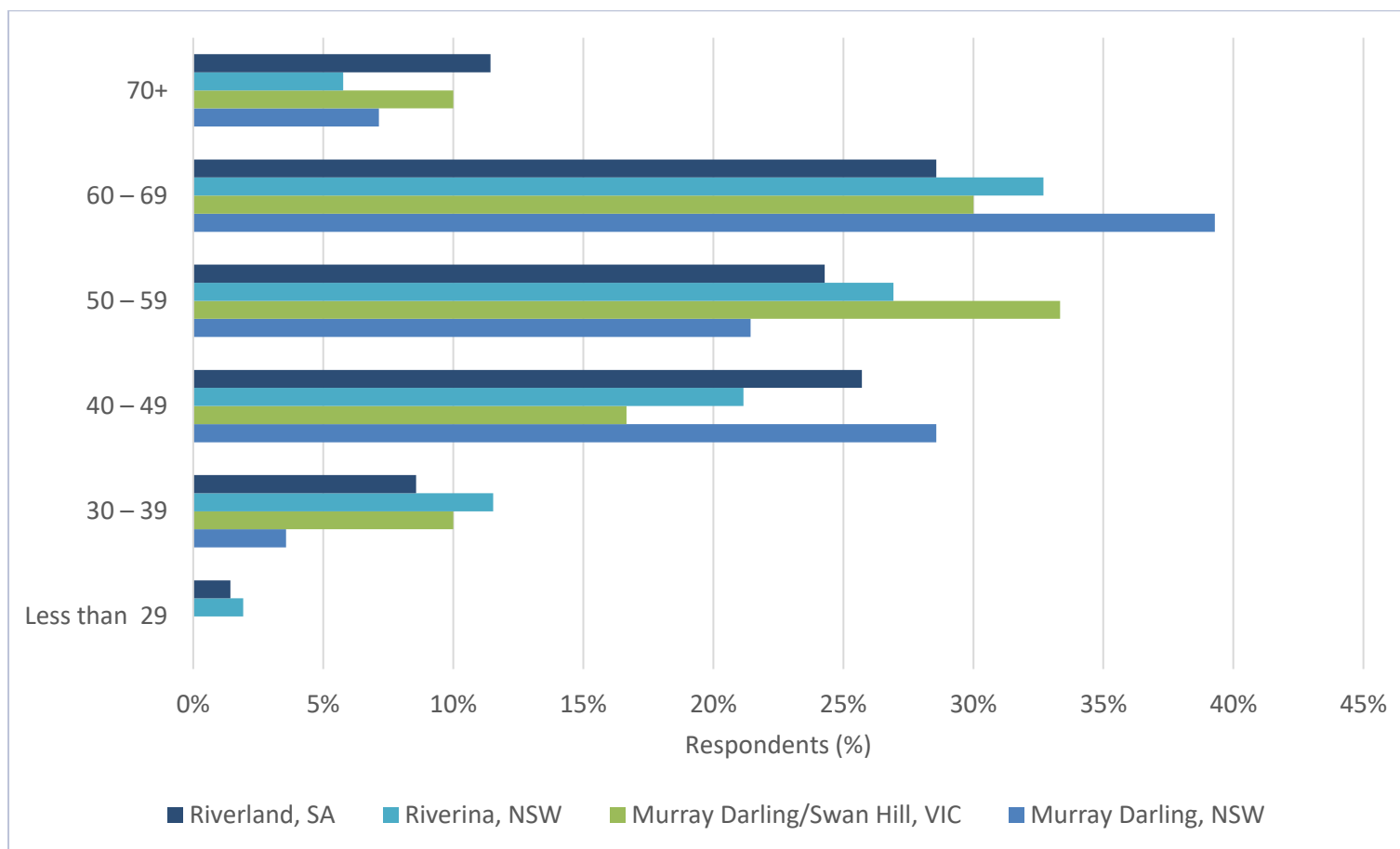
The weighted average grape price for Riverina, Riverland and Murray Darling and Swan Hill Shiraz steadily rose each year from 2017 to 2020 to reach at the highest price seen in 13 years (> \$600/tonne).

Previous to this, the weighted average grape price for Riverland and Riverina Shiraz had remained below \$400/tonne for 9 years from 2009 until 2017.

Figure 2. Historical weighted average grape price for Riverina, Riverland and Murray Darling and Swan Hill Shiraz

Note 4. Riverina and Riverland data sourced from Wine Australia (2020) National Vintage Report 2020 accessed from <https://www.wineaustralia.com/market-insights/national-vintage-report>, Murray Darling and Swan Hill data sourced from Murray Darling & Swan Hill Wine Grape Crush Report 2020 Vintage accessed from http://www.mvwi.com.au/mvwi_crush_surveys/

4. Age of respondents

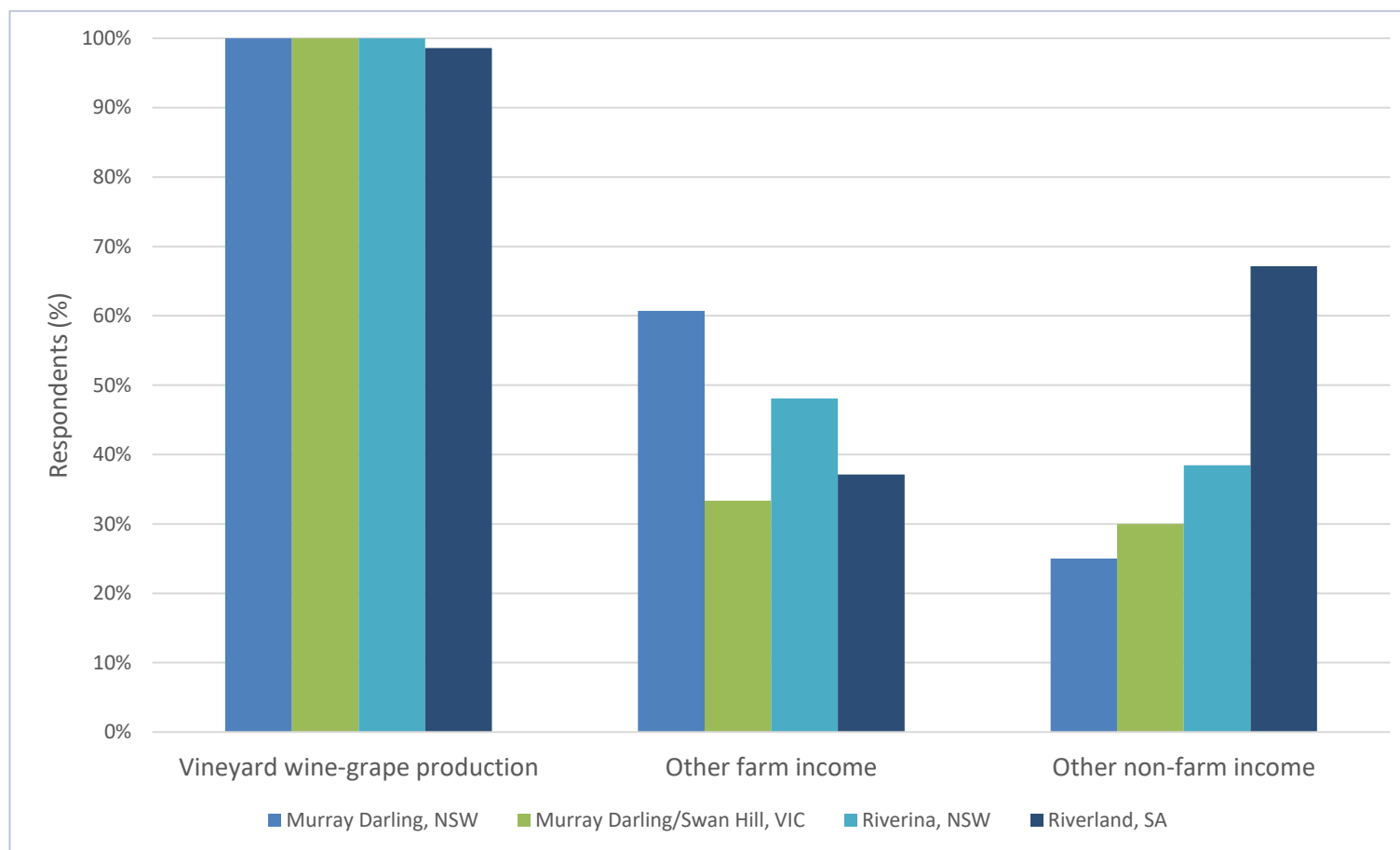


81% of respondents across all regions were aged between 40 and 69 years old.

9% of respondents across all regions were above 70 years old, compared to only 1% that were below 29 years of age.

Figure 3. Proportion of respondents in each region within each age bracket

5. Business structure



The percentage of respondents who received other farm income ranged from 33% in Murray Darling VIC/Swan Hill to 61% in Murray Darling NSW.

The percentage of respondents who received other non-farm income ranged from 25% in Murray Darling NSW to 67% in the Riverland.

Figure 4. Proportion of respondents in each region receiving an income from the different income sources

6. Business position and outlook

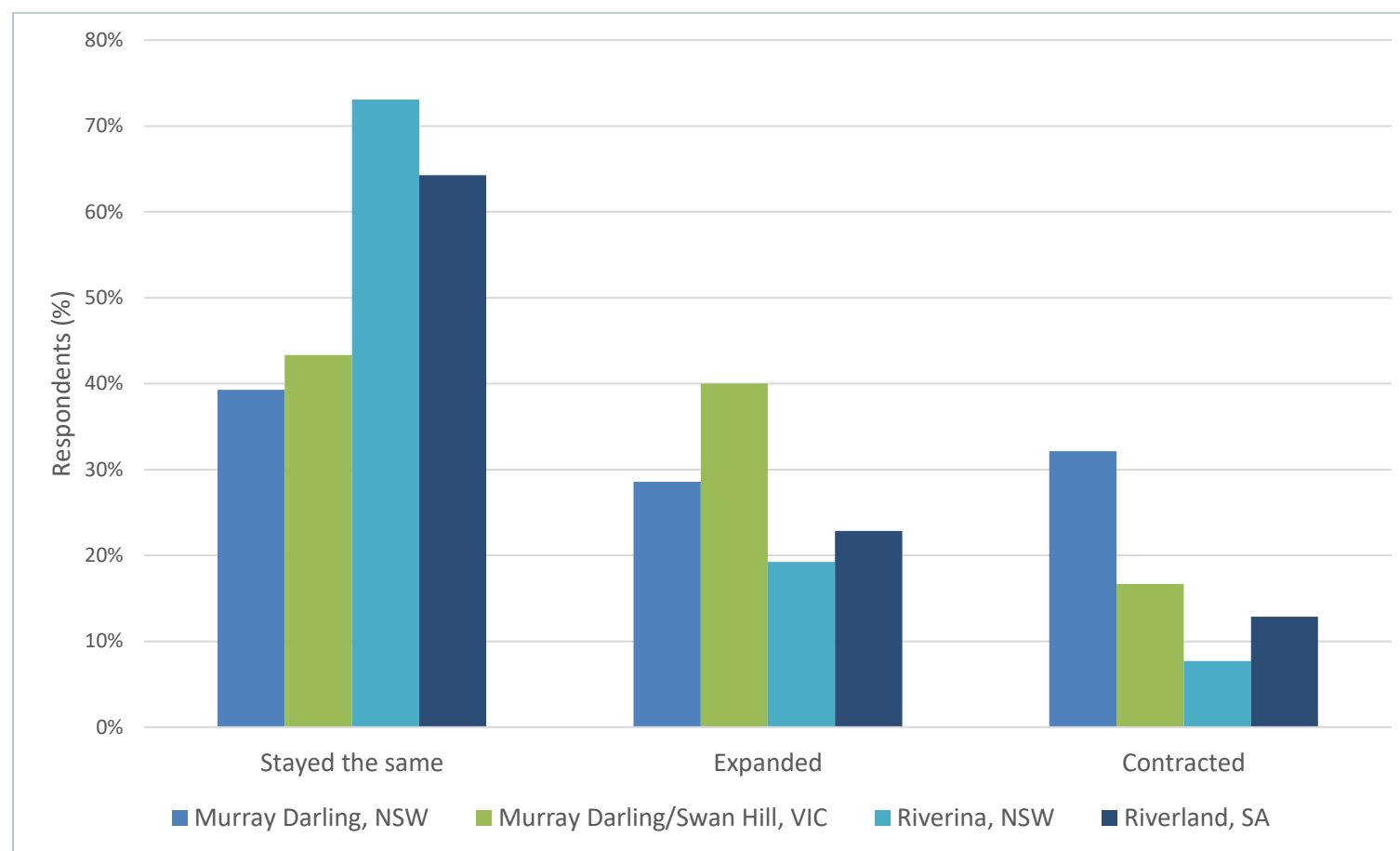


Figure 5. Proportion of respondents in each region whose vineyard area stayed the same, expanded or contracted in the last 5 years

The majority of respondents in all regions reported no change to their vineyard area in the last five years.

Murray Darling VIC/Swan Hill had the highest proportion of respondents who reported an expanding vineyard area in the last five years (40%).

A higher proportion of respondents in Murray Darling NSW reported a contracting vineyard area (32%) compared to an expanding vineyard area (29%).

The Riverina had the lowest proportion of respondents with a contracting vineyard area (8%).

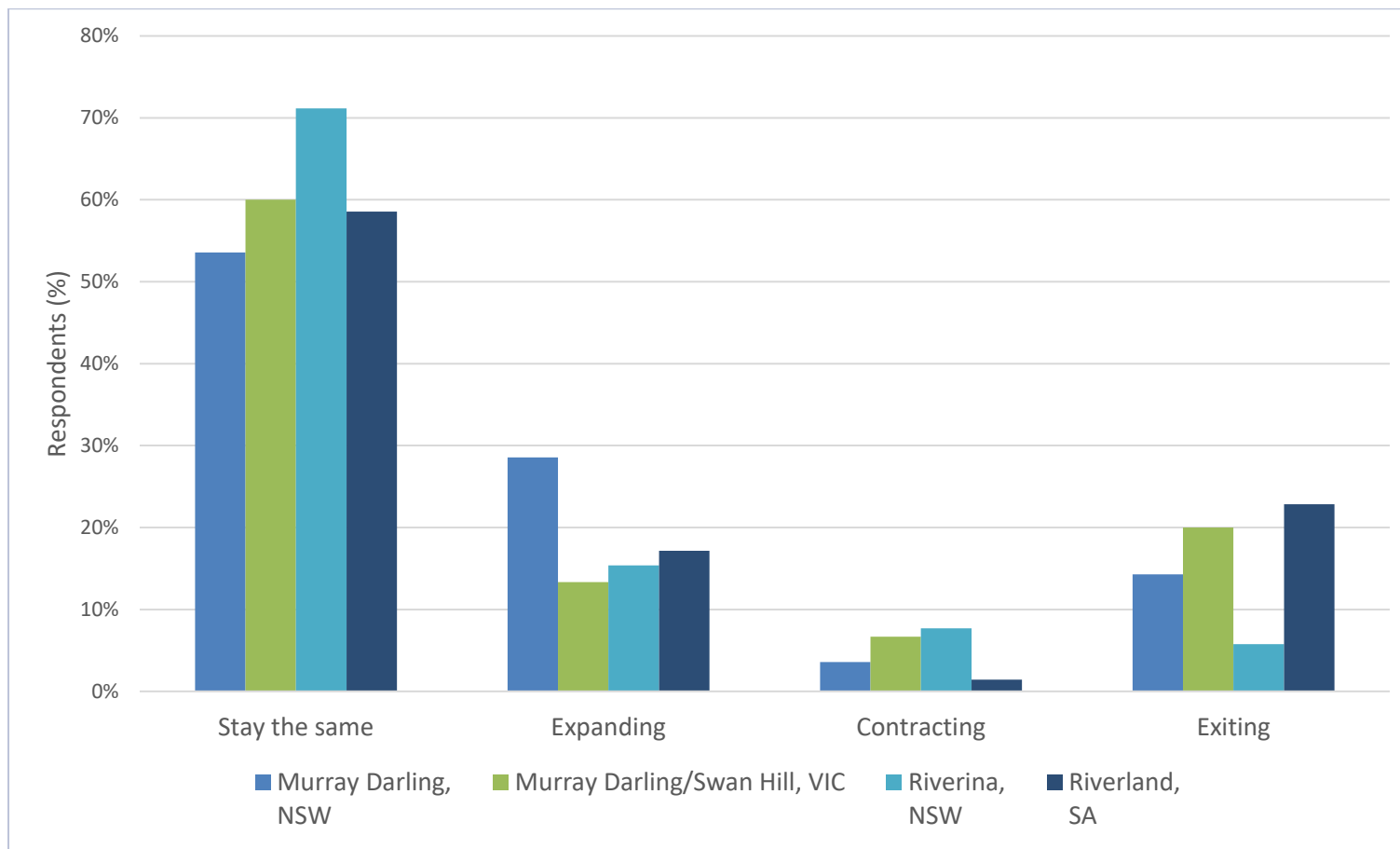


Figure 6. Proportion of respondents in each region who plan to expand, contract, or keep their vineyard area the same or exit the wine industry

The majority of respondents are not planning to change their vineyard area in the next five years.

Very few respondents are planning to contract/reduce their vineyard area.

16% of respondents across all regions are planning to exit the wine industry in the next five years, with retirement given as the main reason.

7. Capital investments

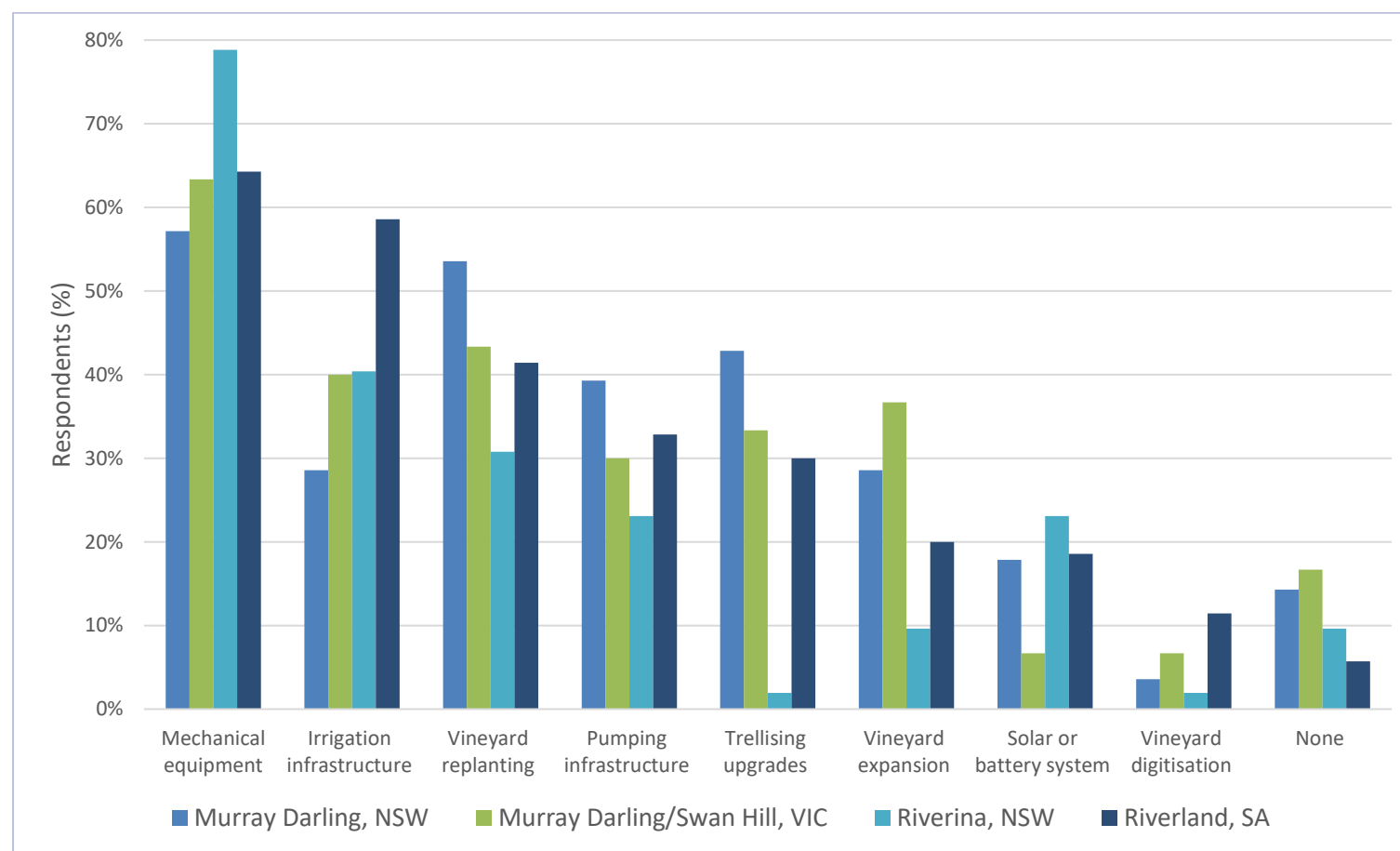


Figure 7. Proportion of respondents in each region that made investments in the different areas in the last five years

Note 5. Respondents could select more than one category

The majority of respondents in all regions made investments towards mechanical equipment in the last five years.

45% of respondents across all regions invested in irrigation infrastructure in the last five years and 30% invested in pumping infrastructure.

59% of Riverland respondents invested in irrigation infrastructure compared to 40% of Murray Darling/Swan Hill and Riverina respondents and 29% of Murray Darling NSW respondents.

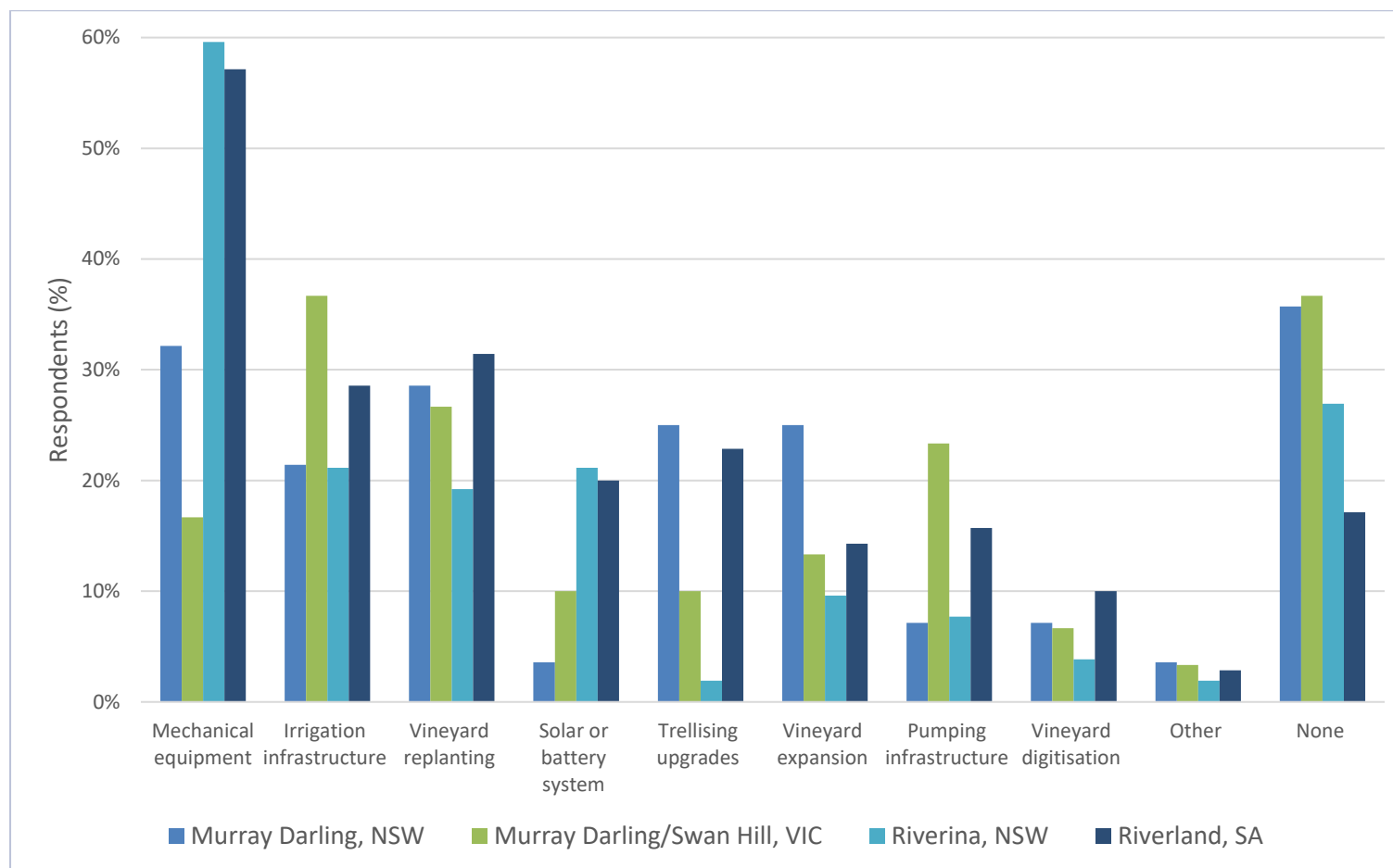


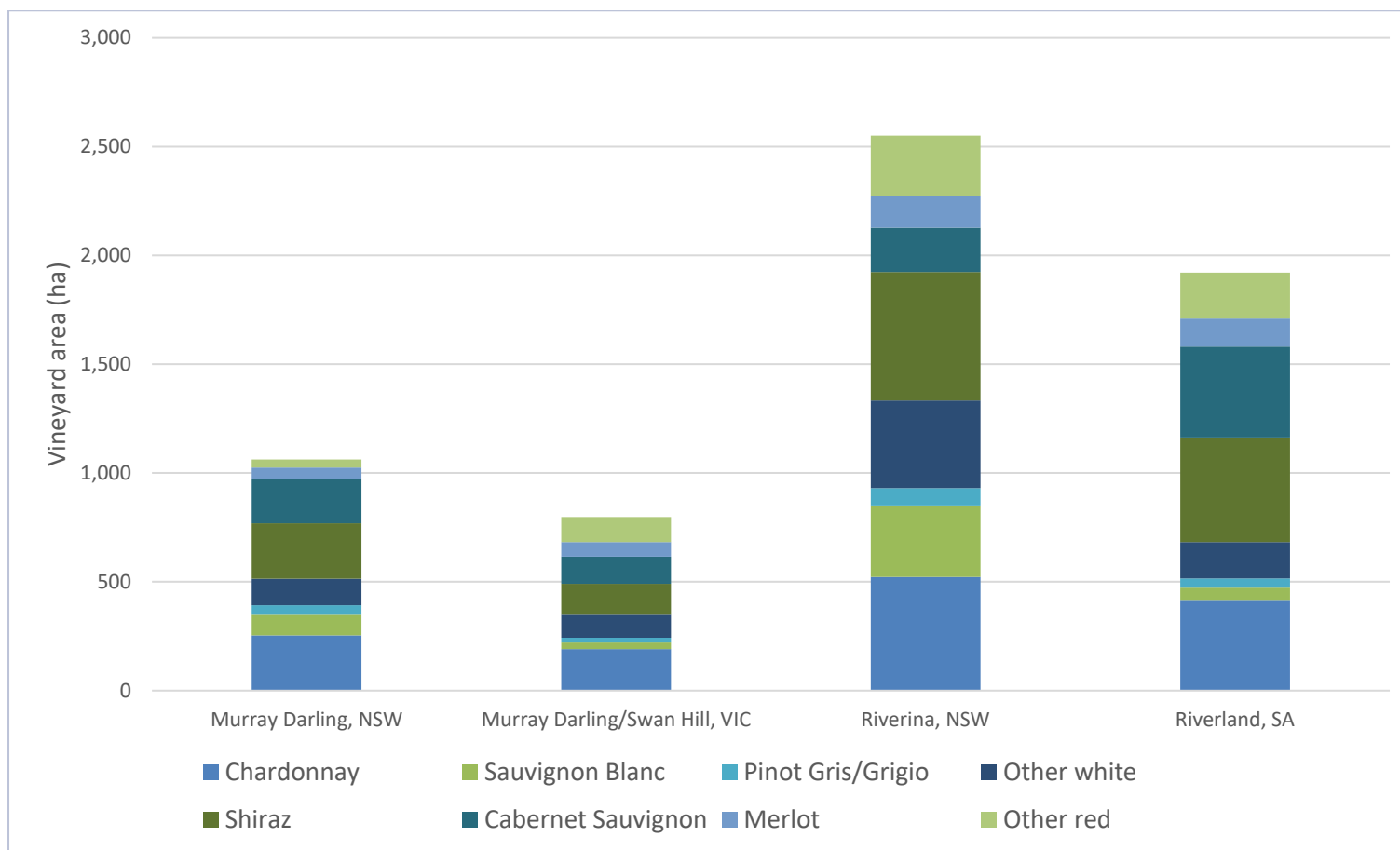
Figure 8. Proportion of respondents in each region that plan to make investments in the different areas

Note 6. Respondents could select more than one category

Fewer respondents are planning to make investments towards irrigation and pumping infrastructure in the next five years compared to the number who made investments towards these areas in the last five years.

Compared to the number of respondents that did not make any vineyards investments in the last 5 years, twice as many are not planning any investments in the next 5 years.

8. Vineyard area



The Riverina vineyard area represented 40% of the total area reported in the survey while the Riverland vineyard area represented 30%, the Murray Darling NSW vineyard area represented 17% and the Murray Darling VIC/Swan Hill vineyard area represented 13%.

Figure 9. Total vineyard area by region and variety

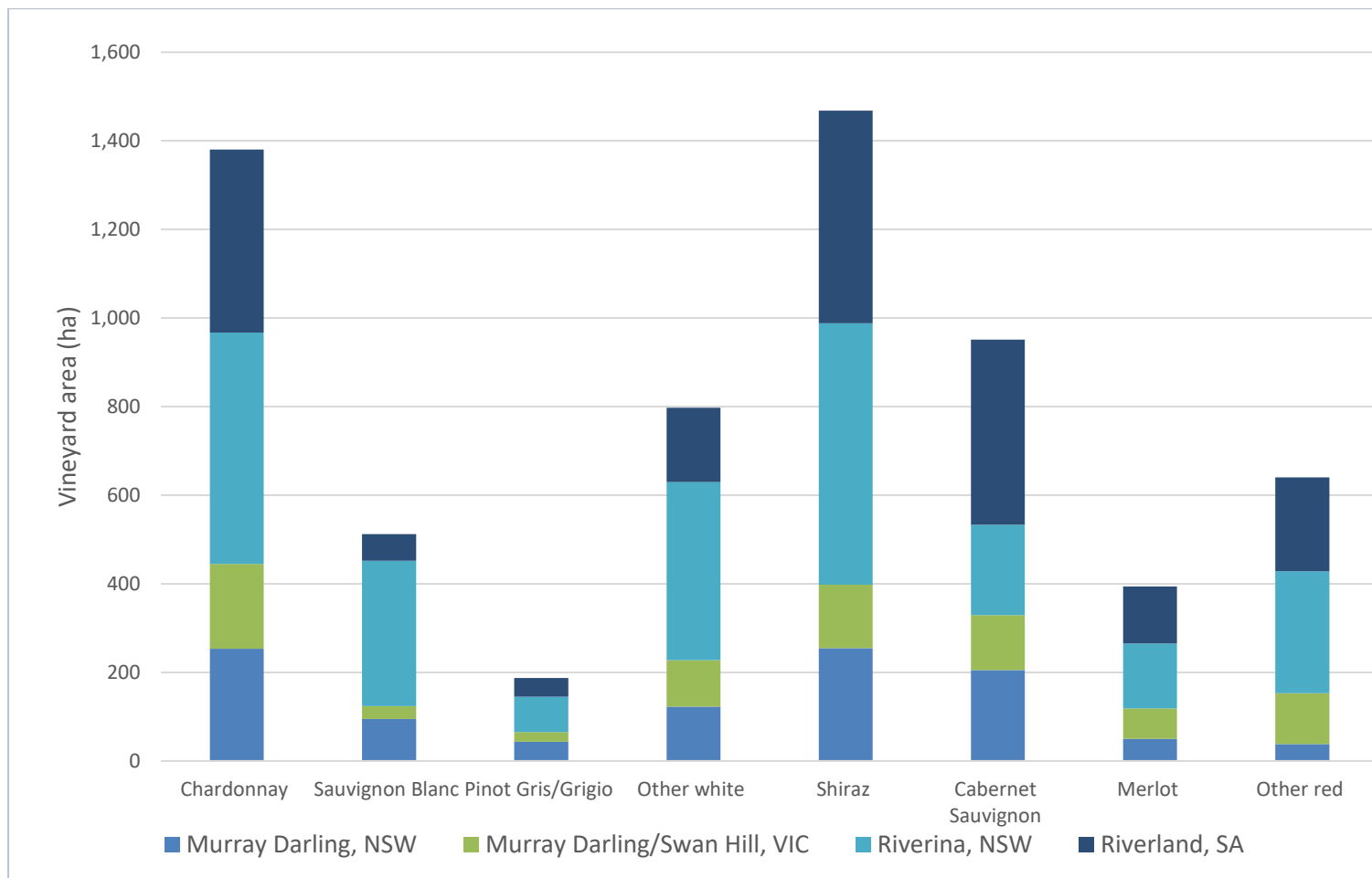
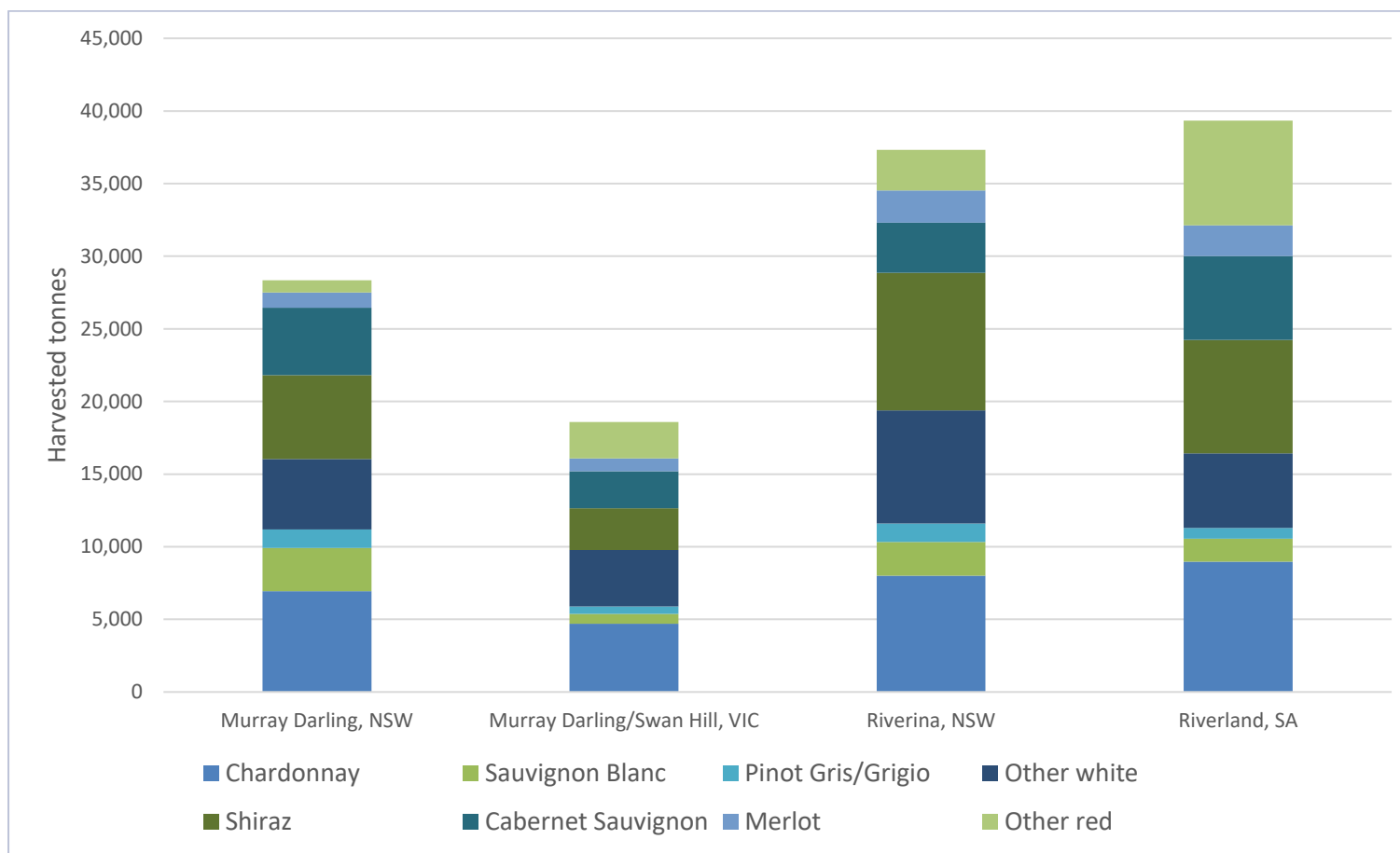


Figure 10. Total vineyard area by variety and region

The variety with the largest planted area reported in the survey was Shiraz (23% of the total planted vineyard area), followed by Chardonnay (22%), and Cabernet Sauvignon (15%).

The area planted to red varieties represented 55% of the vineyard area reported in the survey and the area planted to white varieties represented 45%.

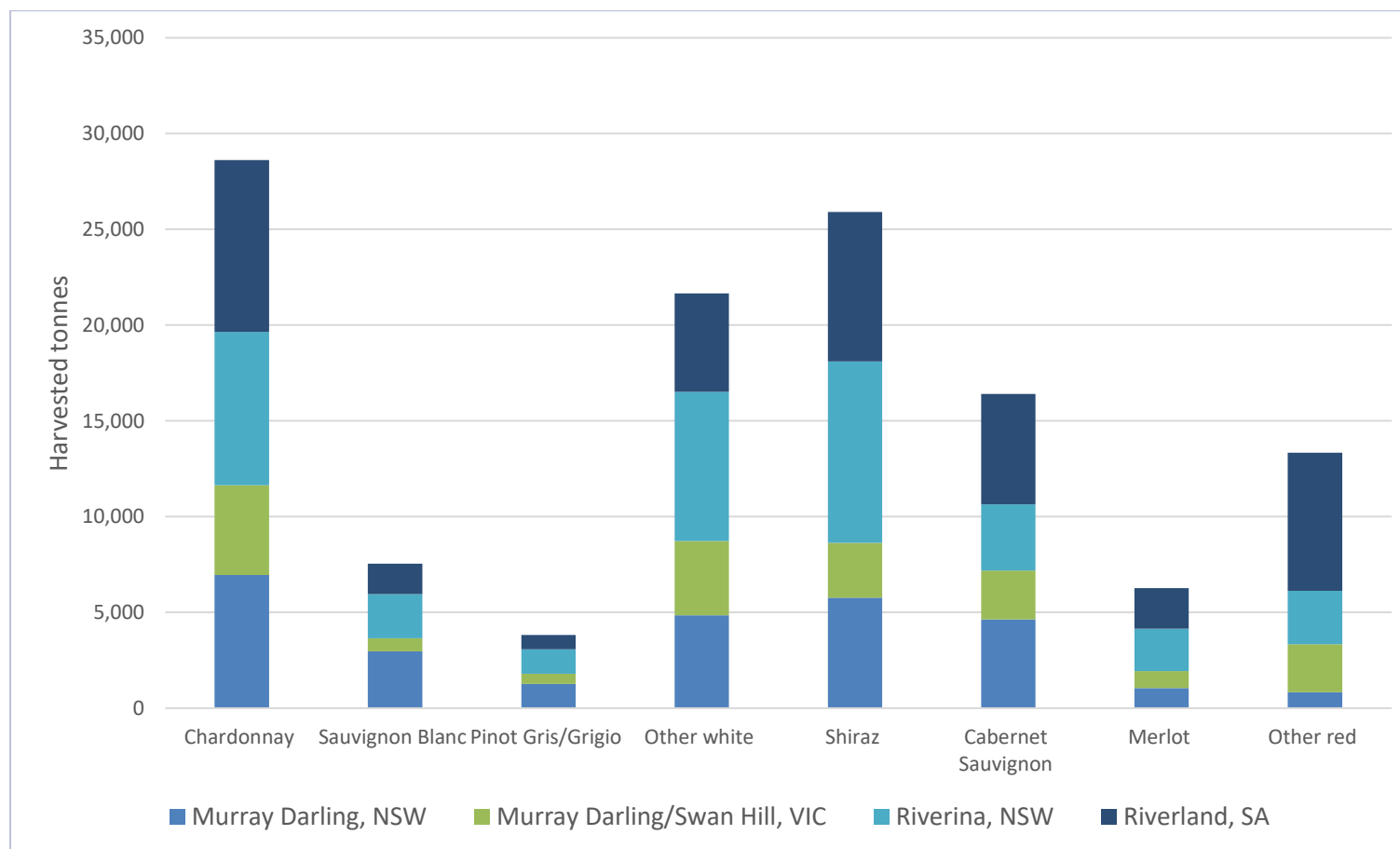
9. Harvested tonnes



Chardonnay was the variety with the highest harvested tonnes reported for the 2019/20 season in each region except the Riverina.

In the Riverina Shiraz was the variety with the highest harvested tonnes reported for the 2019/20 season.

Figure 11. Total tonnes harvested in the 2019/20 season by region and variety



The Chardonnay harvested tonnes represented 23% of the total harvested tonnes reported in the survey for the 2019/20 season and the Shiraz harvested tonnes represented 21%.

Figure 12. Total tonnes harvested in the 2019/20 season by variety and region

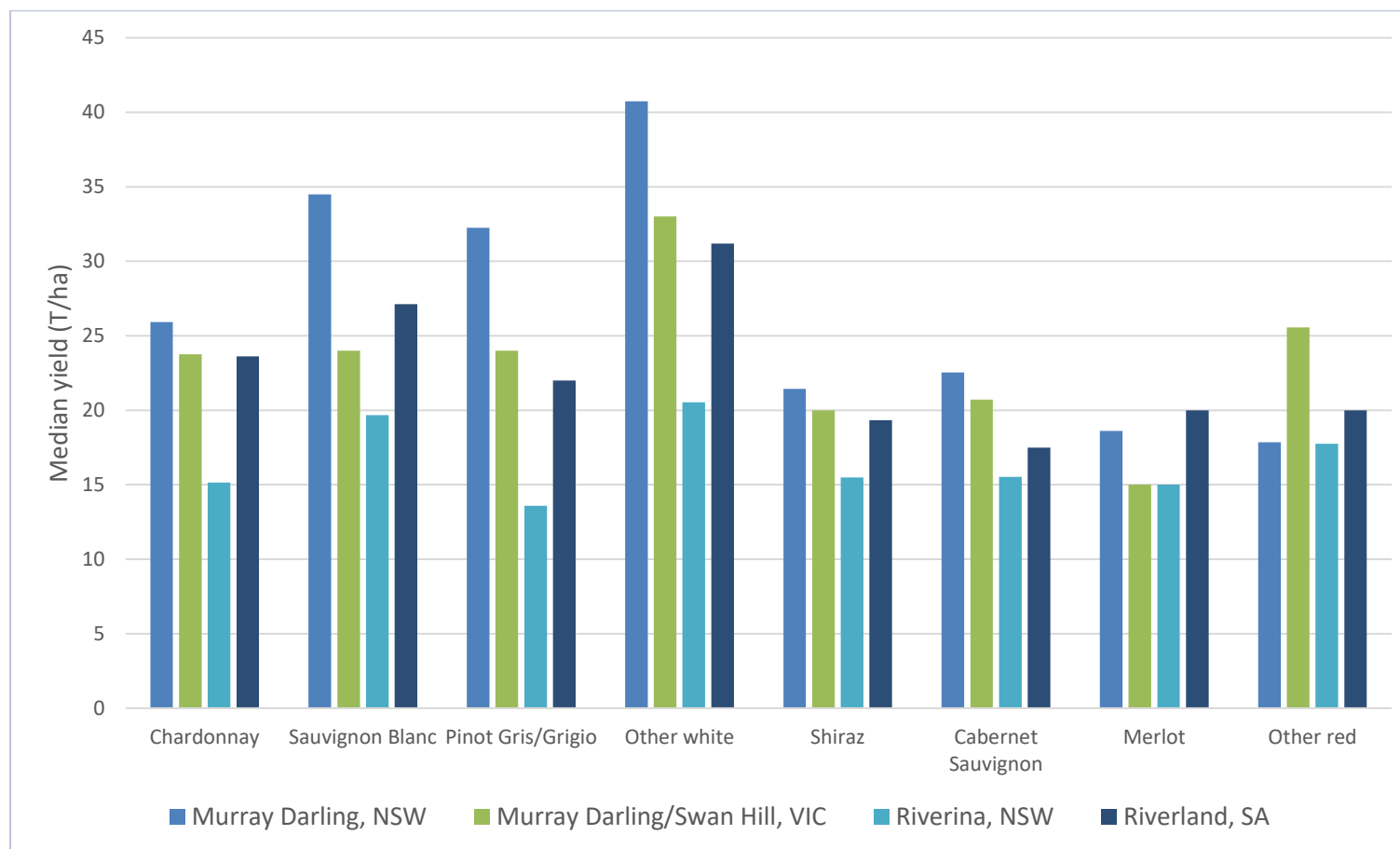


Figure 13. Median yield in the 2019/20 season by variety and region (excluding outliers)

Vineyards yielded higher in Murray Darling NSW than in the other regions for all varieties except 'Other red' and Merlot.

Vineyards in the Riverina yielded lower than in other regions (40% lower than Murray Darling NSW, and 30% lower than Murray Darling VIC and Swan Hill and the Riverland).

Red varieties yielded lower than white varieties in all regions except the Riverina.

The 'Other white' category had the highest yields in all regions.

10. Water use



Figure 14. Median water use in the 2019-20 season by variety and region (excluding outliers)

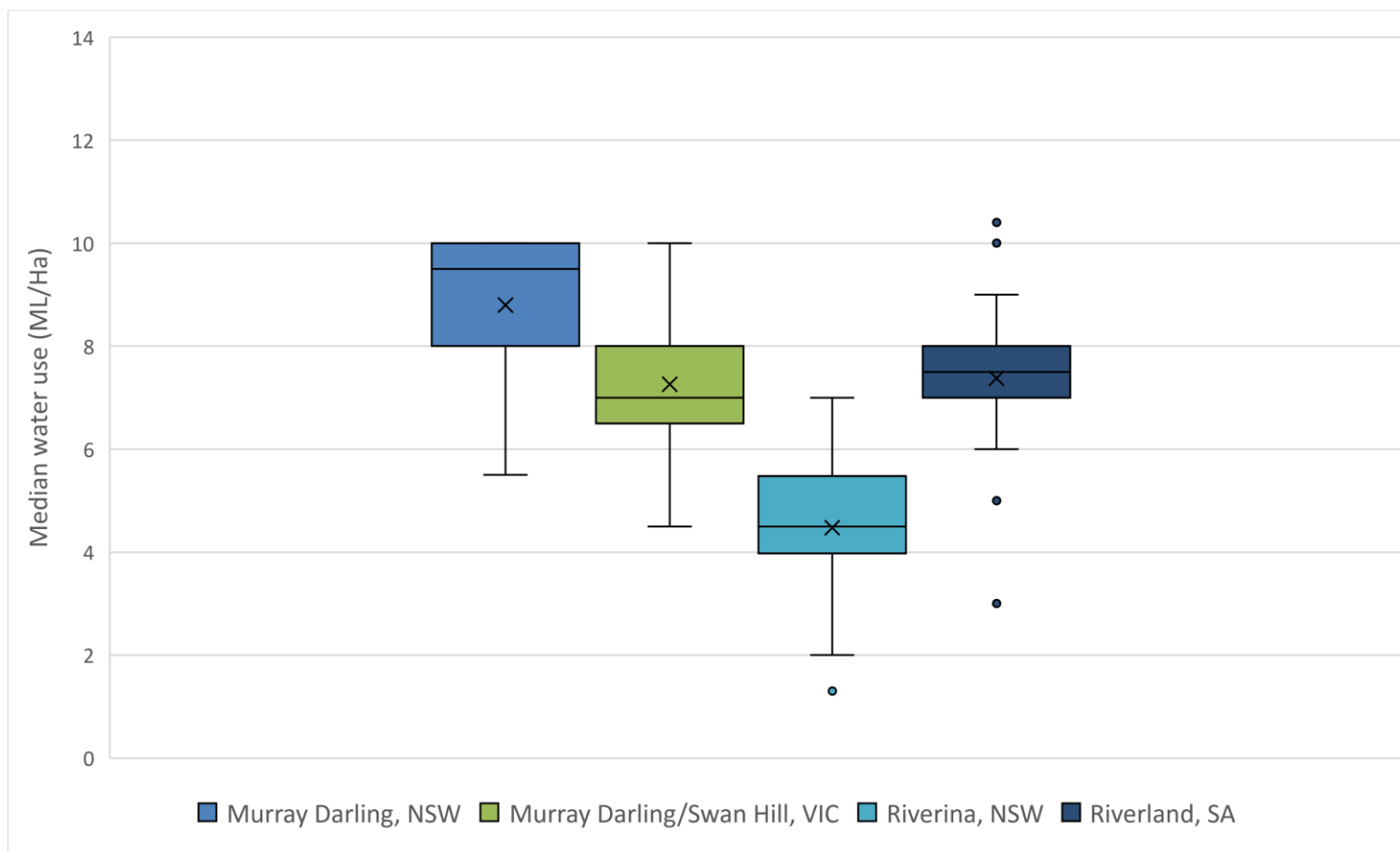
Note 7. Water use was calculated as the ML applied per hectare (ML/ha)

Median water use was highest in Murray Darling NSW (8 ML/ha) followed by the Riverland (7.1 ML/ha) and then Murray Darling VIC/Swan Hill (7 ML/ha).

Riverina vineyards had the lowest median water use (4.7 ML/ha).

The median water use figures were confirmed by growers and industry leaders during workshops held in each of the inland regions subsequent to the survey.

Insights obtained from workshops participants suggest that the low water use in the Riverina compared to the other regions is driven by lower yields due to yield caps and lower planting densities.

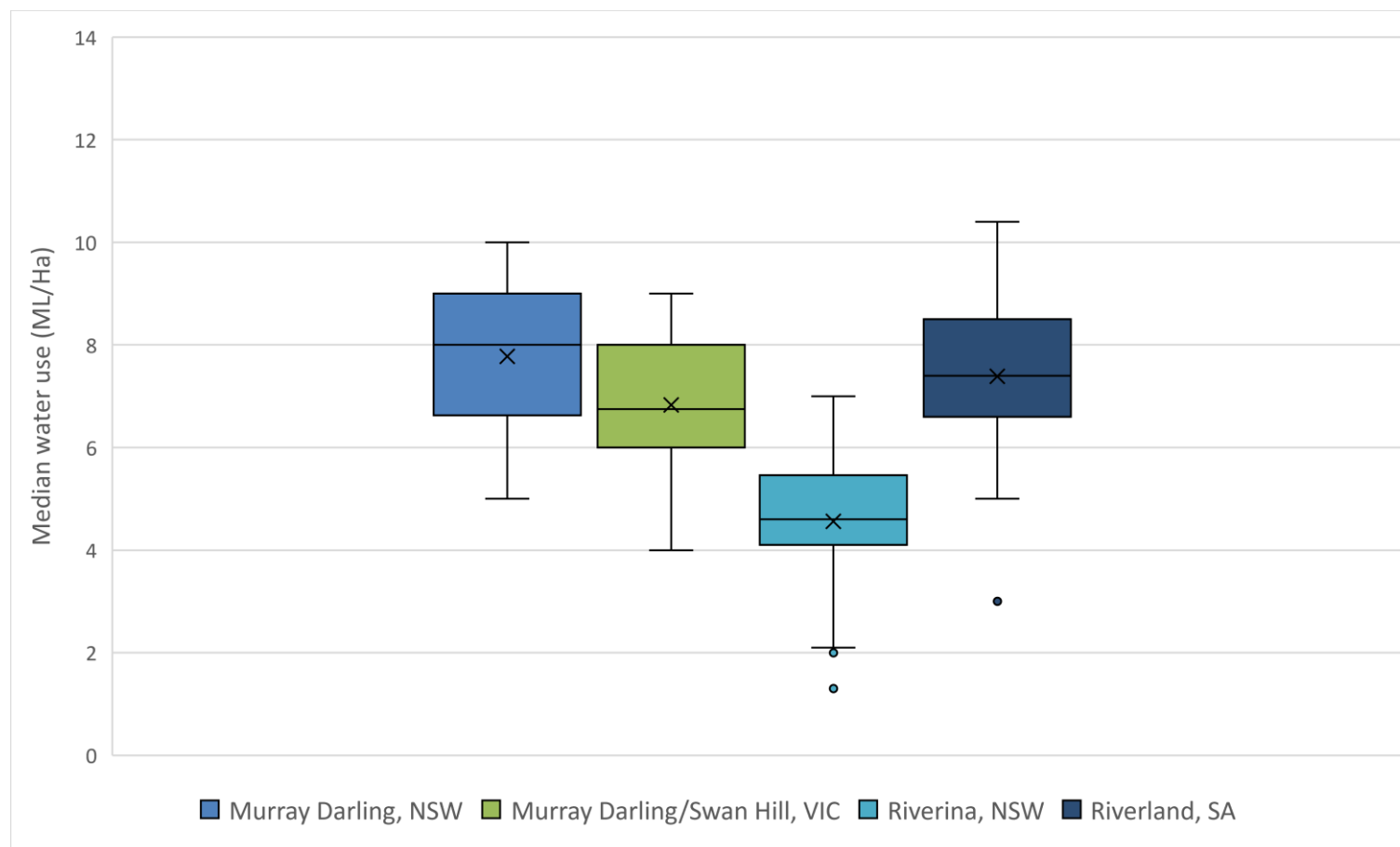


The median water use for Chardonnay grown in Murray Darling NSW was more than twice the median water use for Chardonnay grown in the Riverina (9.5 compared to 4.5 ML/ha).

The median water use for Chardonnay grown in Murray Darling VIC/Swan Hill and the Riverland were similar; however, the range of water use was much broader in Murray Darling VIC/Swan Hill.

Figure 15. Chardonnay water use in the 2019/2020 season

Note 8. Data is presented as a box-and-whiskers plot to show the distribution of the dataset. X = average value, line in box = median value, top of box = upper quartile, bottom of box = lower quartile, ° = outliers (more than 1.5 times the upper or lower quartile), L = lowest value (excluding outliers), T = highest value (excluding outliers).



The median water use for Shiraz grown in the Riverina was 4.6 ML/ha, compared to 6.8 ML/ha in Murray Darling VIC/Swan Hill, 7.4 ML/ha in the Riverland and 8.0 ML/ha in Murray Darling NSW.

The difference between the highest and lowest water users was close to 5 ML/ha in all regions however, there were outliers in the Riverina and Riverland who used much less water per hectare.

Figure 16. Shiraz water use in the 2019/2020 season

Note 9. Data is presented as a box-and-whiskers plot to show the distribution of the dataset. X = average value, line in box = median value, top of box = upper quartile, bottom of box = lower quartile, ° = outliers (more than 1.5 times the upper or lower quartile), L = lowest value (excluding outliers), T = highest value (excluding outliers).

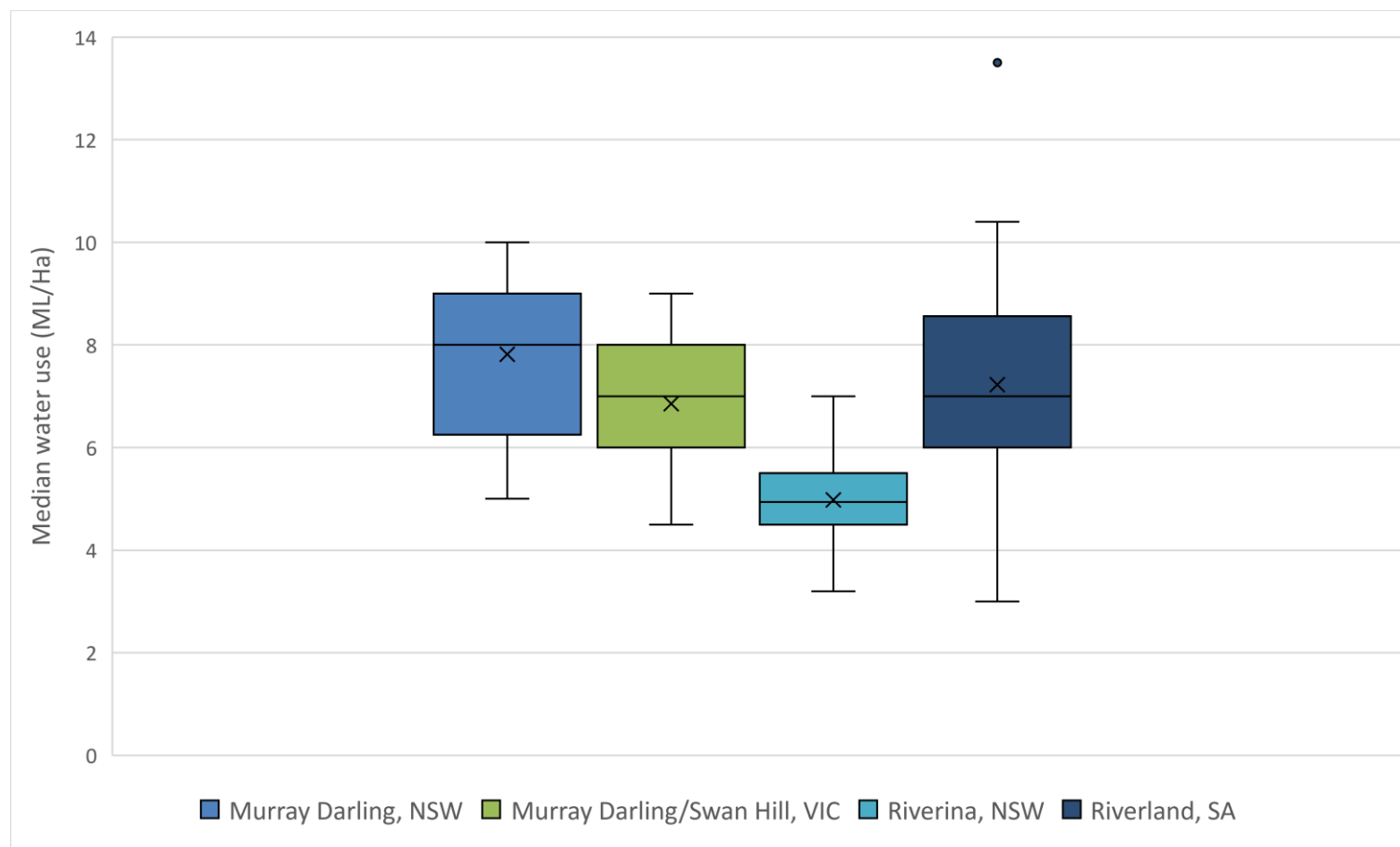


Figure 17. Cabernet Sauvignon water use in the 2019/2020 season

Note 10. Data is presented as a box-and-whiskers plot to show the distribution of the dataset. X = average value, line in box = median value, top of box = upper quartile, bottom of box = lower quartile, ° = outliers (more than 1.5 times the upper or lower quartile), L = lowest value (excluding outliers), T = highest value (excluding outliers).

The median water use for Cabernet Sauvignon grown in the Riverina was 4.9 ML/ha, compared to 7.0 ML/ha in Murray Darling VIC/Swan Hill and the Riverland and 8.0 ML/ha in Murray Darling NSW.

The difference between the highest water user and the lowest water user in the Riverland was much more than in the other regions (7.4 ML/ha compared to 3.8 – 5 ML/ha).

11. Water use efficiency



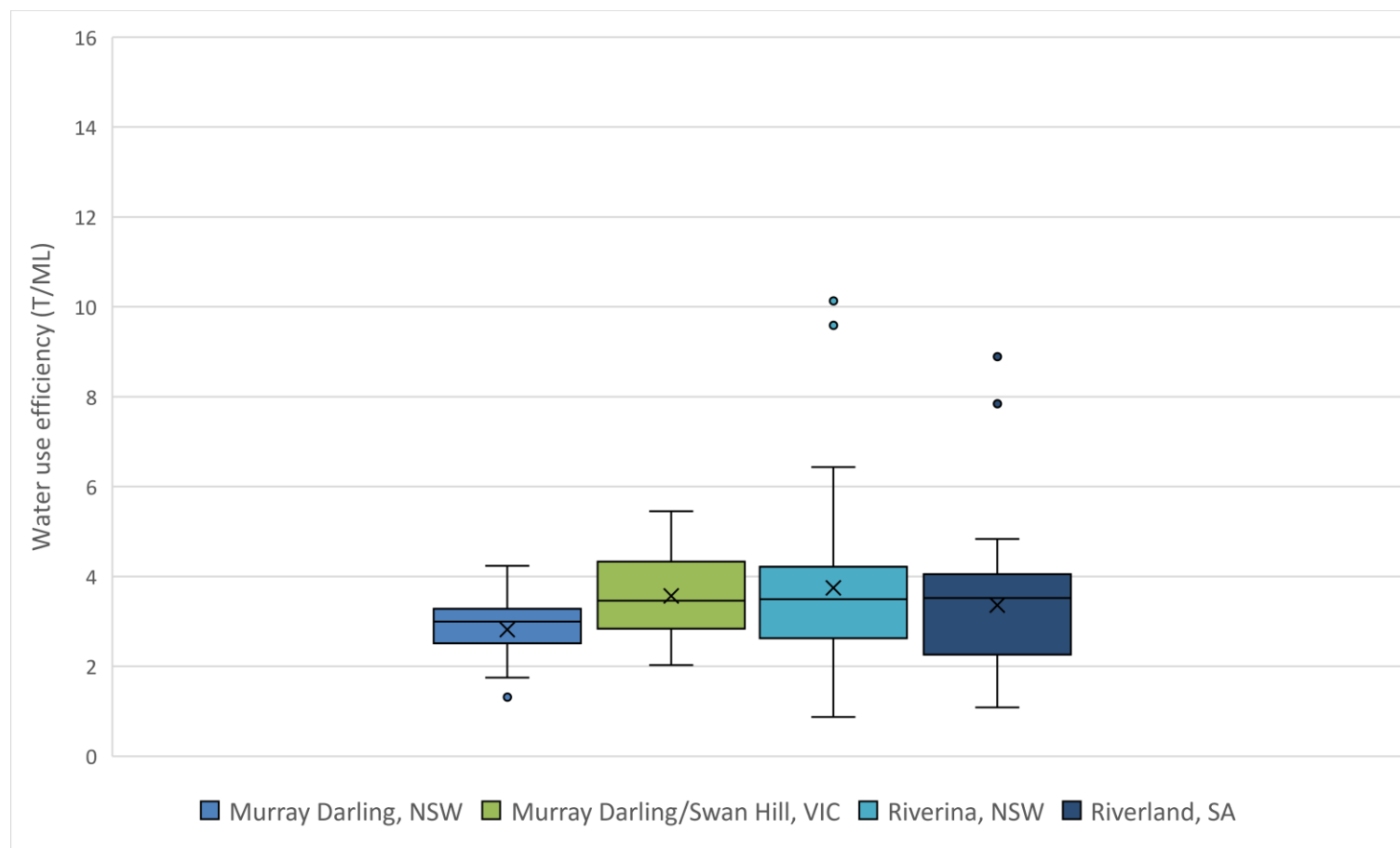
Figure 18. Median water use efficiency in the 2019/20 season by variety and region

Note 11. Water use efficiency was calculated as the tonnes harvested per ML of water applied (T/ML)

Median water use efficiency was highest in the Riverina (4.1 T/ML) followed by the Riverland (3.5 T/ML), and Murray Darling VIC/Swan Hill (3.4 T/ML).

Murray Darling NSW vineyards had the lowest median water use efficiency (3.1 T/ML).

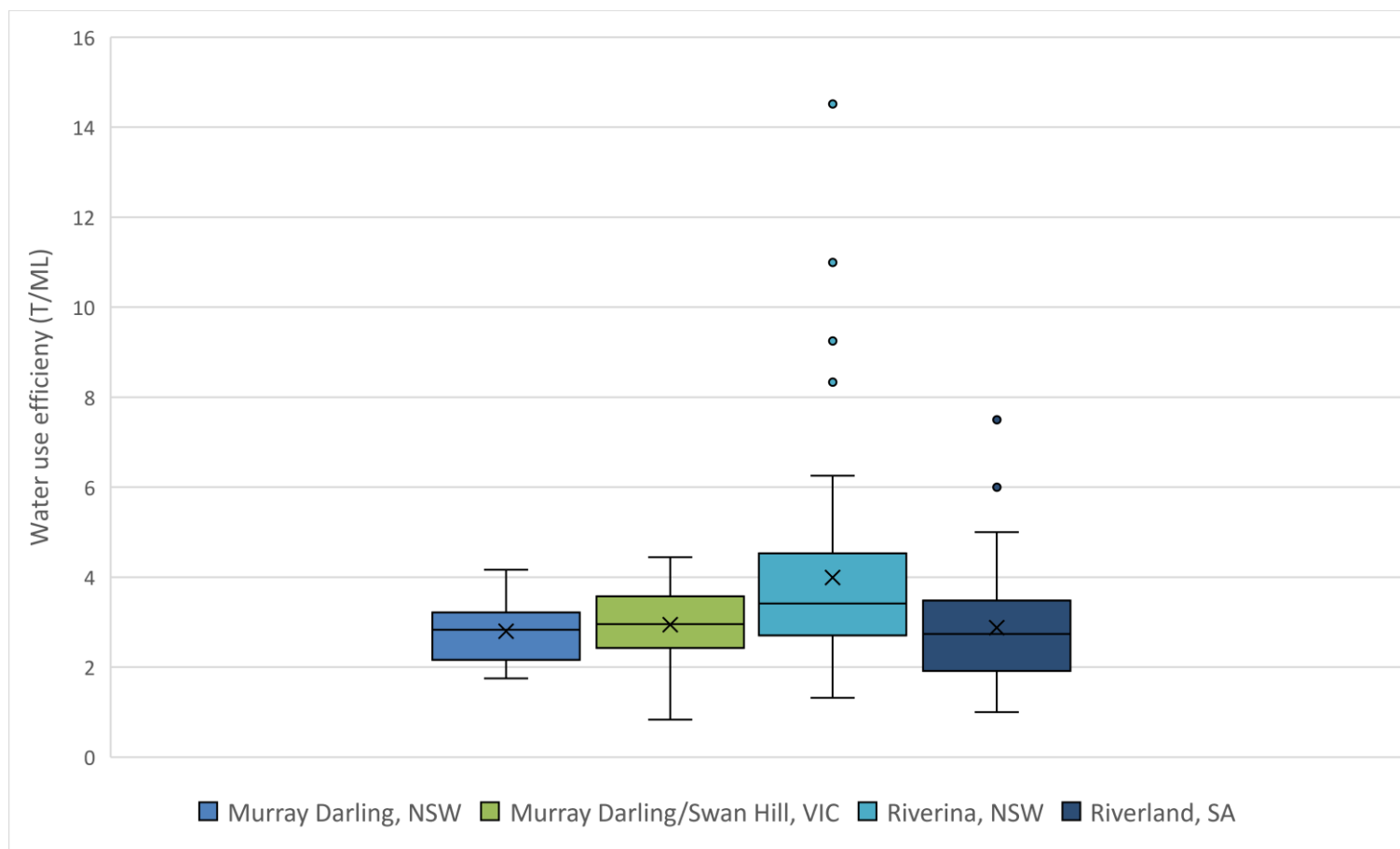
In most cases, white varieties had a higher median water use efficiency than red varieties.



The median water use efficiency for Chardonnay was similar in all regions (3 – 3.5 T/ML) however, the range of water use efficiency was broader in the Riverina compared to the other regions.

Figure 19. Chardonnay water use efficiency in the 2019/2020 season

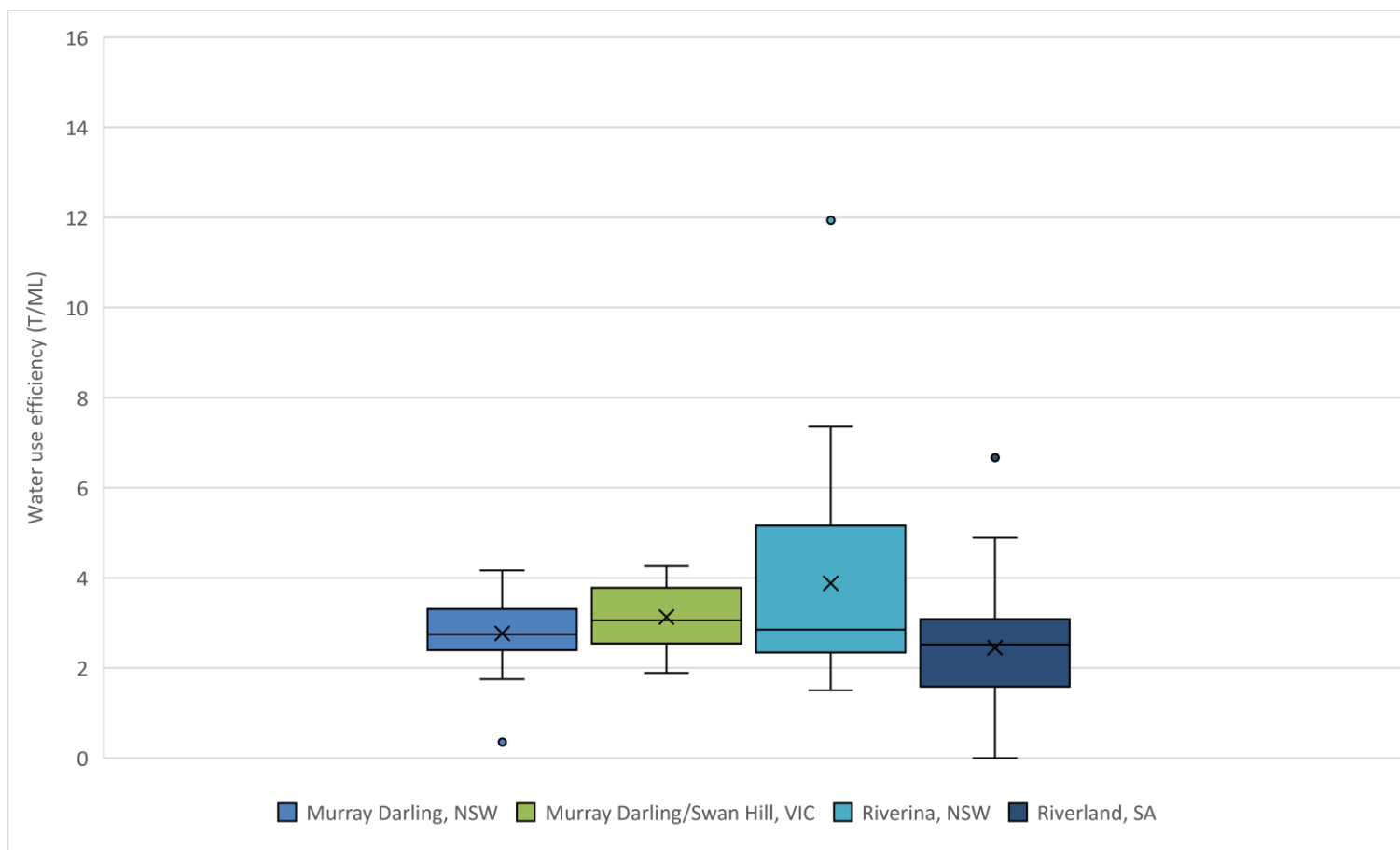
Note 12. Data is presented as a box-and-whiskers plot to show the distribution of the dataset. X = average value, line in box = median value, top of box = upper quartile, bottom of box = lower quartile, ° = outliers (more than 1.5 times the upper or lower quartile), ⊥ = lowest value (excluding outliers), T = highest value (excluding outliers).



The median water use efficiency for Shiraz was similar in all regions (2.7 – 3.4 T/ML) however, the range of water use efficiency was broader in the Riverina compared to the other regions.

Figure 20. Shiraz water use efficiency in the 2019/2020 season

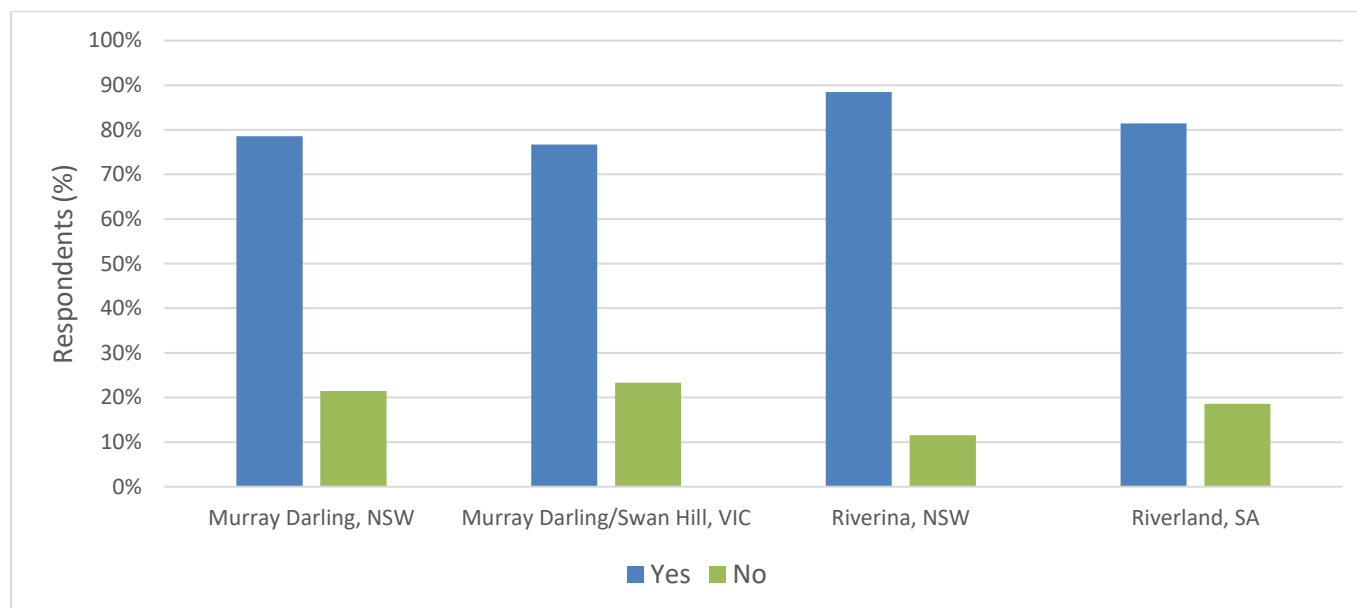
Note 13. Data is presented as a box-and-whiskers plot to show the distribution of the dataset. X = average value, line in box = median value, top of box = upper quartile, bottom of box = lower quartile, ° = outliers (more than 1.5 times the upper or lower quartile), ⊥ = lowest value (excluding outliers), T = highest value (excluding outliers).



The median water use efficiency for Cabernet Sauvignon was similar in all regions (2.5 – 3.1 T/ML) however, the range of water use efficiency was broader in the Riverina compared to the other regions.

Figure 21. Cabernet Sauvignon water use efficiency in the 2019/2020 season

Note 14. Data is presented as a box-and-whiskers plot to show the distribution of the dataset. X = average value, line in box = median value, top of box = upper quartile, bottom of box = lower quartile, ° = outliers (more than 1.5 times the upper or lower quartile), L = lowest value (excluding outliers), T = highest value (excluding outliers).



The majority of respondents in all regions gave their vines their full water requirement in the 2019/2020 season.

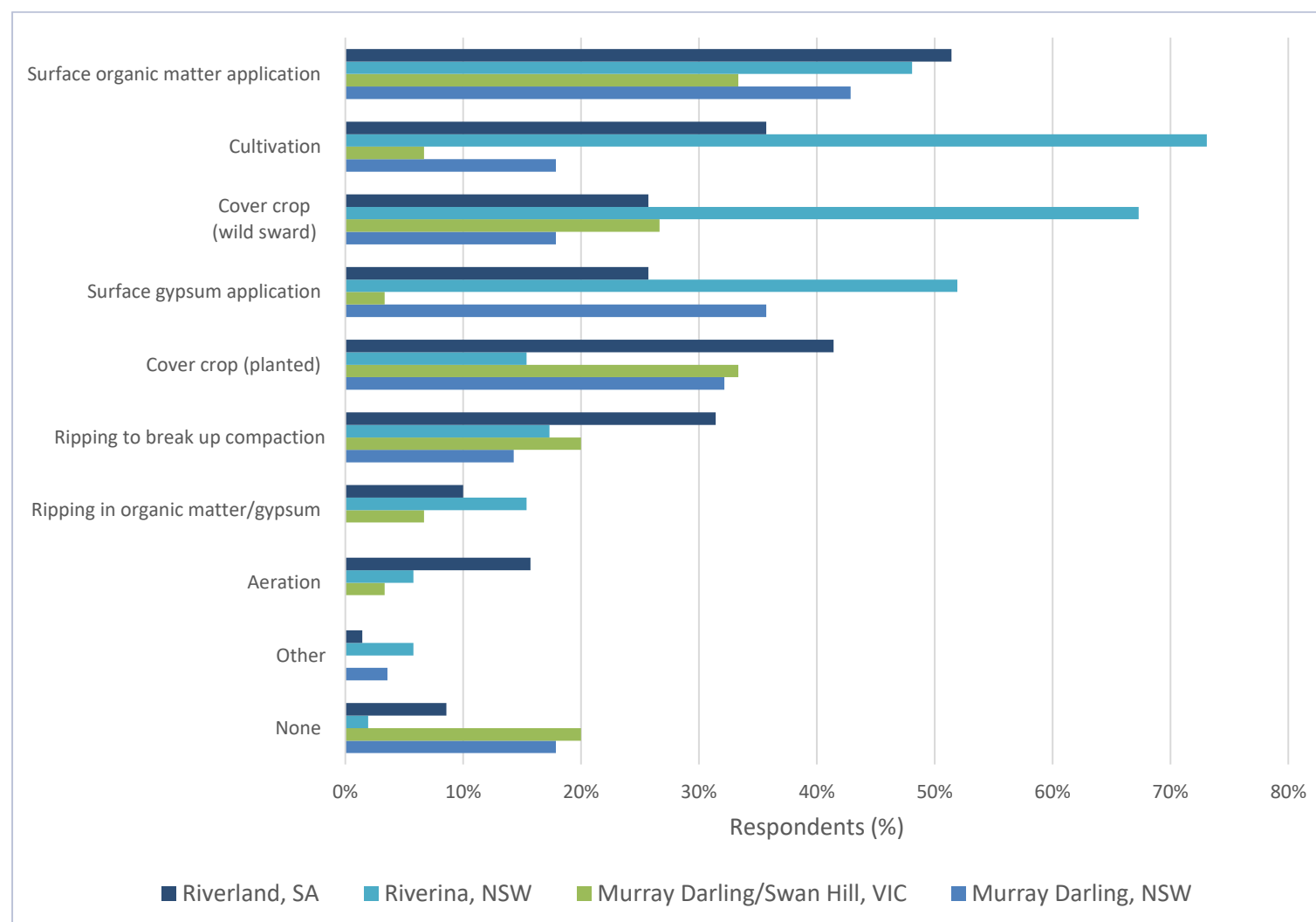
The main reason given for not giving their vines their full water requirement was high water cost, low yields (hail in the Riverland) and low grape prices for some varieties (especially Gordo).

Figure 22. Proportion of respondents from each region that gave their vines their full water requirements in the 2019/2020 season

Table 3. Reasons respondents gave for not giving their vines their full water requirement

Reason for not giving vines full water requirement	Murray Darling, NSW	Murray Darling/ Swan Hill, VIC	Riverina, NSW	Riverland, SA	Total
High power costs				1	1
High water cost	2	3	3	3	11
Low grape price	1		1	1	3
Low yields	1		2	2	5
Poor scheduling	1			1	2
Poor water infiltration rates				1	1
Water availability		1			1

12. Soil remediation



Cultivation was used by 73% of respondents in the Riverina compared to only 36% or less in the other regions.

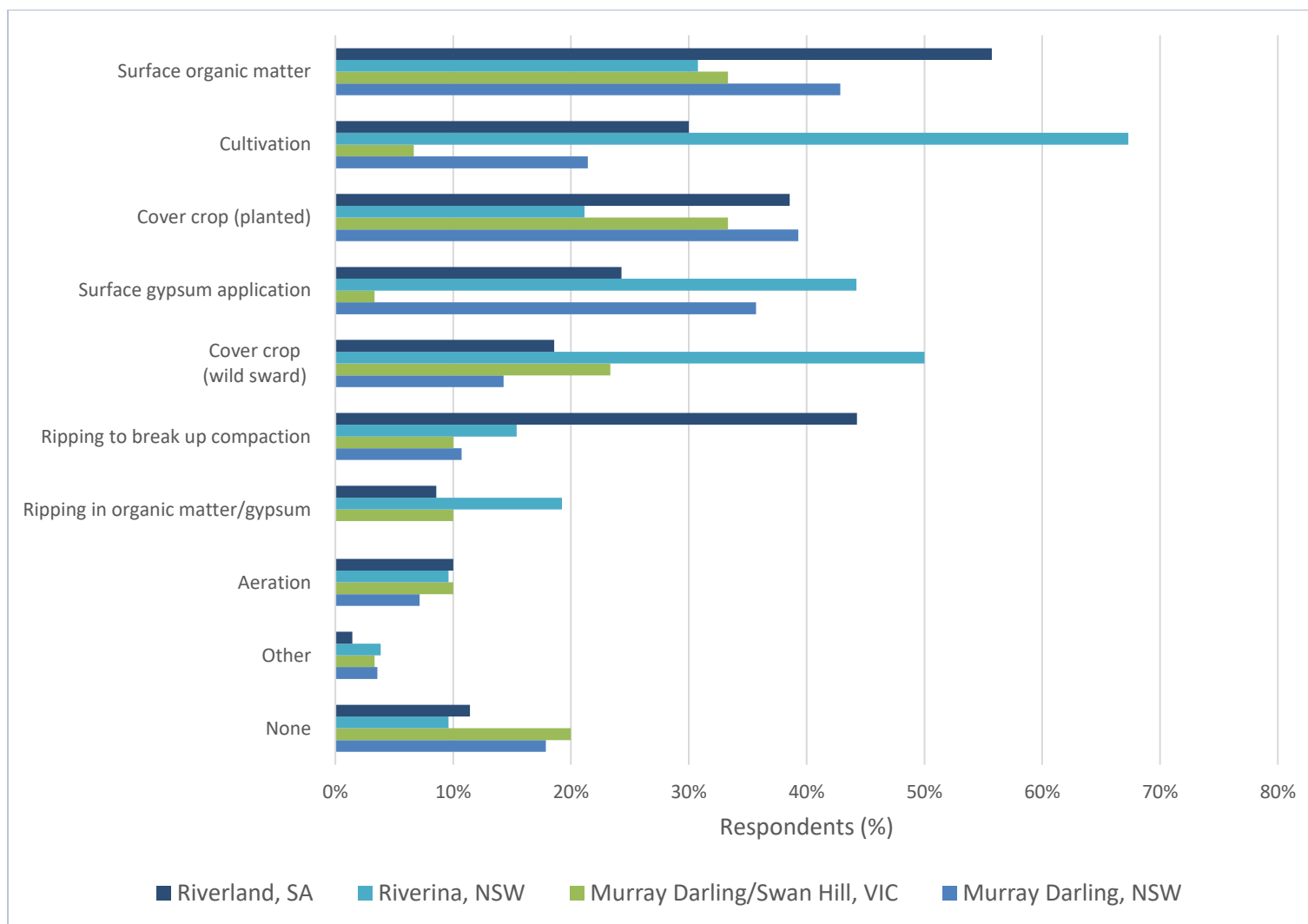
The Riverland used more cover crops and ripping than the other regions.

Between 33% and 51% of respondents said they had applied surface organic matter to their vineyards.

Close to 20% of respondents from Murray Darling VIC/Swan Hill and Murray Darling NSW did not perform any soil remediation in the last five years.

Figure 23. Proportion of respondents in each region that have performed the various types of soil remediation in the last five years

Note 15. Respondents could select more than one category. Data regarding the type and purpose of the surface organic matter application was not collected.



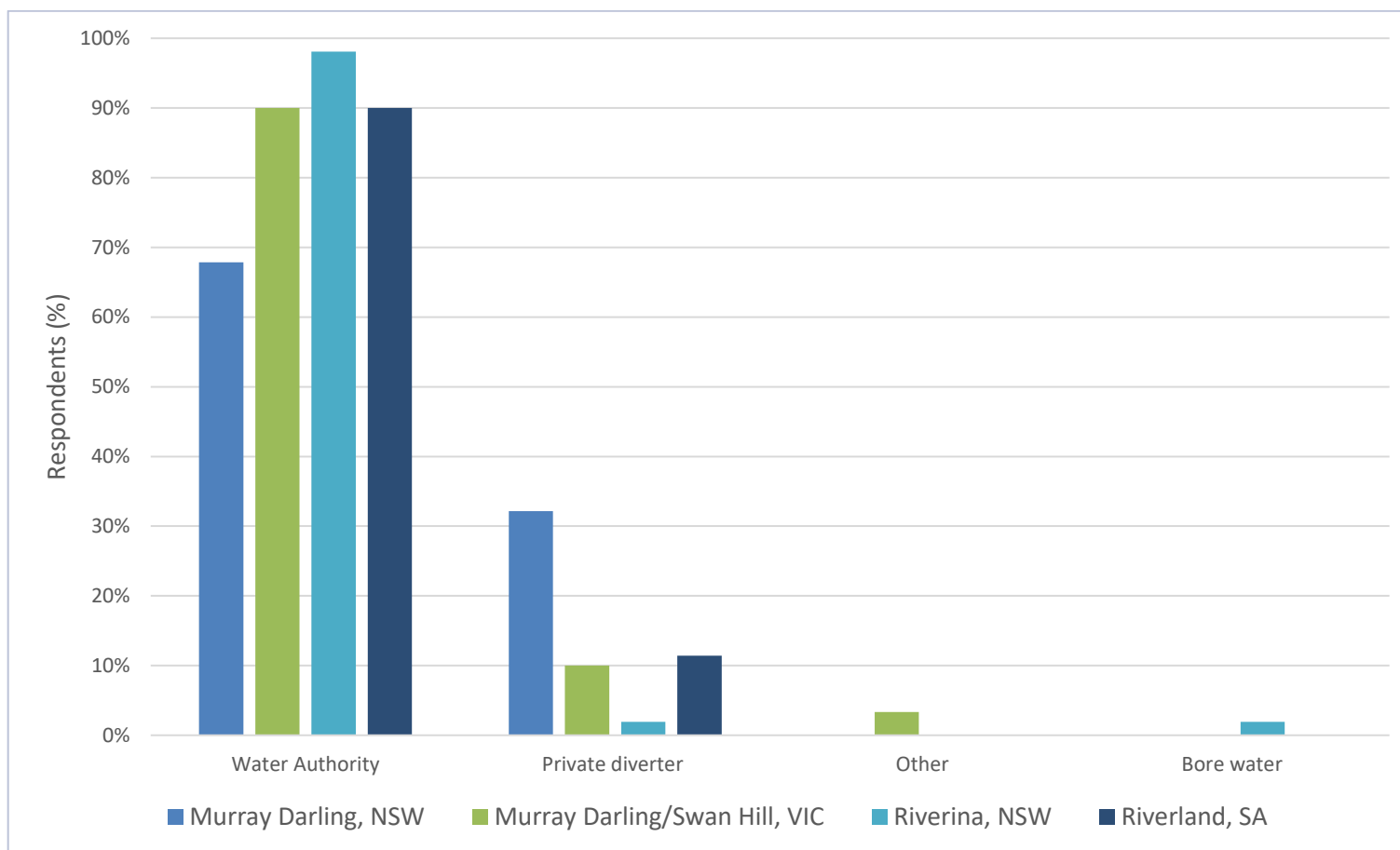
No significant change in soil remediation practices are planned for the next five years in any of the regions.

Slightly more Riverina respondents are planning to plant a cover crop in the next five years than the number who planted cover crops in the last five years.

Figure 24. Proportion of respondents in each region that plan to perform the various types of soil remediation in the next five years

Note 16. Respondents could select more than one category. Data regarding the type and purpose of the surface organic matter application was not collected.

13. Irrigation water source



The majority of respondents in all regions receive irrigation water from a water authority.

32% of Murray Darling NSW respondents receive irrigation water from a private diverter compared to only 11% in the Riverland, 10% in Murray Darling VIC/Swan Hill and 2% in the Riverina.

2% of Riverina respondents receive irrigation water from a bore.

Figure 25. Proportion of respondents in each region that receive irrigation water from the various water sources

Note 17. Respondents could select more than one category

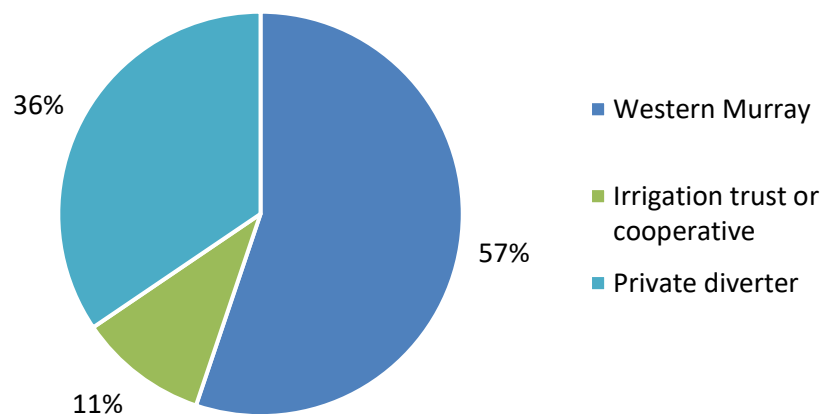


Figure 26. Proportion of respondents receiving water from the different water authorities in Murray Darling NSW

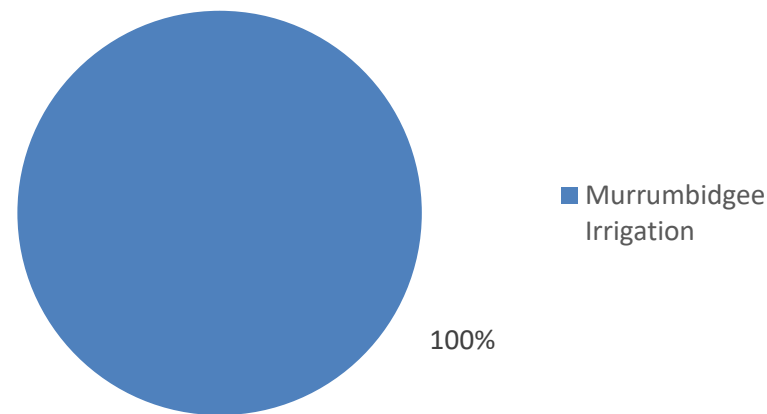


Figure 28. Proportion of respondents receiving water from the different water authorities in the Riverina

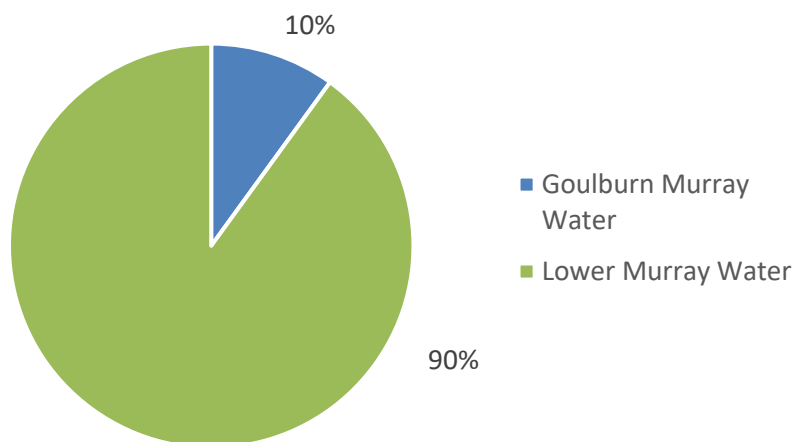


Figure 27. Proportion of respondents receiving water from the different water authorities in Murray Darling VIC/Swan Hill

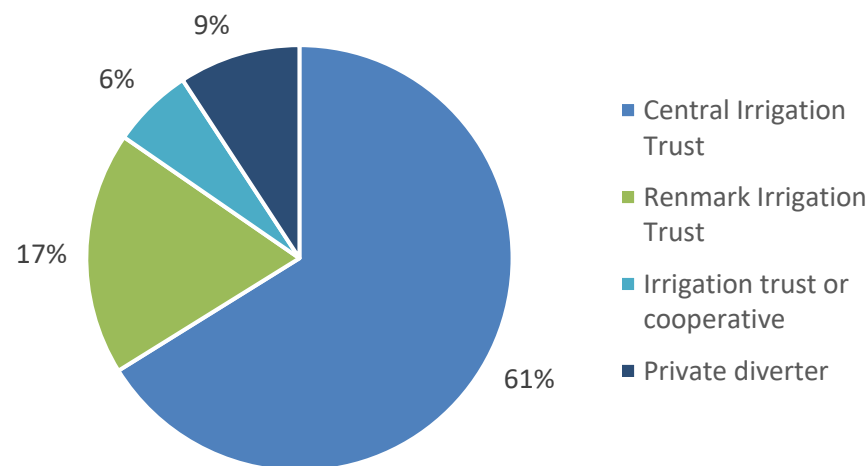
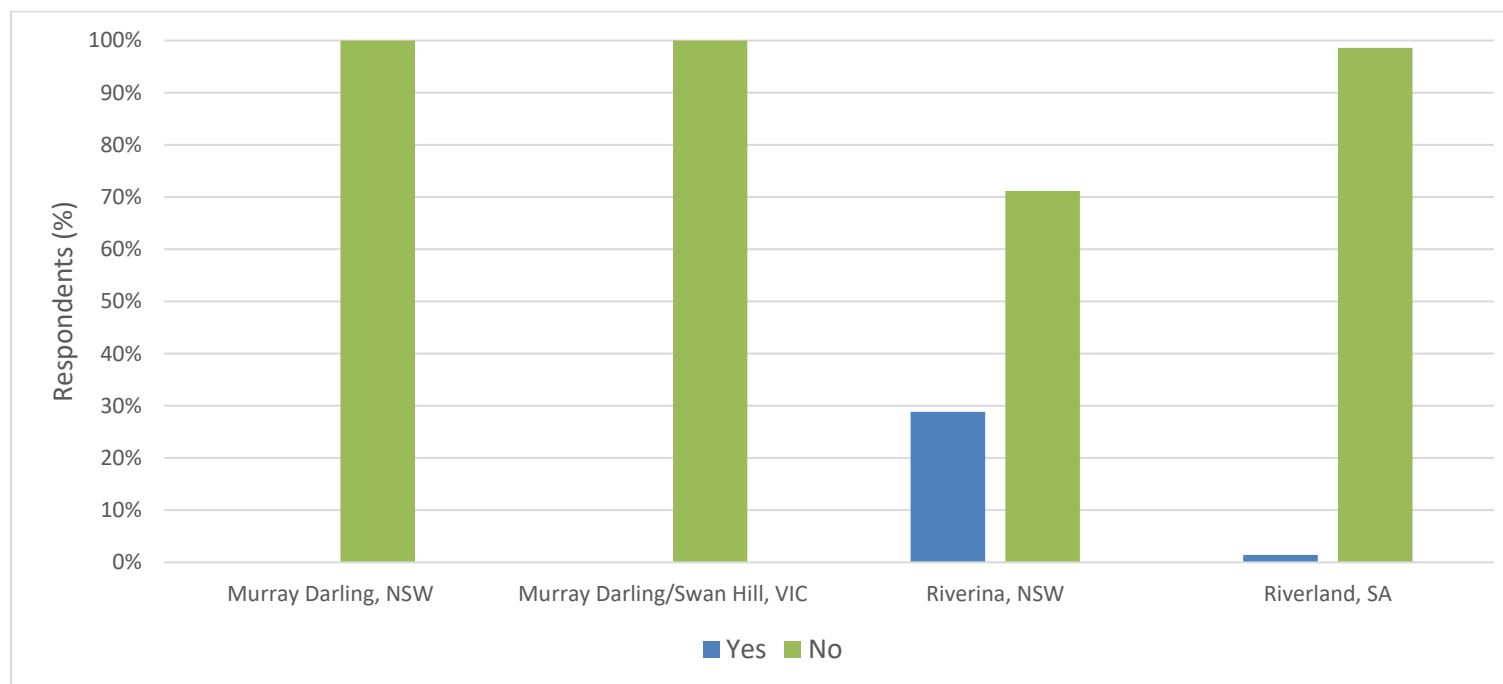


Figure 29. Proportion of respondents receiving water from the different water authorities in the Riverland



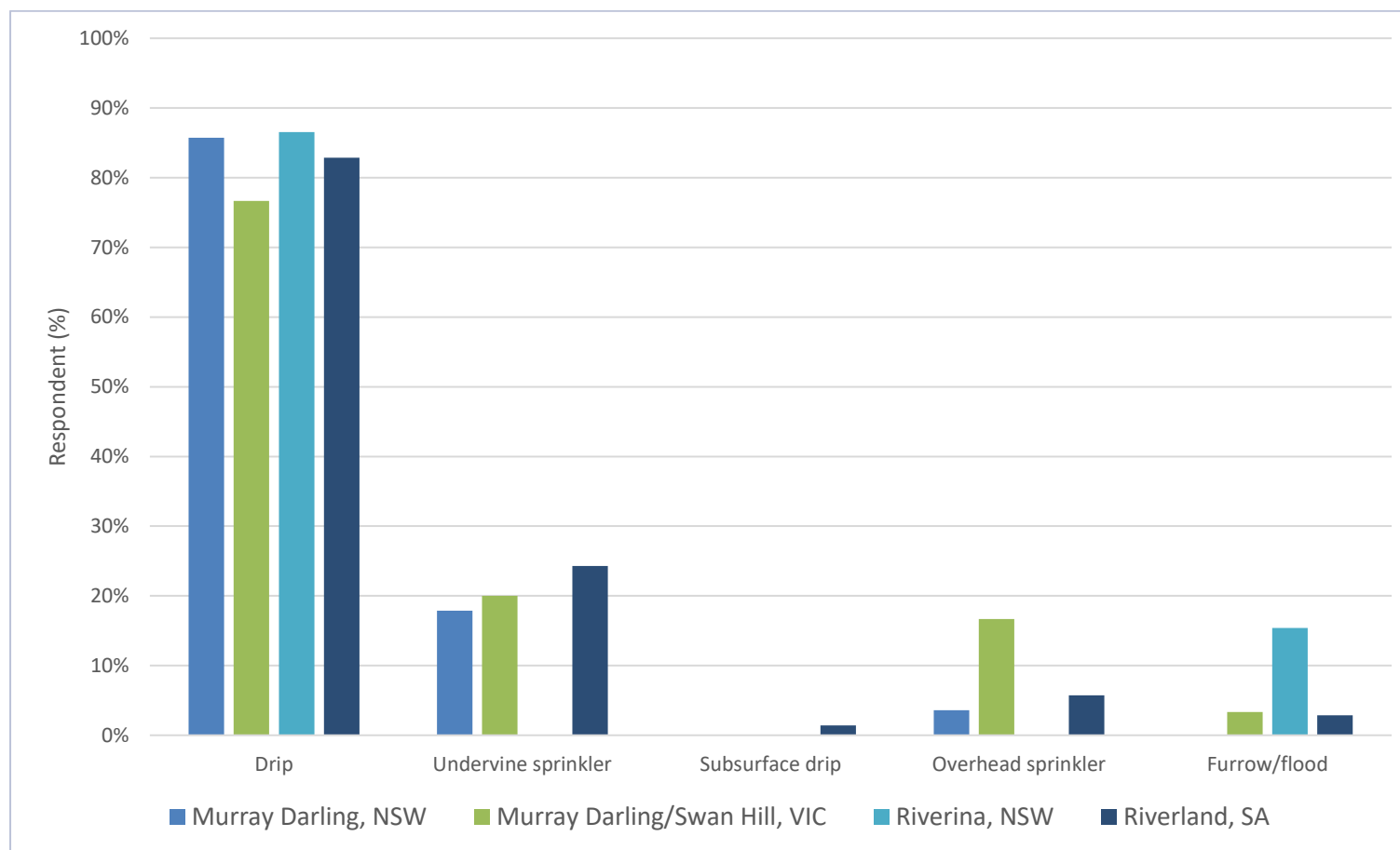
The majority of the on-site storage dams (11/12) are located in the Riverina region; however, most are quite small.

Figure 30. Proportion of respondents within each region with an on-farm water storage dam on their property

Table 4. Size of on-site storage dam

Size of dam (ML)	0.5	1	2	4	5	7	10	14	18	20	50	70
Riverina, NSW	1	2	2	2	2	1	1		1	1	1	1
Riverland, SA								1				

14. Irrigation delivery method



The majority of respondents in all regions use drip irrigation to apply their irrigation water.

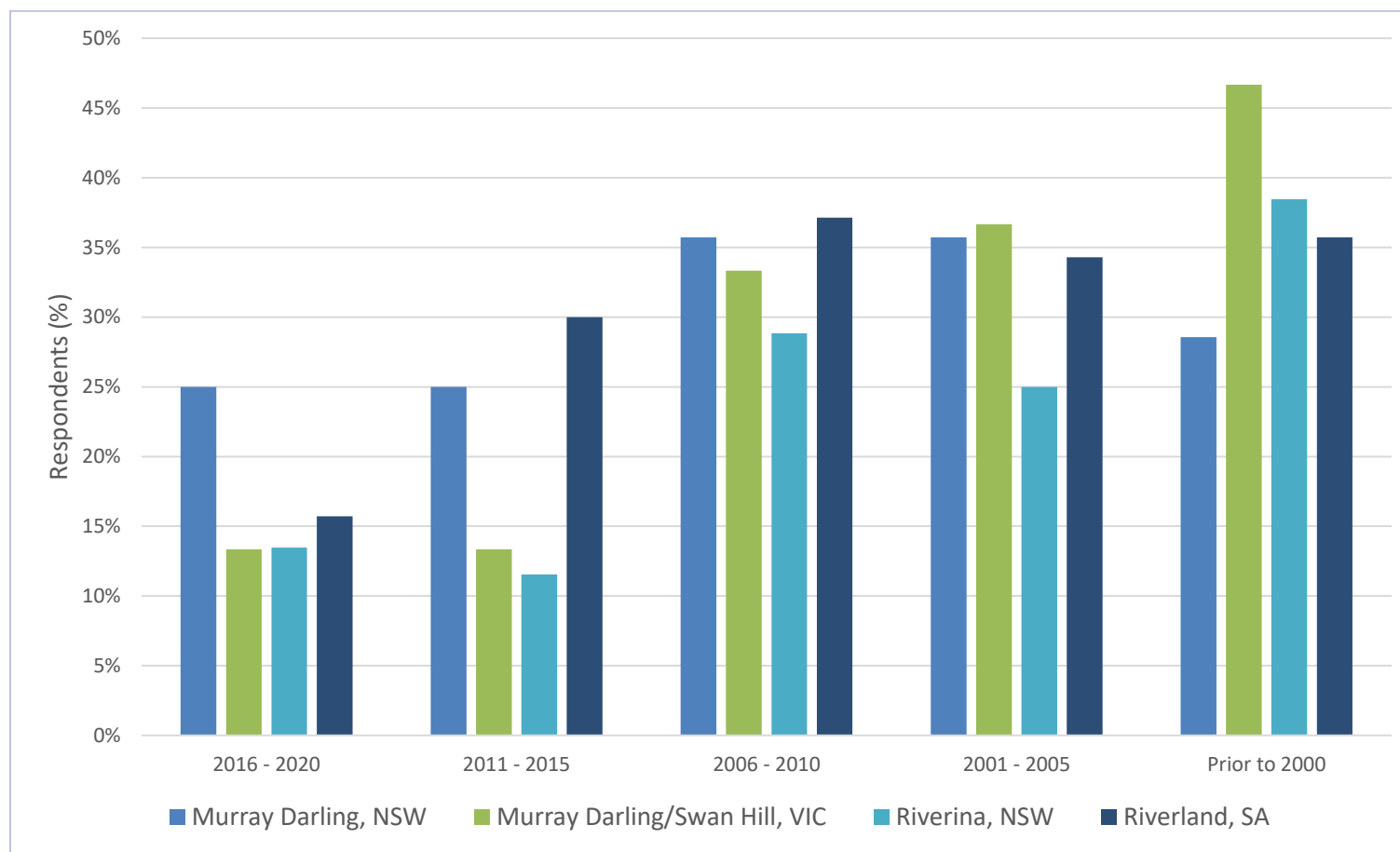
15% of Riverina respondents use furrow/flood irrigation, compared to 3% of Murray Darling VIC/Swan Hill and Riverland respondents and 0% of Murray Darling NSW respondents.

Only 1% of Riverland respondents use subsurface drip irrigation.

Figure 31. Proportion of respondents in each region using the different irrigation delivery methods

Note 18. Respondents could select more than one category

15. Irrigation system age



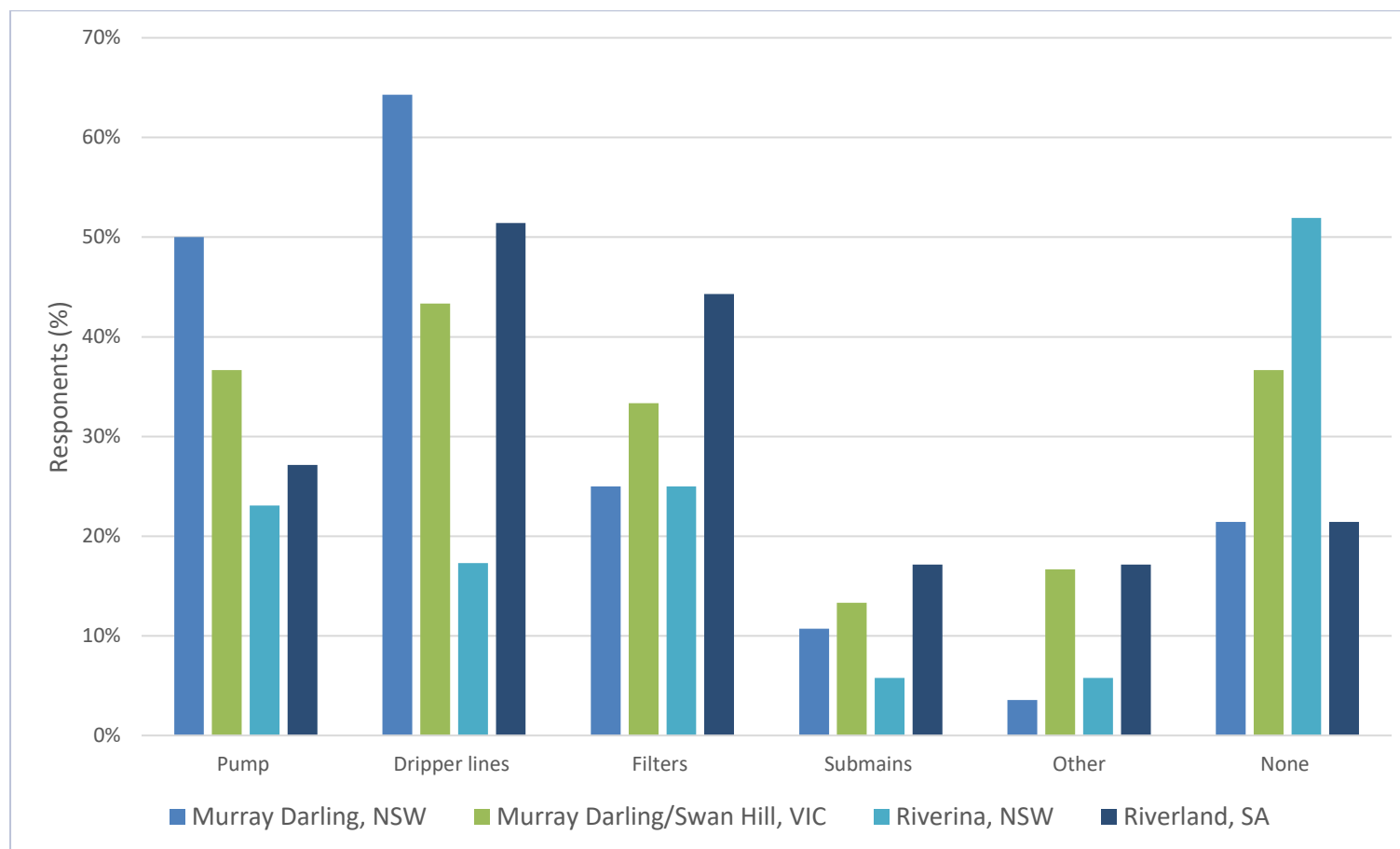
34% of respondents have an irrigation system that was installed between 10 and 15 years ago.

32% of respondents have an irrigation system that was installed between 15 and 20 years ago.

37% of respondents have an irrigation system that was installed over 20 years ago.

Figure 32. Proportion of respondents in each region with an irrigation system installed in the different date ranges

Note 19. Respondents could select more than one date range



33% of all respondents have not upgraded any part of their irrigation system since it was installed.

Over half of the Riverland respondents have not upgraded any part of their irrigation system since installation even though 80% of these systems were over 10 years old.

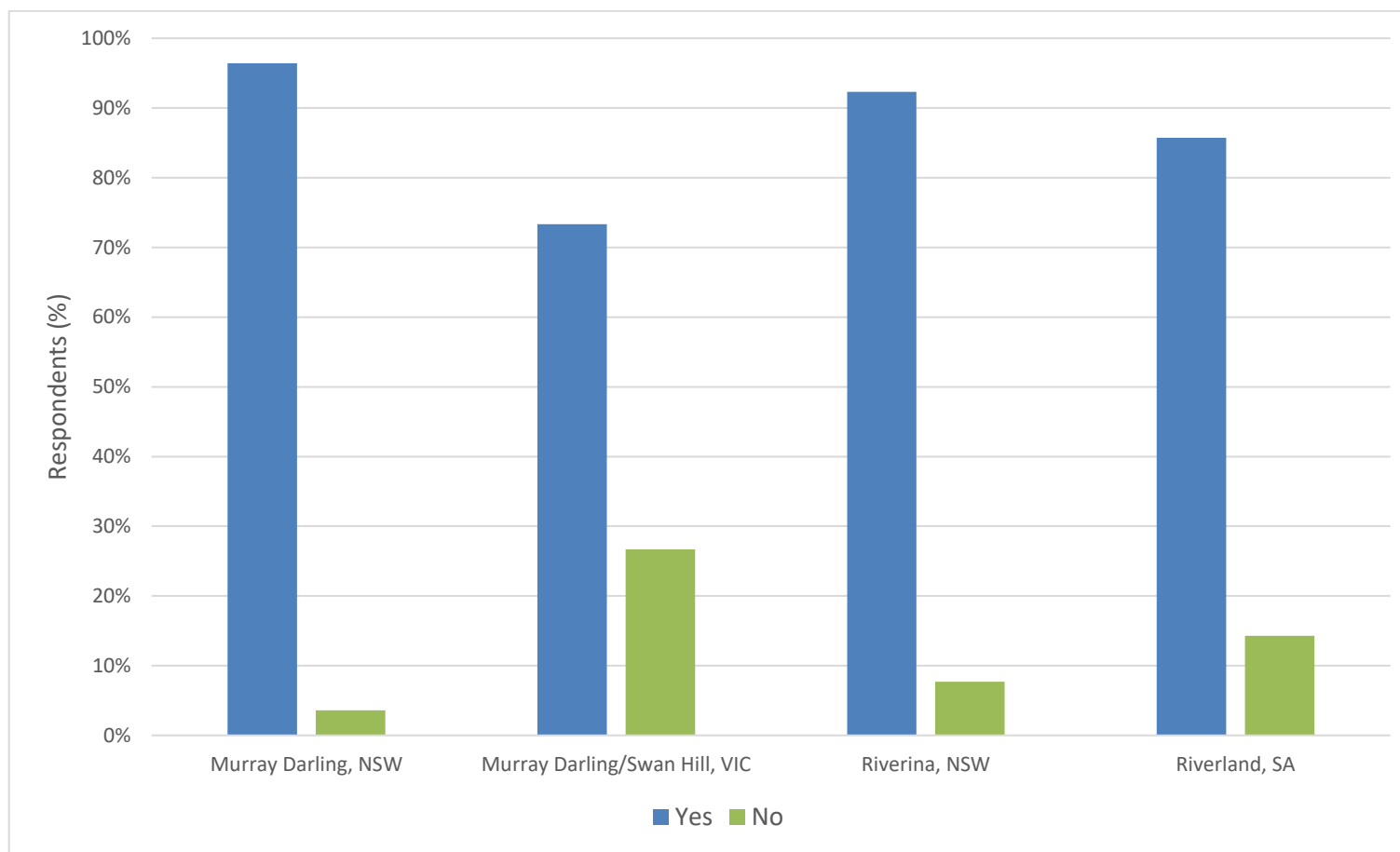
Figure 33. Proportion of respondents in each region who have upgraded different parts of their irrigation system

Note 20. Respondents could select more than one category

Table 5. Other irrigation system upgrades made since installation

Irrigation system upgrades	Murray Darling NSW	Murray Darling Vic/Swan Hill	Riverina	Riverland	Total
Automatic filtration		1			1
Automation				2	2
Controller			1		1
Electric valves				1	1
Fertigation system				1	1
Galcon system				1	1
Removed furrows to allow flooding between rows				1	1
Replace micro sprinkler heads		1			1
Replaced overhead sprinkler heads		1		2	2
Soil moisture probes				3	3
Variable Speed Drive	1	1			1

16. Irrigation system capacity



Over 90% of respondents in Murray Darling NSW and the Riverina can vary irrigation application rates across their vineyard, compared to 86% in the Riverland and only 73% in Murray Darling VIC/Swan Hill.

Figure 34. Proportion of respondents in each region who can vary irrigation application rates between different areas on their vineyard

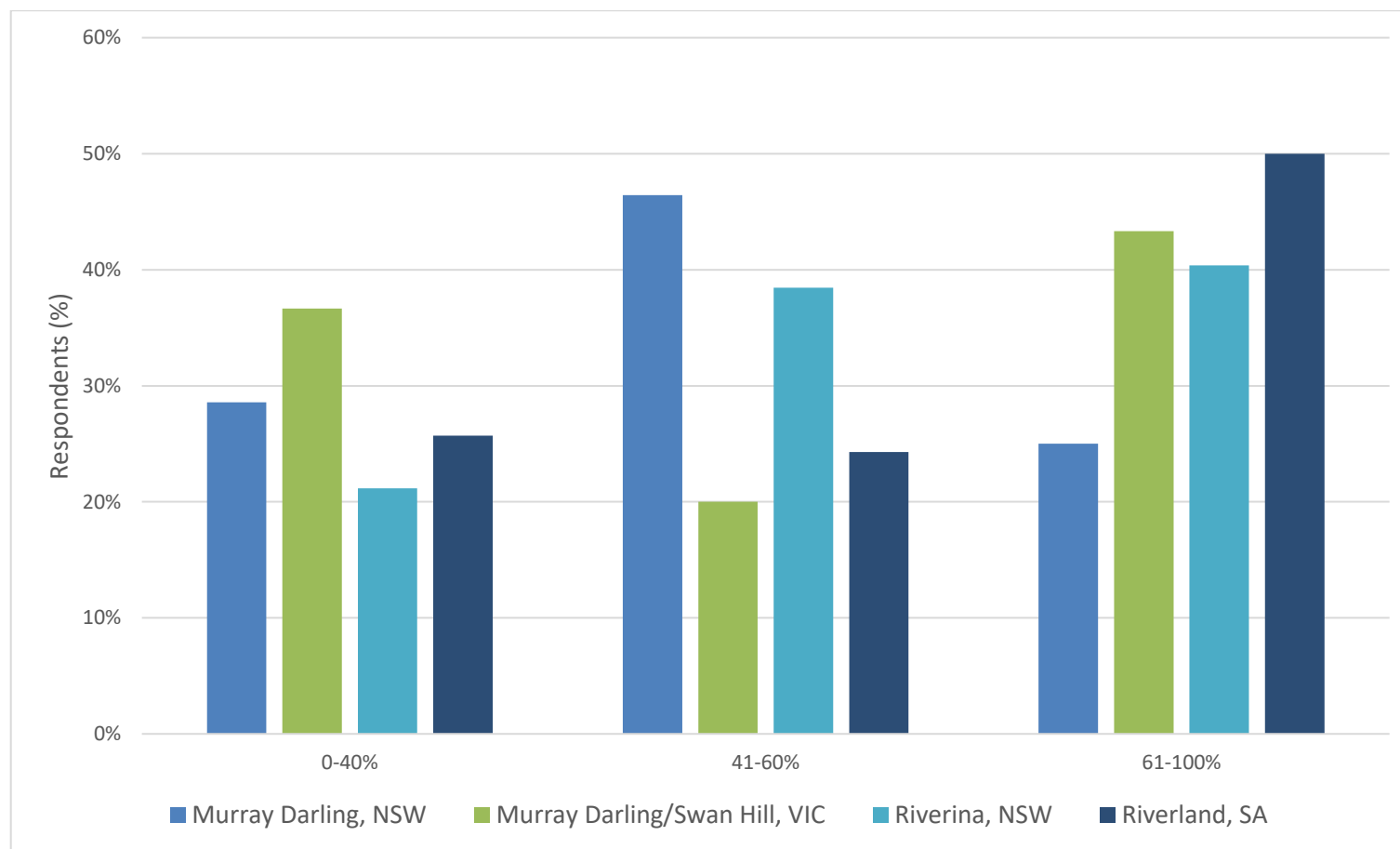


Figure 35. Proportion of respondents in each region with irrigation systems within each capacity category

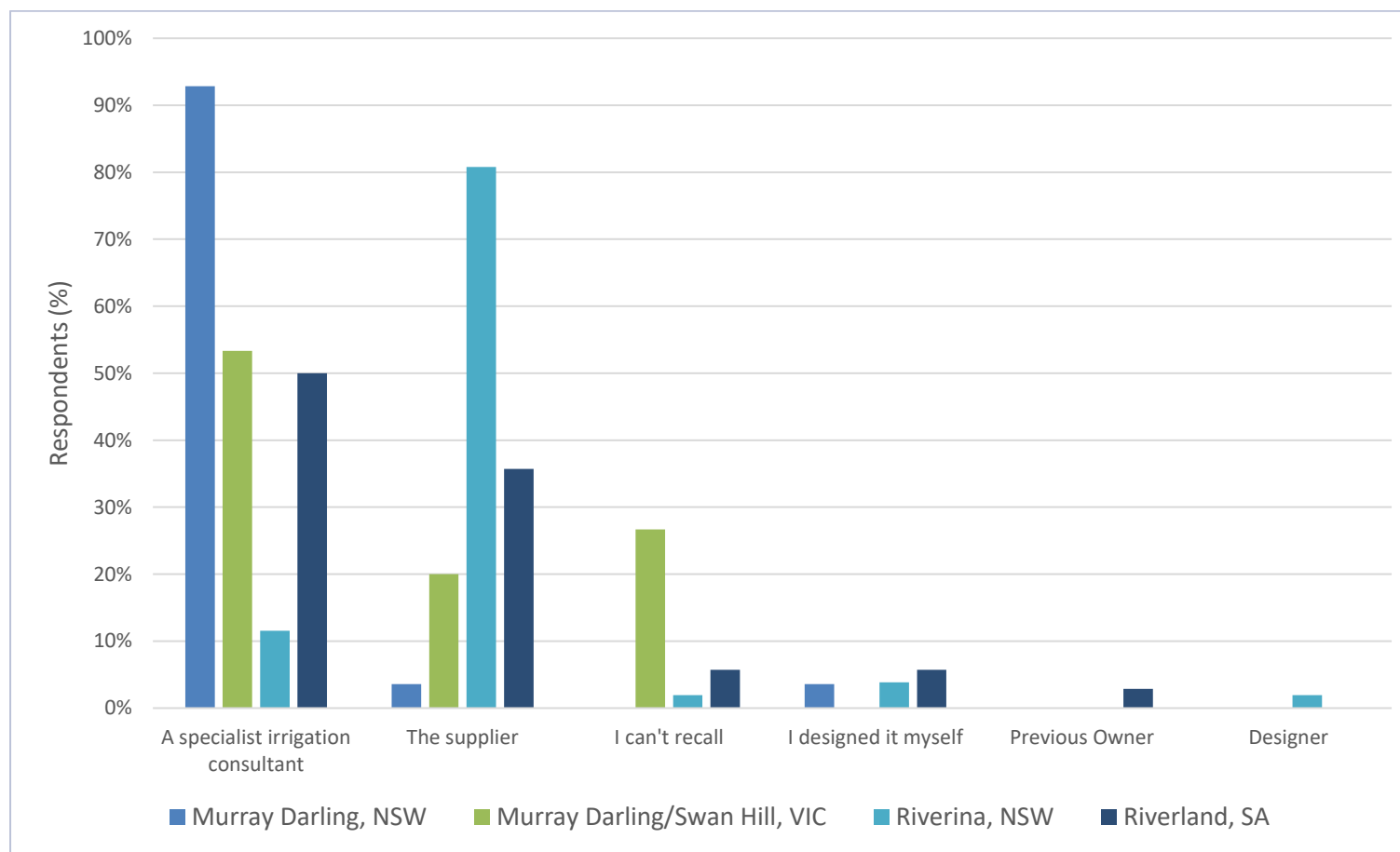
Note 21. Irrigation capacity is measured as the maximum area of vineyard that can be irrigated at one time

The majority of Riverland respondents (50%) can irrigate more than 60% of their vineyard area at one time, compared to 43% of Murray Darling VIC/Swan Hill respondents 40% of Riverina respondents and only 25% of Murray Darling NSW respondents.

The majority of Murray Darling NSW respondents (46%) can irrigate 41-60% of their vineyard at one time.

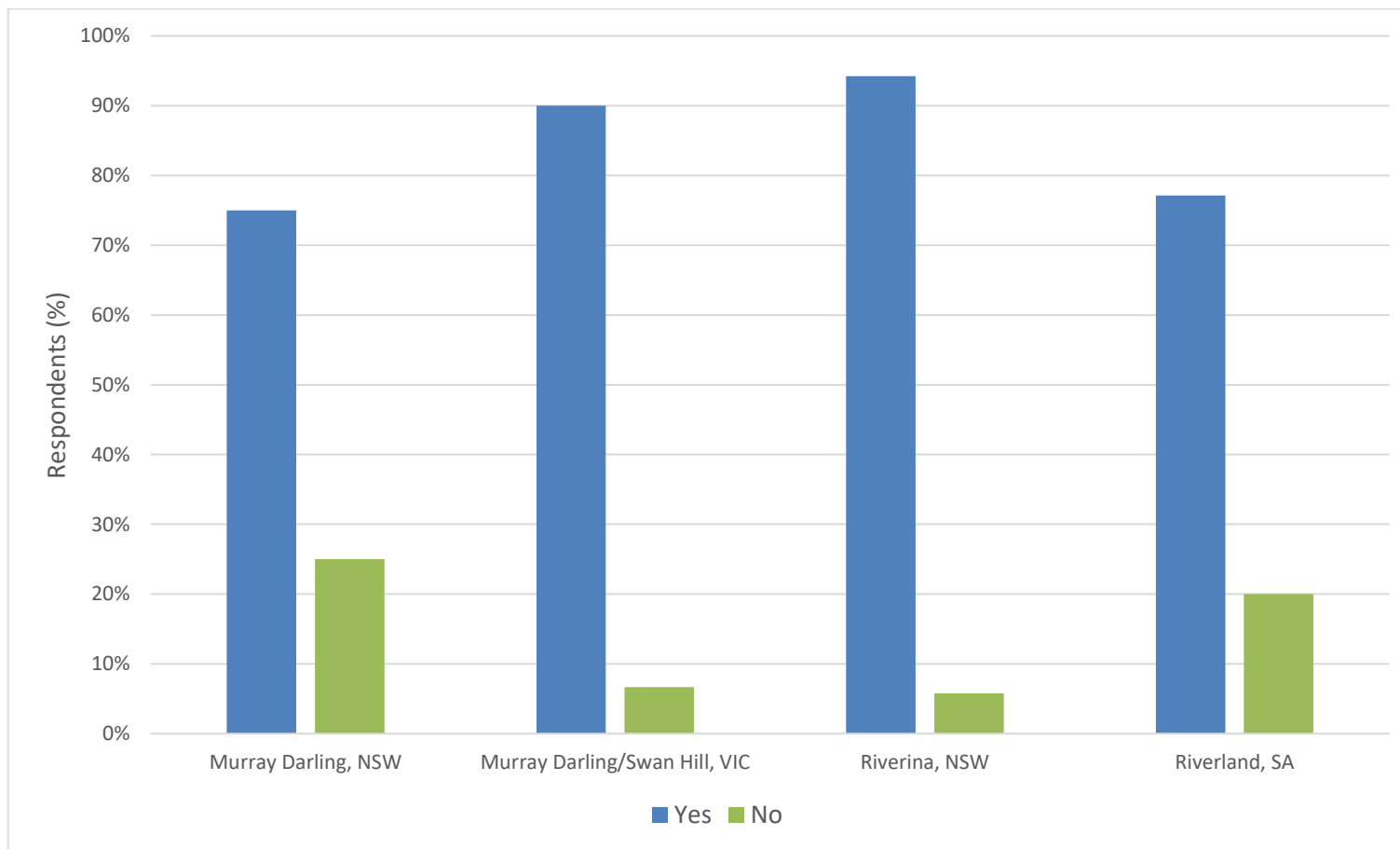
37% of Murray Darling VIC/Swan Hill respondents can irrigate 40% or less of their vineyard at one time.

17. Irrigation system design



The majority of respondents in all regions had their irrigation system designed by a professional.

Figure 36. Proportion of respondents in each region that had their irrigation system designed by a professional



The majority of respondents in all regions reported being satisfied with their irrigation system design.

The highest proportion of unsatisfied respondents were in Murray Darling NSW (25%) and the Riverland (20%).

Figure 37. Proportion of respondents in each region who are satisfied with their irrigation system design

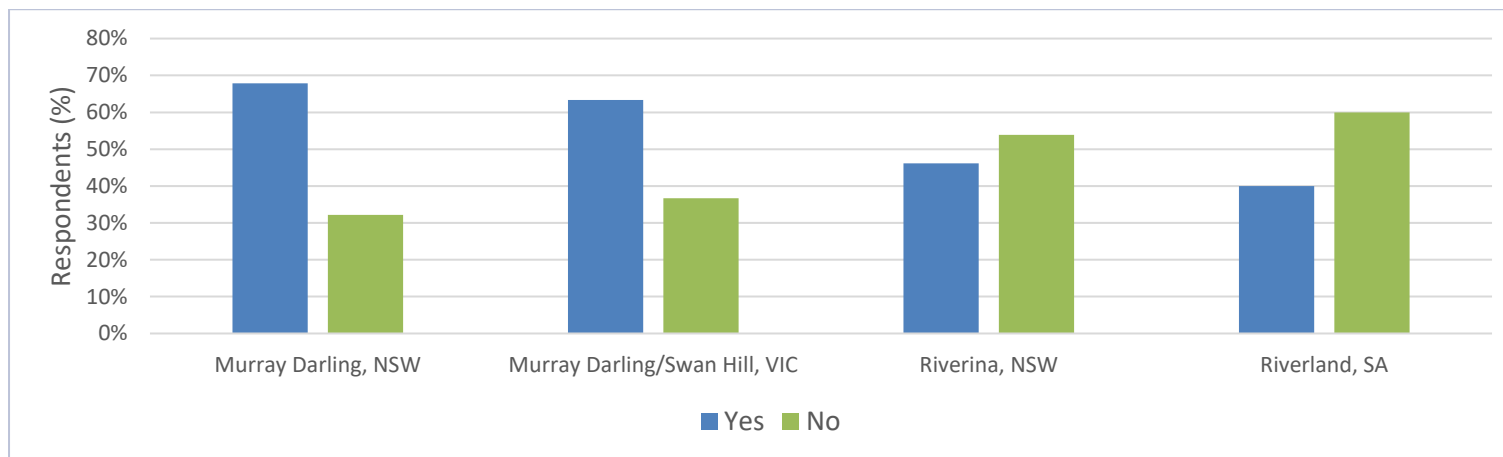


Figure 38. Proportion of respondents in each region that completed a soil survey prior to irrigation design

The majority of respondents in Murray Darling NSW and Murray Darling VIC/Swan Hill completed a soil survey prior to irrigation design while the majority of respondents in the Riverland did not complete a soil survey.

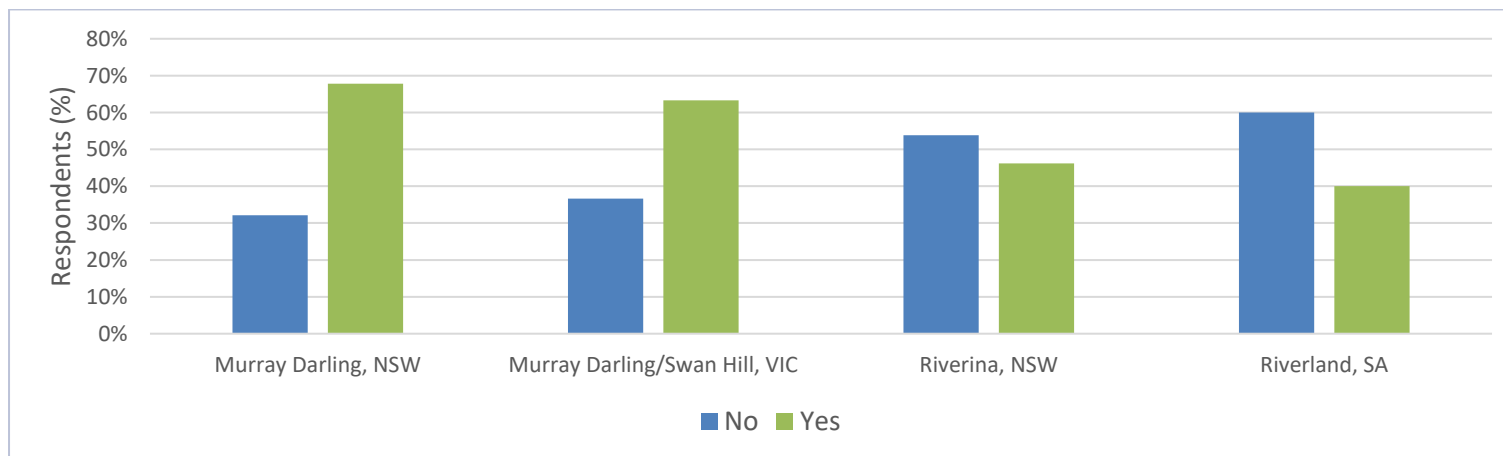


Figure 39. Proportion of respondents in each region that used the soil report in their irrigation design

Just under half of the Riverina respondents completed a soil survey prior to irrigation design.

Almost all of the respondents that did complete a soil survey prior to irrigation design incorporated the survey results into the design of their irrigation system.

18. Irrigation scheduling tools

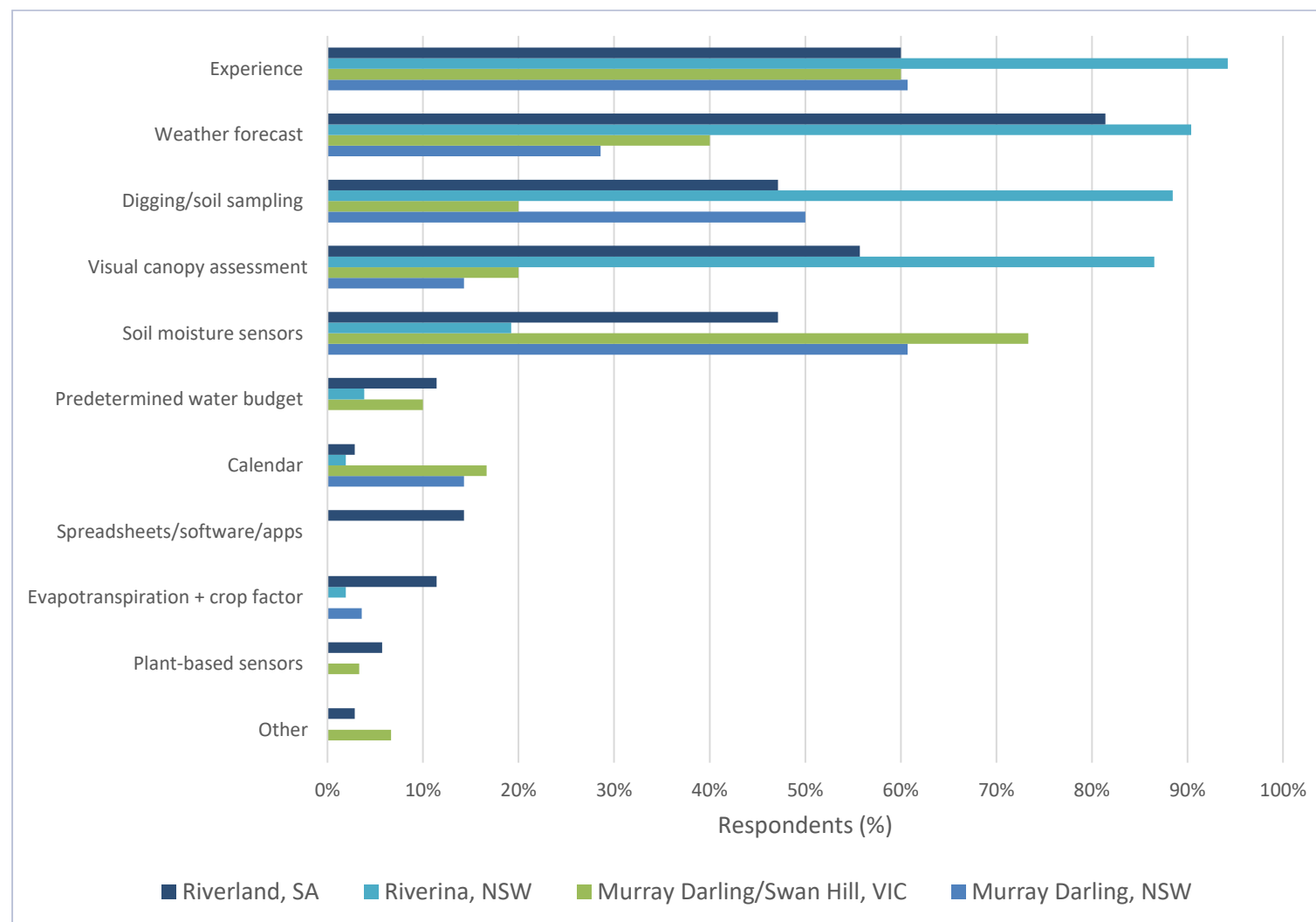


Figure 40. Proportion of respondents in each region using the various irrigation scheduling tools

Note 22. Respondents could select more than one category

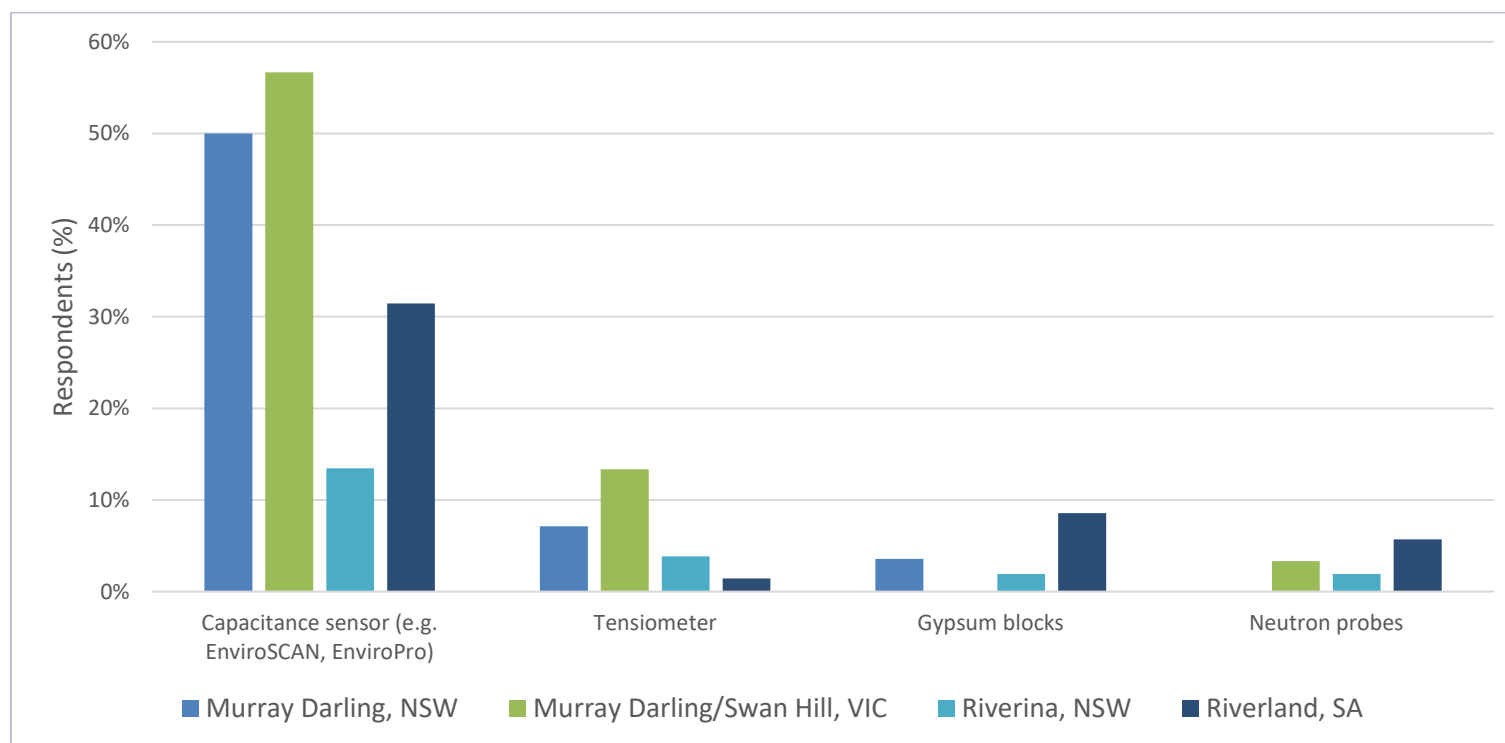
The majority of respondents in Murray Darling NSW and Murray Darling VIC/Swan Hill used experience and soil moisture sensors as their main irrigation scheduling tools.

The majority of Riverland respondents used a combination of soil moisture sensors, visual canopy assessment, digging/soil sampling, weather forecast and experience as their main irrigation scheduling tools.

Only 20% of Riverina respondents reported using soil moisture sensors as an irrigation scheduling tool. The main tools Riverina respondents reported using were visual canopy assessment, digging/soil sampling, weather forecast and experience.

Table 6. Other irrigation scheduling tools currently used

Irrigation scheduling tool	Murray Darling VIC/Swan Hill	Riverland	Total respondents
CCW app	-	2	2
Water availability time slots	1	-	1
Water when power is cheaper (e.g. weekends)	1	-	1



Capacitance sensors were the most common soil moisture sensors used in all regions.

Tensiometers were used more commonly in Murray Darling VIC/Swan Hill and gypsum blocks were more commonly used in the Riverland.

Figure 41. Proportion of respondents in each region using each type of soil moisture sensor

Note 23. Respondents could select more than one category

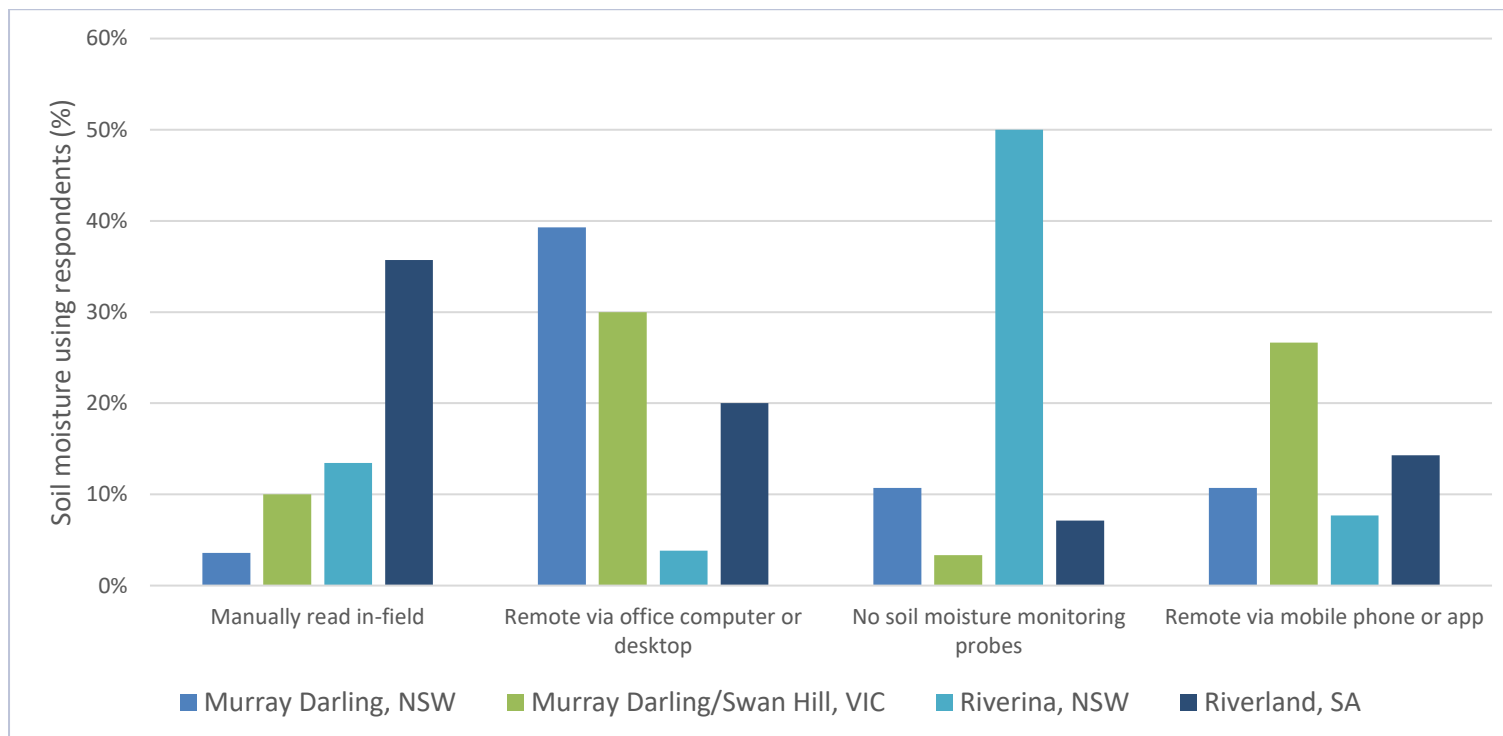


Figure 42. Proportion of soil moisture sensor users in each region that receive soil moisture data by the various methods

Note 24. Respondents could select more than one category

Of the respondents that are using soil moisture sensors, the majority in Murray Darling NSW are receiving their soil moisture data remotely to their office computer.

Conversely, the majority of Riverina and Riverland respondents using soil moisture sensors receive their data manually in the field.

The largest number of respondents receiving soil moisture data remotely are in the Riverland.

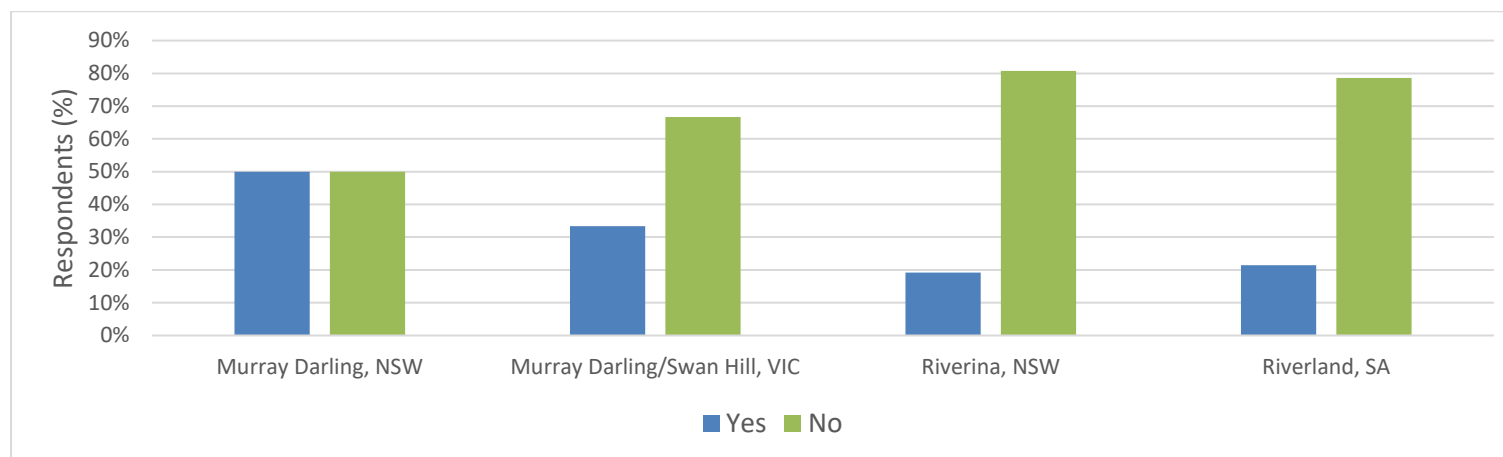


Figure 43. Proportion of respondents in each region with irrigation scheduling tools no longer in use

Table 7. Type of irrigation scheduling tool installed but no longer used in each region

Irrigation scheduling tool	Murray Darling NSW respondents	Murray Darling Vic/Swan Hill respondents	Riverina respondents	Riverland respondents
C Probe		1	1	
Capacitance probe	2		1	1
Controller	1			
Diviner 2000				2
Enviroscan	1	1	2	2
G-bug				1
Goldtech				1
Gypsum block		1	1	
Neutron probe		1	1	
Remote operation of pump using app		1		
Tensiometer	1	2	1	3
Water meter		1		
Total	5	8	7	10

All regions have respondents who reported having irrigation scheduling tools they no longer use.

93% of the irrigation scheduling tools reported to be installed but no longer in use were types of soil moisture sensors.

The only non-soil moisture monitoring tools installed but no longer used were an app for remote operation of a pump at one site and a water meter at another site.

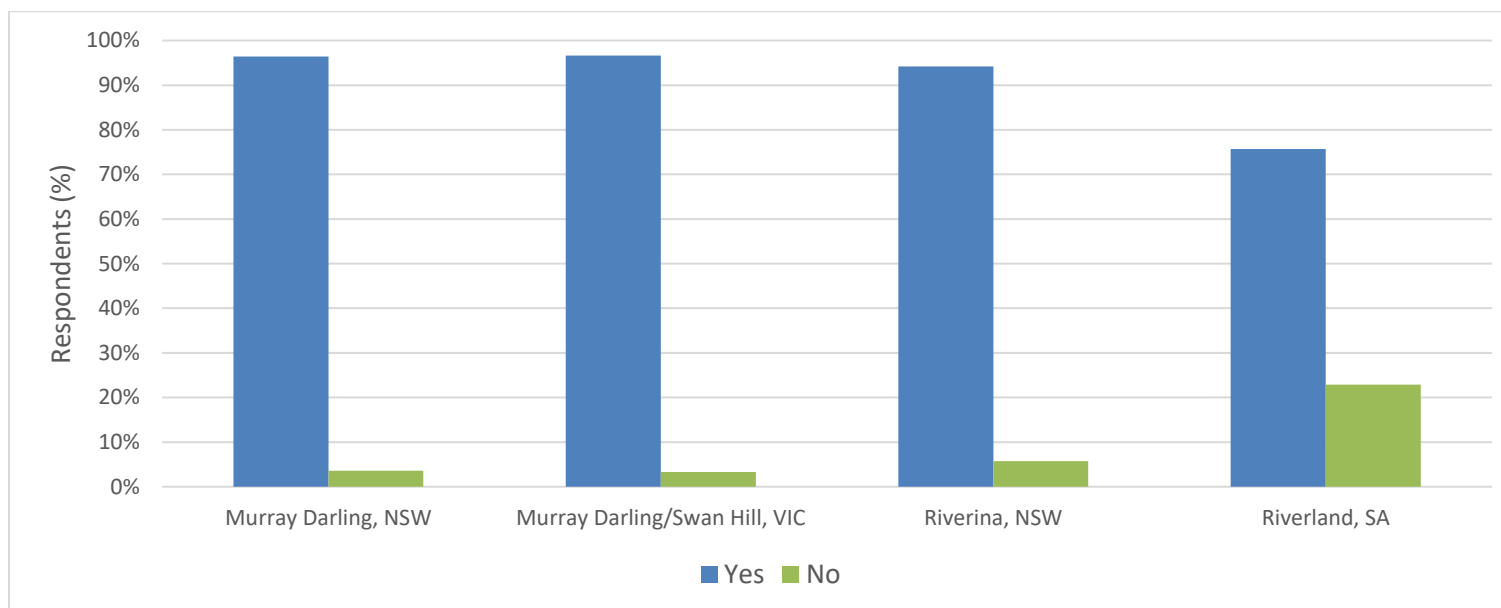


Figure 44. Proportion of respondents in each region who monitor their water use

Table 8. Other technology used to evaluate irrigation system performance in each region

Irrigation scheduling technology	Murray Darling NSW respondents	Riverland respondents	Riverina respondents	Murray Darling Vic/Swan Hill respondents
Drone	-	-	1	-
Flow meter	-	1	-	3
IrriSAT	1	1	-	2
NDVI (normalised difference vegetation index)	1	3	3	-
Pressure gauge	-	1	1	2
Thermal imaging	-	4	-	-

More than 90% of respondents in Murray Darling NSW, Murray Darling VIC/Swan Hill and Riverina reported monitoring their water use.

Only 76% of Riverland respondents reported monitoring their water use.

Small numbers of respondents in Murray Darling NSW, Riverland and Riverina are using NDVI to evaluate their irrigation system performance.

Thermal imaging is being used by small numbers of Riverland respondents to evaluate their irrigation system performance.

19. Irrigation system maintenance

Table 9. Summary of irrigation system maintenance responses

Maintenance	Regularly (at least every two years)	Never
Pressure checks	83%	17%
Flow rates	87%	13%
Distribution uniformity	72%	28%
Pump maintenance	79%	21%
Flushing dripline	83%	17%
Flushing mains	89%	11%
Injecting chlorine	38%	62%
Injecting hydrogen peroxide	32%	68%
Injecting acid	10%	90%
Cleaning filters	89%	11%

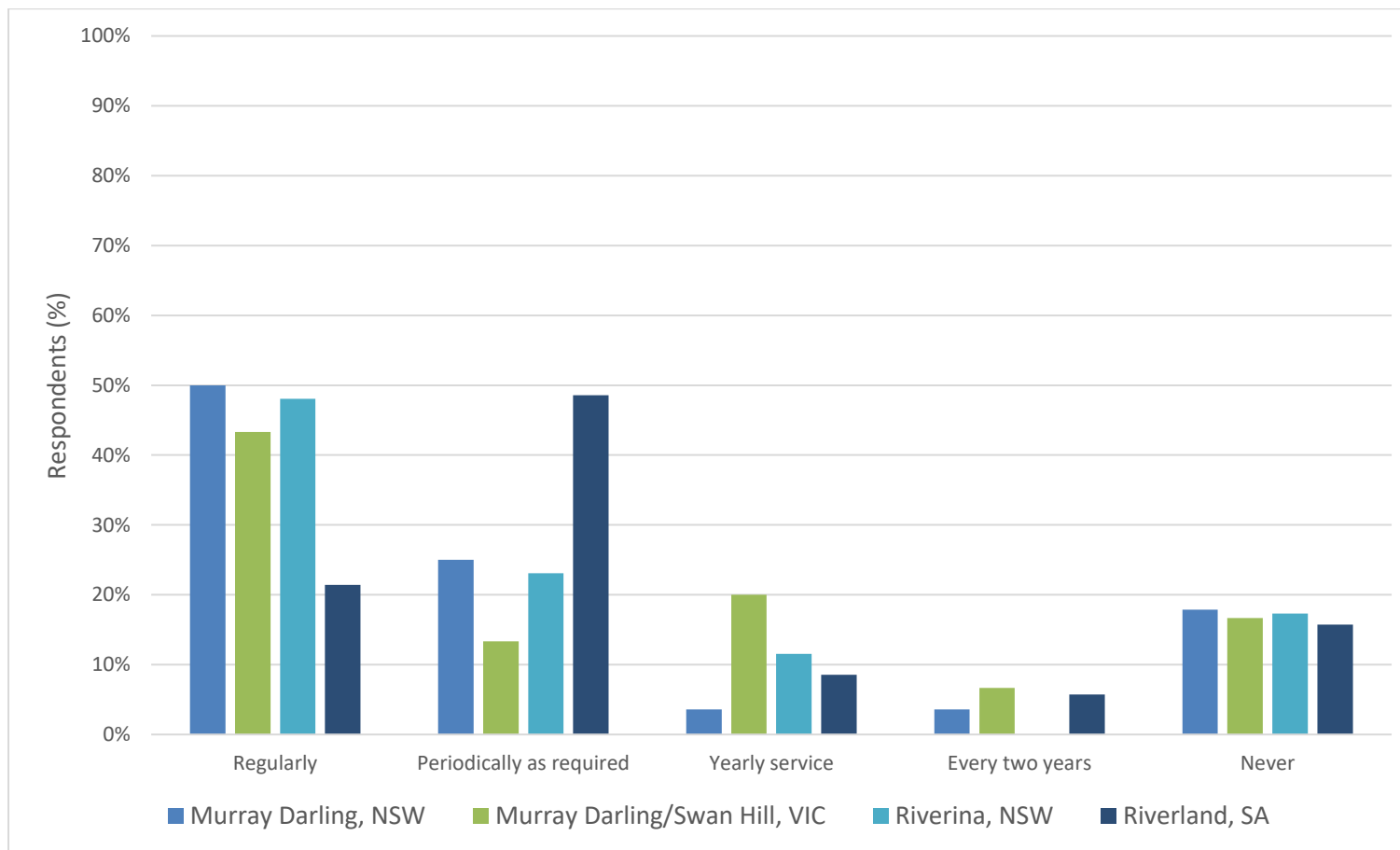
28% of respondents never check the distribution uniformity of their dripper output.

21% have never performed any pump maintenance.

17% have never performed any pressure checks.

17% have never flushed their driplines.

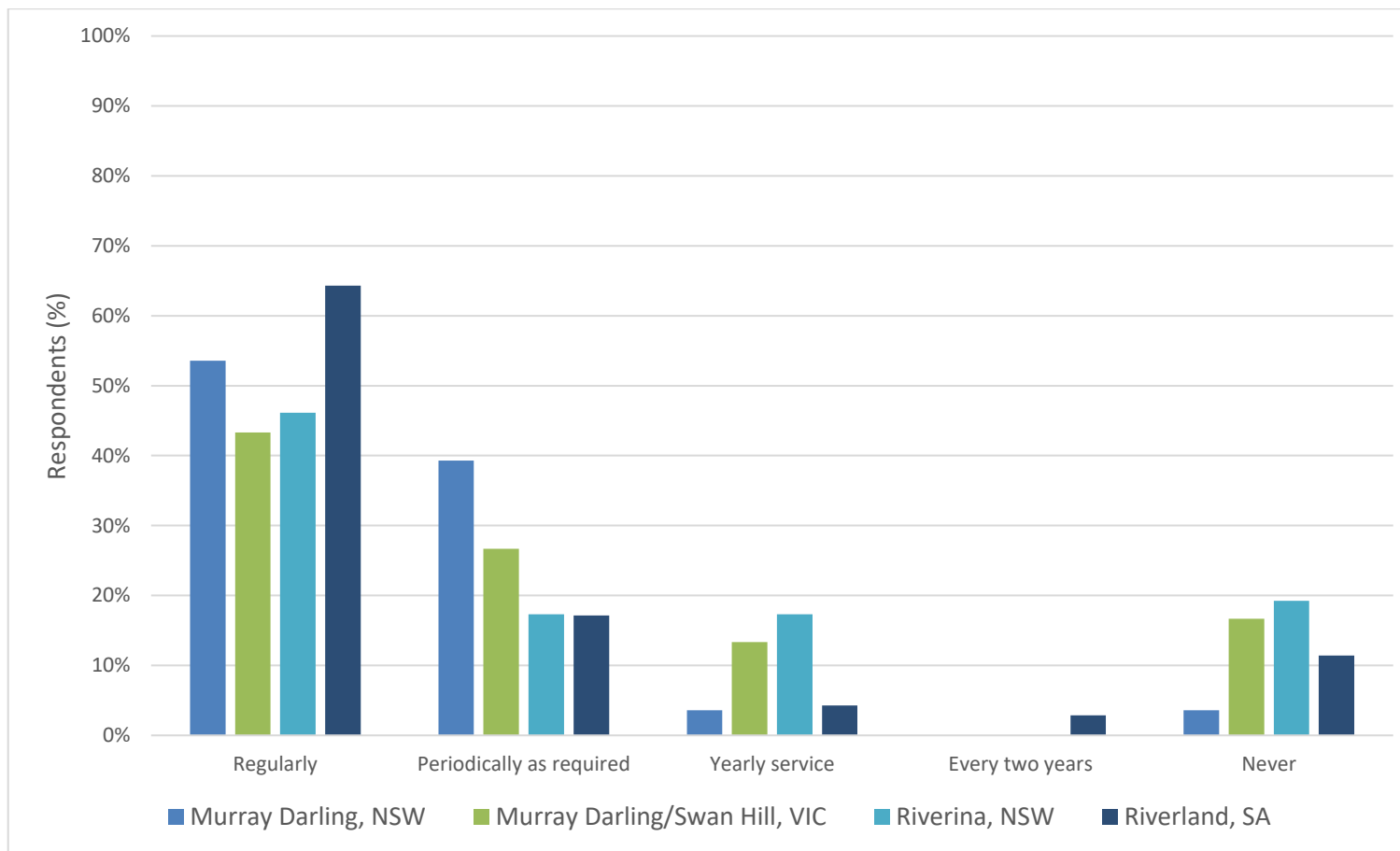
11% have never cleaned their filters.



83% of Riverina respondents conduct pressure checks at least once a year, compared to 78% of Murray Darling NSW and Riverland respondents and 76% of Murray Darling VIC/Swan Hill respondents.

17% of all respondents never conduct pressure checks.

Figure 45. Proportion of respondents in each region that conduct pressure checks across their vineyard at the different frequencies



96% of Murray Darling NSW respondents conduct flow rate checks at least once a year, compared to 86% of Riverland respondents, 83% of Murray Darling VIC/Swan Hill respondents and 81% of Riverina respondents.

13% of all respondents never conduct flow rate checks.

Figure 46. Proportion of respondents in each region that conduct flow rate checks at the different frequencies

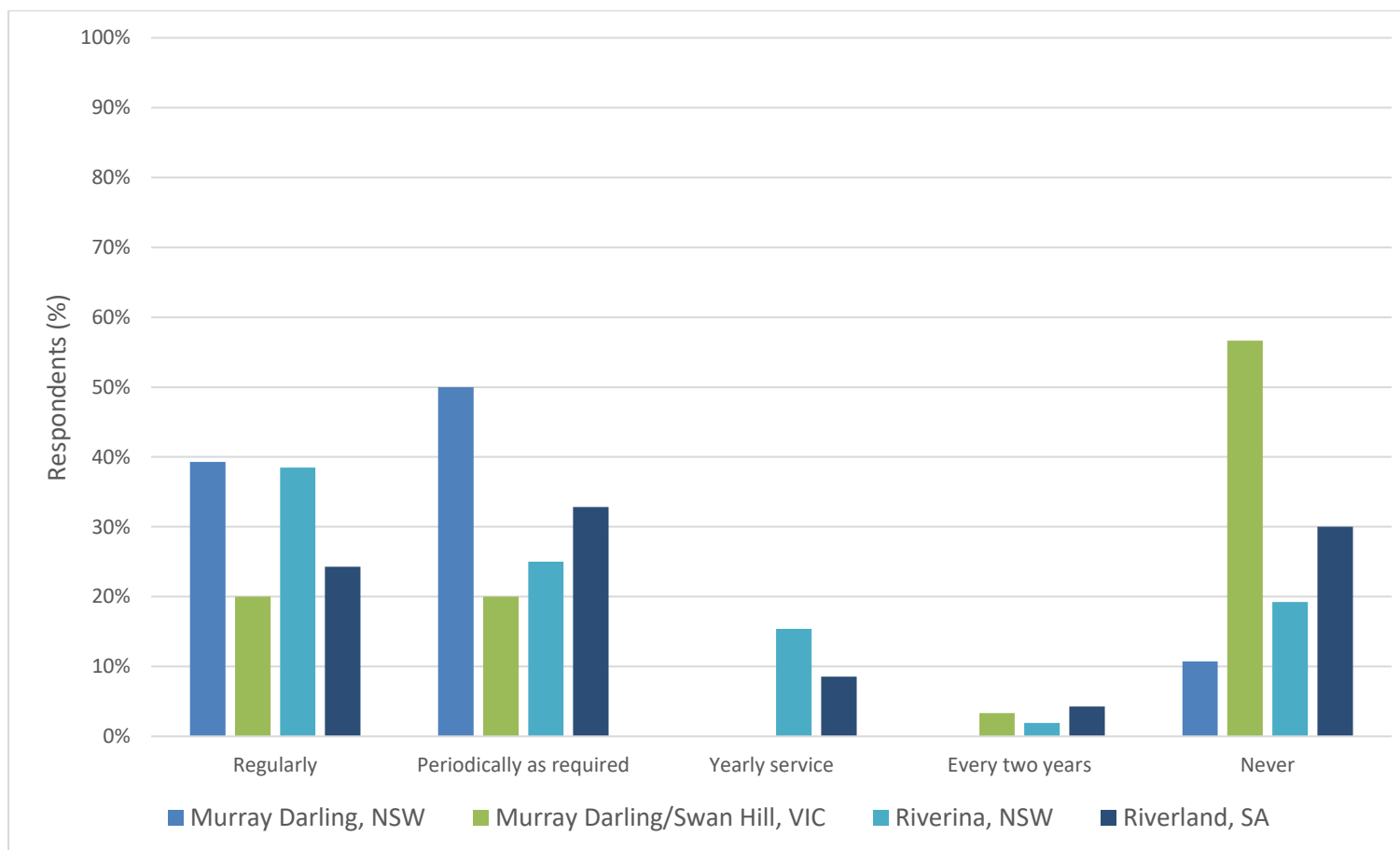
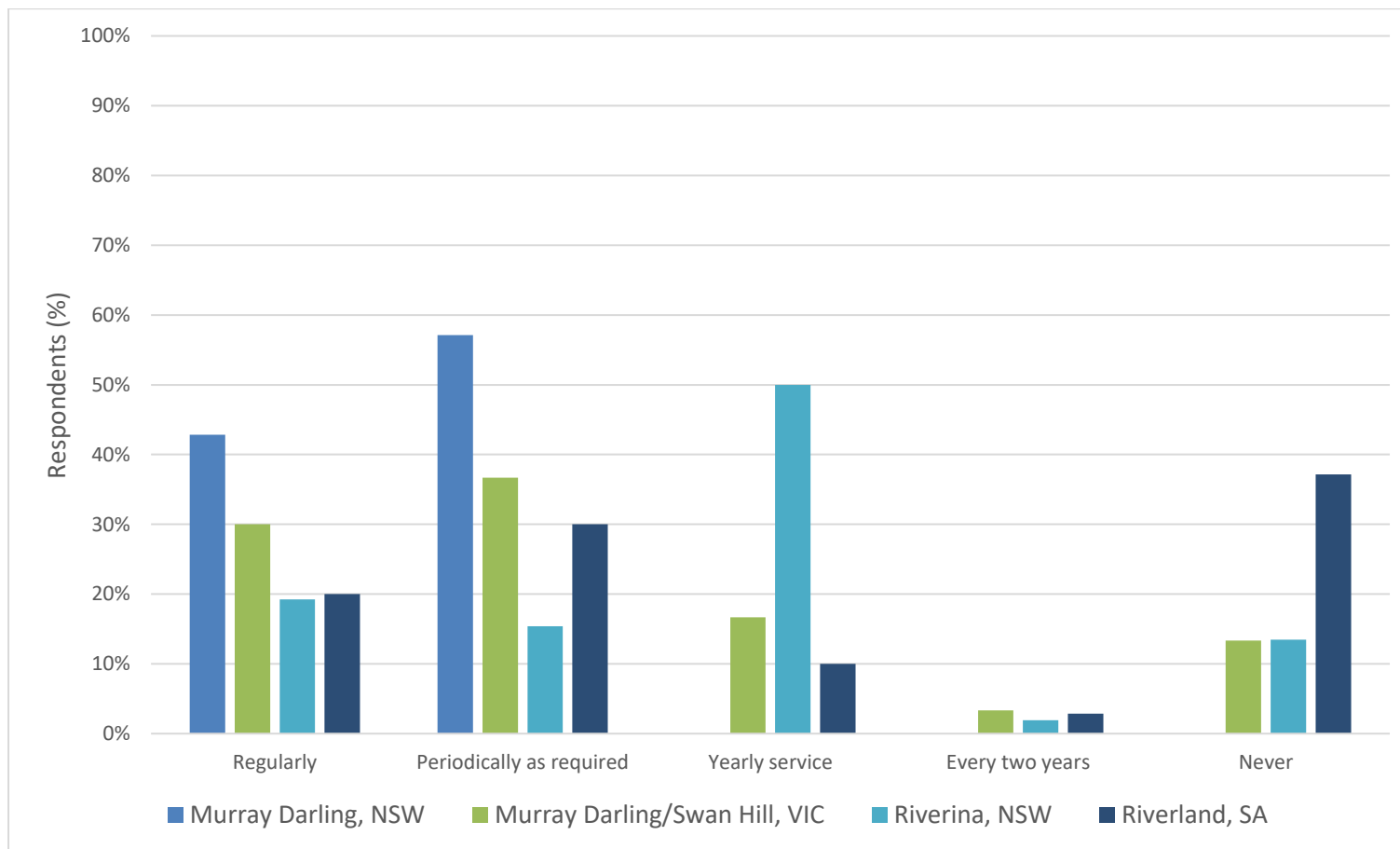


Figure 47. Proportion of respondents in each region that check distribution uniformity across their vineyard at the different frequencies

89% of Murray Darling NSW respondents conduct distribution uniformity checks at least once a year, compared to 79% of Riverina respondents, 66% of Riverland respondents and only 41% of Murray Darling VIC/Swan Hill respondents.

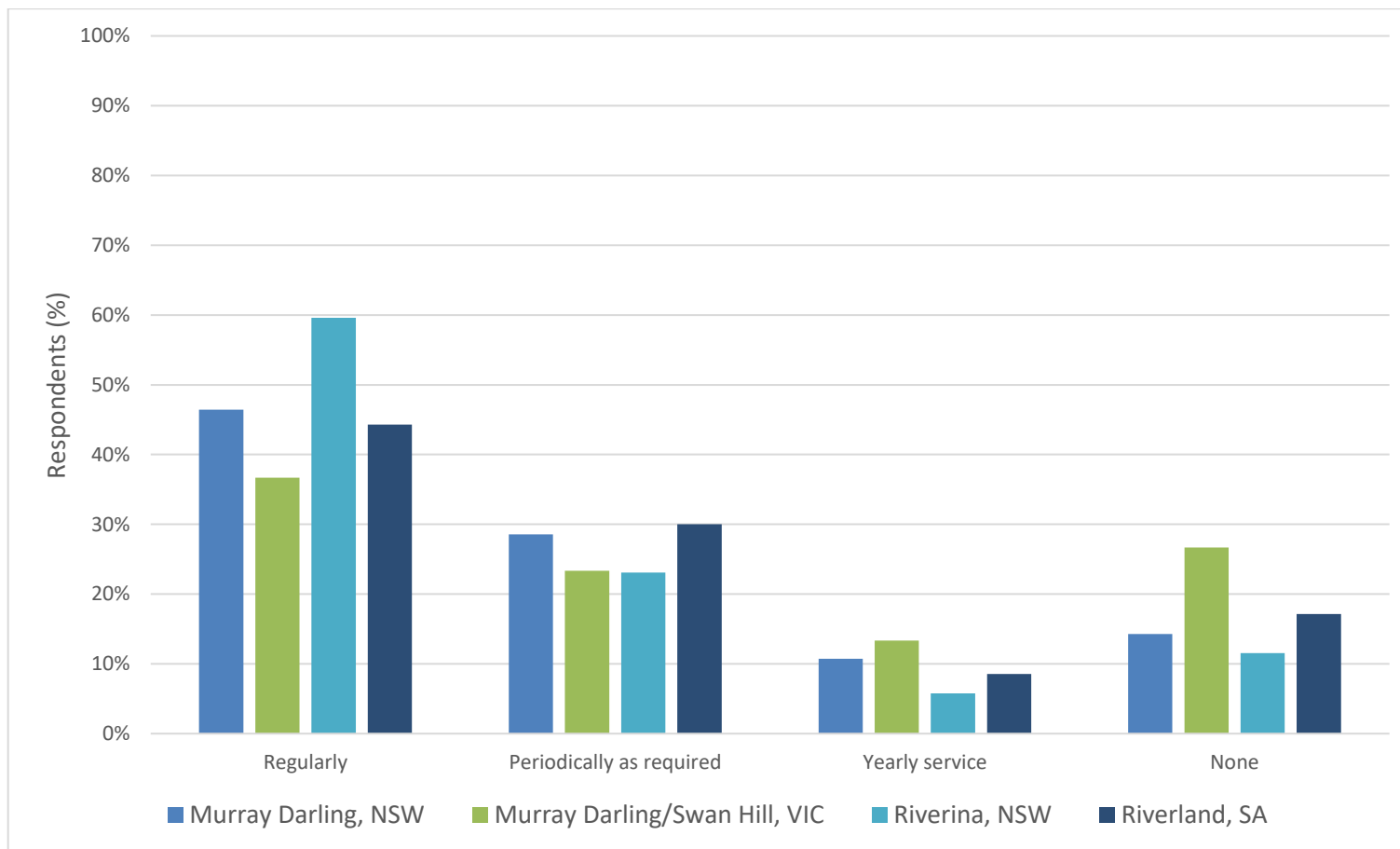
57% of Murray Darling VIC/Swan Hill respondents never check distribution uniformity across their vineyard, compared to 30% of Riverland respondents and 19% of Riverina respondents and only 11% of Murray Darling NSW respondents.



All Murray Darling NSW respondents conduct pump maintenance at least once a year, compared to 85% of Riverina respondents, 84% of Murray Darling VIC/Swan Hill respondents and only 60% of Riverland respondents.

37% of Riverland respondents have never conducted any pump maintenance.

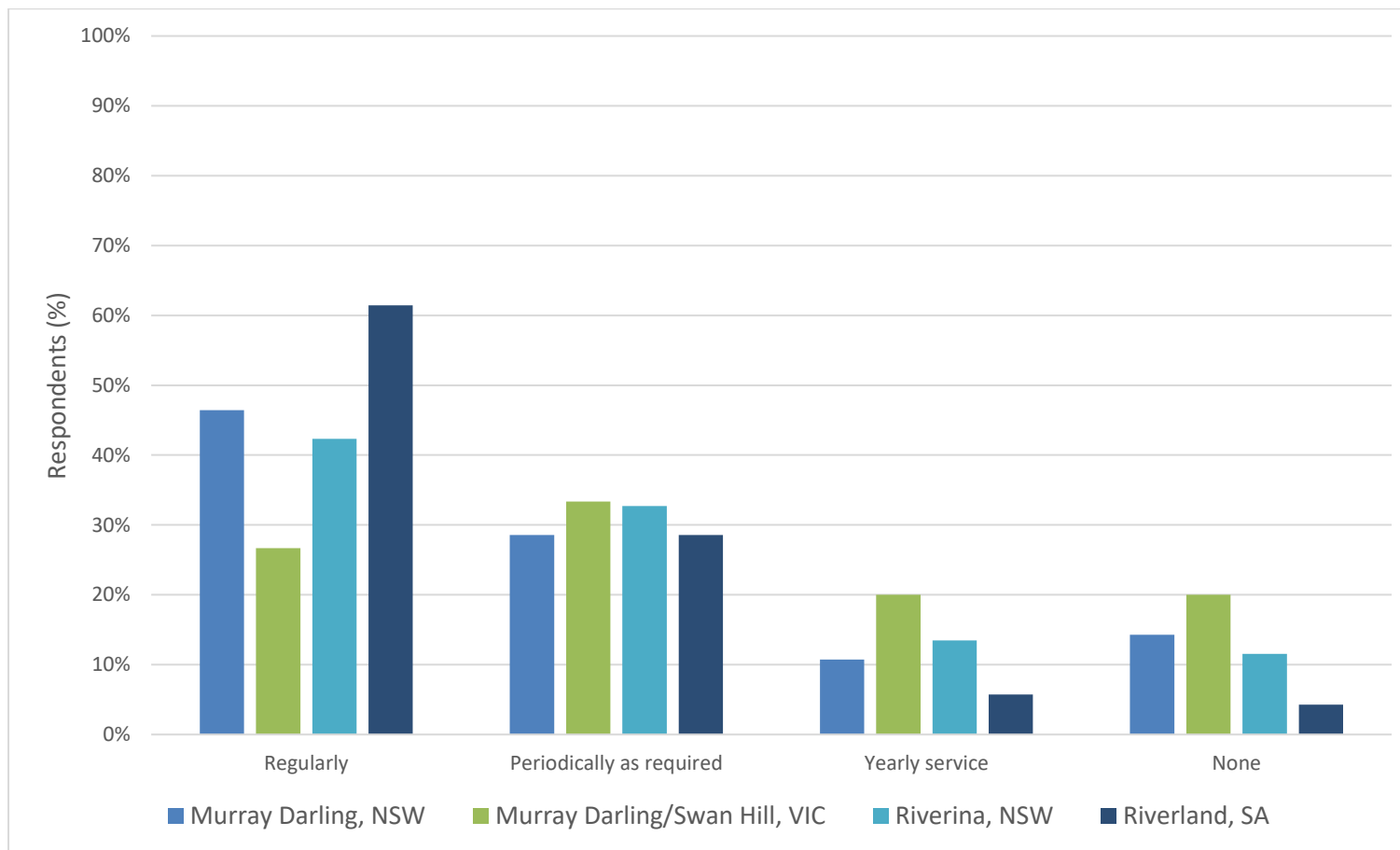
Figure 48. Percentage of respondents in each region that conduct pump maintenance at the different frequencies



The majority of respondents in each region flush their dripline regularly.

27% of Murray Darling VIC/Swan Hill respondents never flush their dripline.

Figure 49. Proportion of respondents in each region that flush their dripline at the different frequencies



96% of Riverland respondents flush their mains at least once a year, compared to 88% of Riverina respondents, 86% of Murray Darling NSW respondents and 80% of Murray Darling VIC/Swan Hill respondents.

11% of all respondents never flush their mains.

Figure 50. Proportion of respondents in each region that flush their mains at the different frequencies

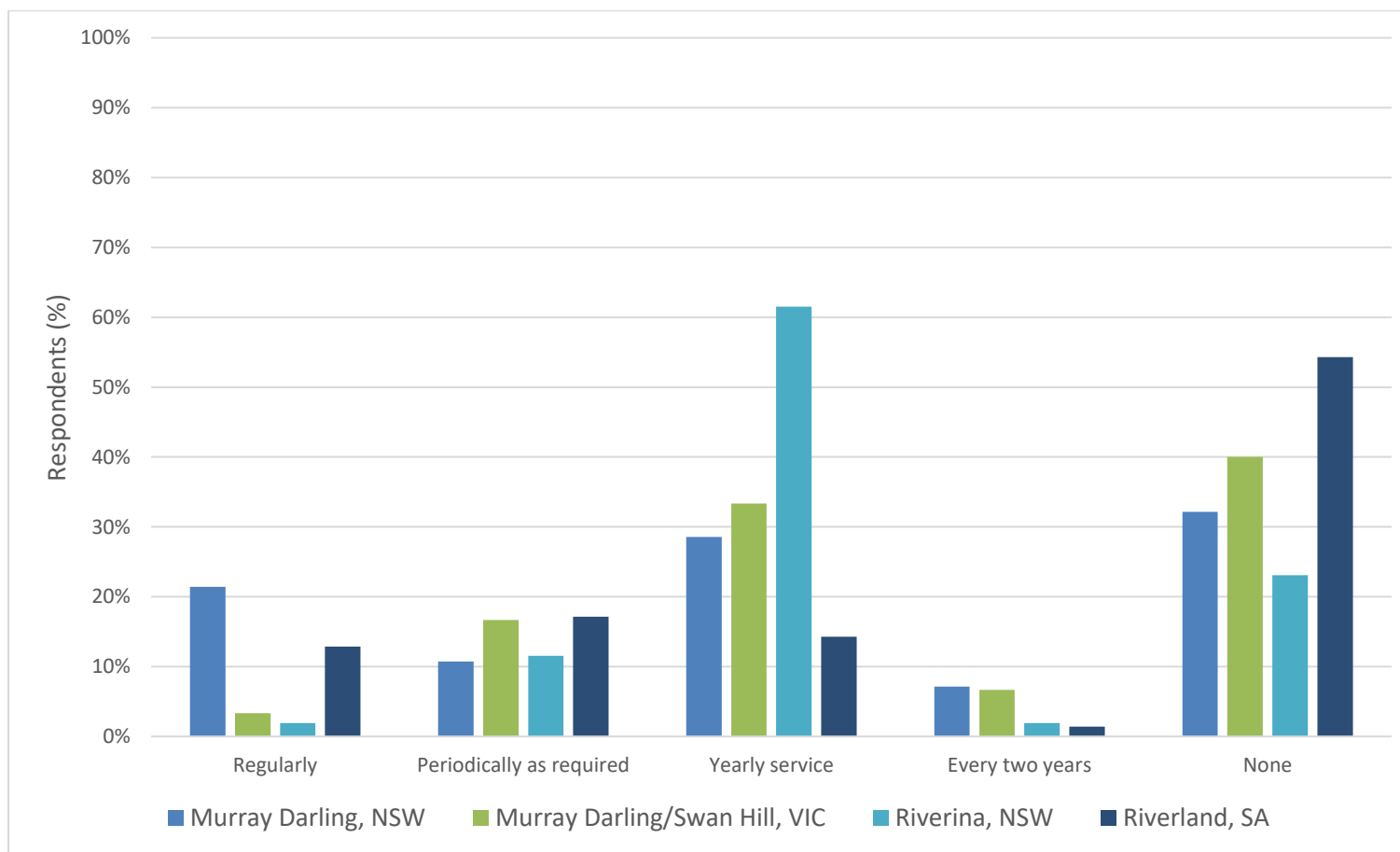
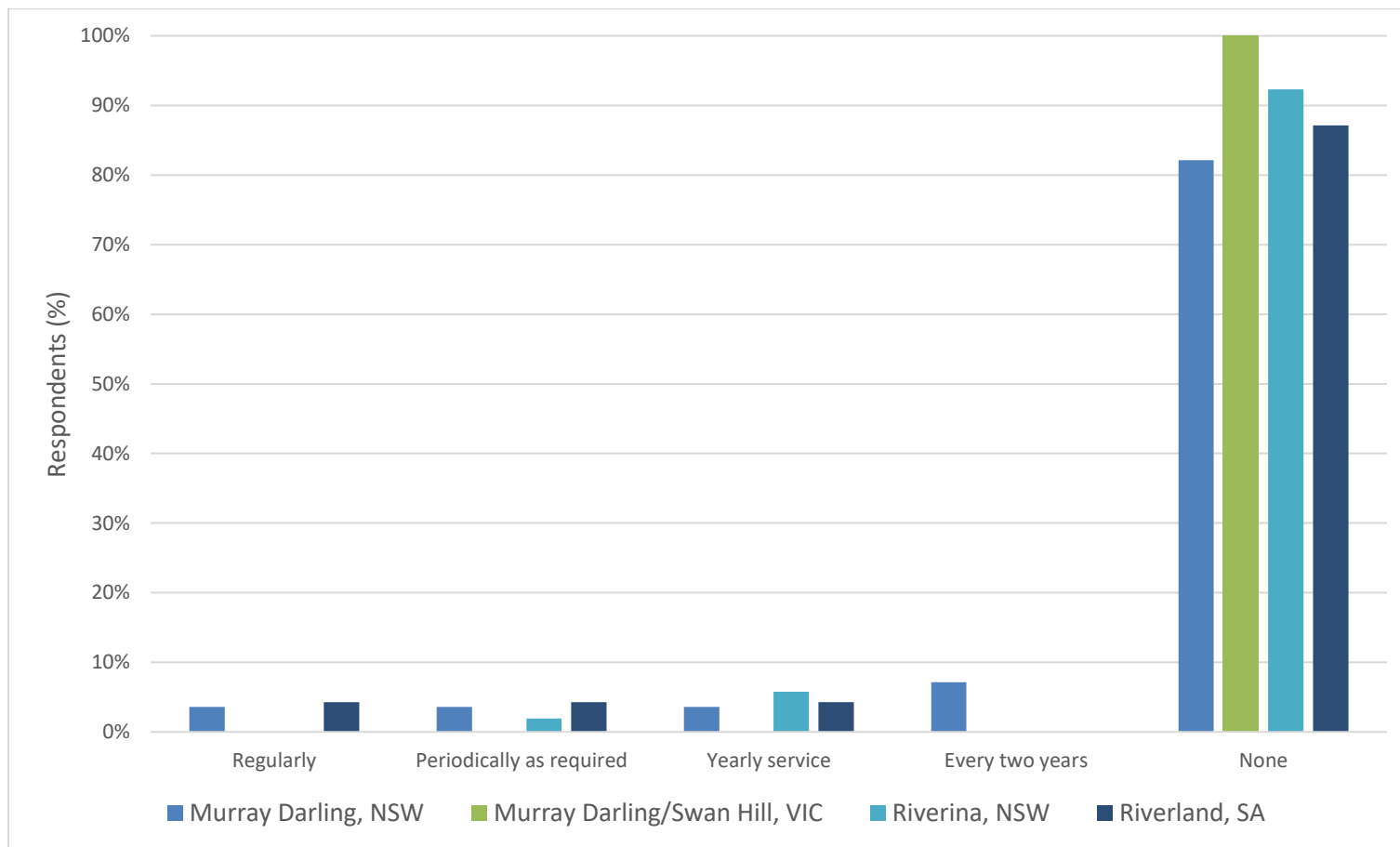


Figure 51. Proportion of respondents in each region that inject their irrigation system with chlorine and/or hydrogen peroxide at the different frequencies

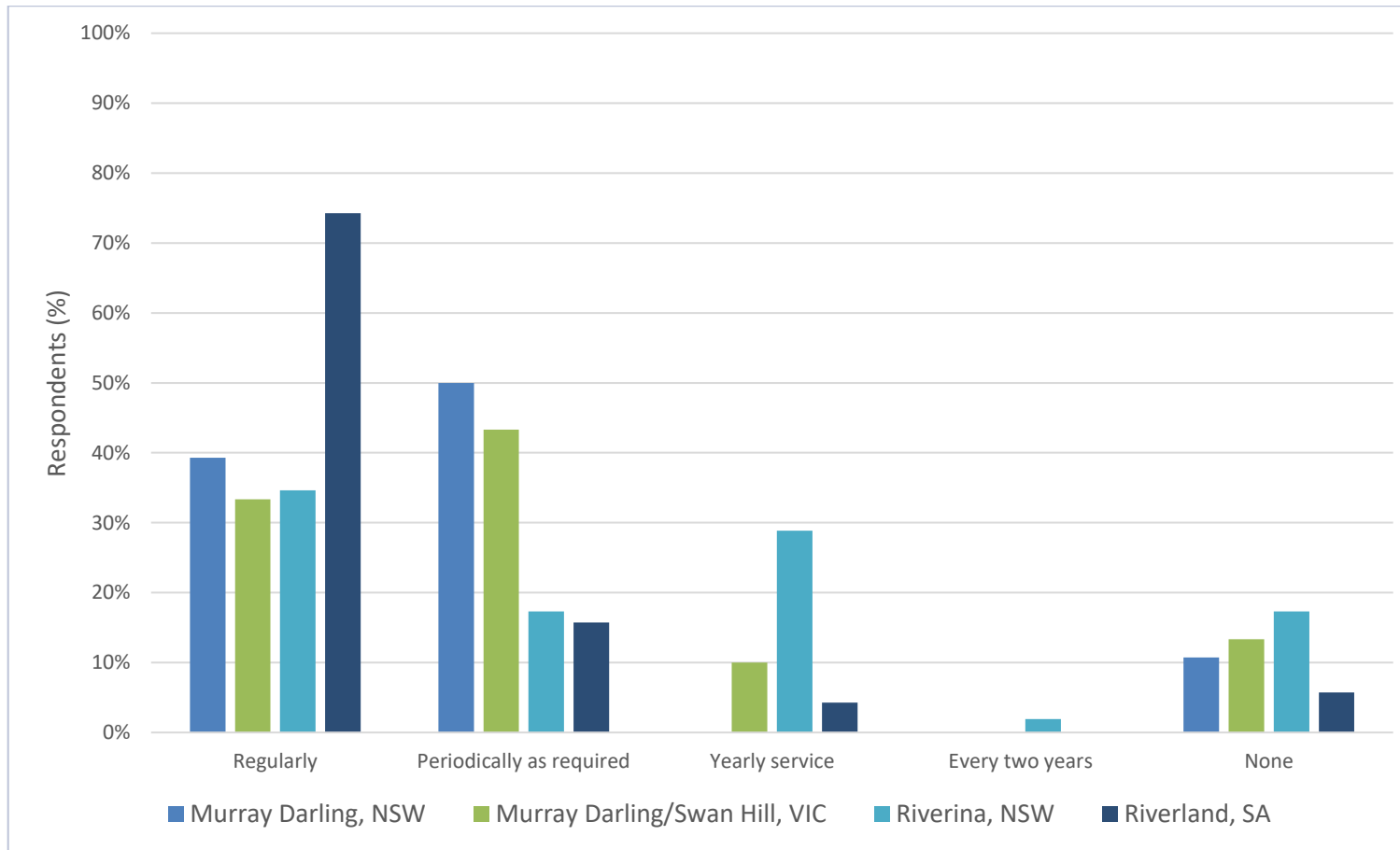
75% of Riverina respondents inject their irrigation system with chlorine and/or hydrogen peroxide at least once a year, compared to 61% of Murray Darling NSW respondents, 53% of Murray Darling VIC/Swan Hill respondents and only 45% of Riverland respondents.

54% of Riverland respondents never inject their irrigation system with chlorine or hydrogen peroxide, compared to 40% of Murray Darling VIC/Swan Hill respondents, 32% of Murray Darling NSW respondents and 23% of Riverina respondents.



The majority of respondents in all regions never inject their irrigation system with acid.

Figure 52. Proportion of respondents in each region that inject their irrigation system with acid at the different frequencies



94% of Riverland respondents clean their filters at least once a year, compared to 89% of Murray Darling NSW respondents, 87% of Murray Darling VIC/Swan Hill respondents, and 81% of Riverina respondents.

11% of all respondents never clean their filters.

Figure 53. Proportion of respondents in each region that clean their filters at the different frequencies

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