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Benchmarking Australian Sheep Parasite Control

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Executive Summary

Background. Australian Wool Innovation (AWI) commissioned this third Benchmarking Australian Sheep Parasite survey to benchmark the 2018 sheep parasite control practices of Australian woolgrowers. The results of this survey will provide industry with information to address the parasite control needs of sheep. For the first time, this survey will compare the parasite control practices of wool sheep with meat sheep and cross-bred sheep. Documenting current parasite practices will highlight the effectiveness of extension networks and identify where more attention is required. By comparing the results of this survey with two previous surveys, we can measure change in attitudes to parasite control which will inform extension work.

The two previous surveys were conducted in 2004 and 2012 which surveyed the years 2003 and 2011, respectively. Both surveyed only sheep producers who managed 500 sheep or more. The 2004 survey was conducted through the IPM-Sheep project, funded by AWI and comprised 30 questions. It was the largest survey of its kind in Australia with 1365 responses to the main questionnaire and 958 to the short survey. In 2012 a follow up survey was commissioned by AWI and MLA from which 575 usable responses were achieved for the main survey and 444 for the short survey.

Methods. For the first time the Benchmarking Australian Sheep Parasite survey was conducted online with paper copies available upon request. An invitation to participate in the survey with a link to the online questionnaire was sent to the AWI email list of approximately 6460 wool producers, with only those who managed 100 sheep or more asked to proceed with the survey. The survey was available online for 10 weeks launching on the 5th February 2019 and closing on 16th April 2019. Three reminder emails were sent out to wool growers on weeks 4, 6 and 8. A short five question survey was emailed to the same email cohort at the end of the survey period to evaluate non-response bias in the responses to the full questionnaire. The majority of the survey questions related to the calendar year 2018.

Summary of findings. The survey involved a total of 6460 initial emails to wool producers who had registered their email accounts with AWI. A total of 354 responses were obtained for the main survey with a further 250 responses for the short survey. Not all questions were attempted by all respondents, the number of respondents per question is presented with the data. The survey response rate for the main survey was lower than the previous two surveys which received 1365 responses in 2004 and 575 in 2011. Survey fatigue, the length of the questionnaire, severe drought in a large part of the country and presentation of the questionnaire as an online survey were all possible contributors to the low response rate. The surveys will be referred to by the calendar year referred to in the respective survey questionnaires: 2003, 2011 and 2018.

Farmer and enterprise details

1. The mean age of respondents was 57 years with a range of 27 to 92 years. This is higher than 2003 (51 years) and similar to 2011 (56 years). Most respondents were owners (93%).
2. Mean reported rainfall in 2018 was 407mm which was 27% lower than the mean average annual rainfall for the surveyed properties (557mm). Mean reported rainfall in 2018 was also lower than 2003 (610mm) and 2011 (650mm), although respondents targeted in the two earlier surveys were in higher rainfall areas.
3. Mean property area in 2018 was 2733 ha which was slightly higher than 2003 (2263 ha) and 2011 (2174 ha).
4. The highest proportion of enterprise income came from wool (41%) followed by sheep meat (27.6%). When combined the proportion of enterprise income from sheep and wool in 2018 was 69.3%. This is similar to proportions of income from sheep and wool in 2003 (68%) and 2011 (67%). Proportion of income from cropping was 13.2%, a little lower than 2003 (17%) and 2011 (18%). Again, there was a wide variation between regions for cropping as a proportion of income with the highest (36.9%) in SA Peninsula and the lowest in Northern NSW/Qld (5.7% $P<0.0001$).
5. The proportion of land use for improved pastures was 38.8% which is much lower than reported in 2003 (67%) and 2011 (69%).

6. The mean proportion of respondents grazing cattle was 34.5% in 2018 with only 15.8% of respondents saying they typically ran cattle which is significantly lower than the proportions who typically ran cattle in 2003 (47%) and 2011 (53%).
7. Mean sheep DSEs (Dry Sheep Equivalent) were marginally higher in 2018 (4971) than 2003 (4753) and 2011 (4454) with no significant difference in DSEs run per Region.
8. Flock composition differed between the three surveys with mean proportion of ewes being 56% in 2018, 65% in 2011 and 53% in 2003.
9. 62% of respondents selected Merino x Merino as their Chosen enterprise, with the next highest proportion being Meat x Meat (21%). Most enterprises were commercial (88%) with small numbers of stud enterprises (5%) and both (8%).

Internal parasites -Worms

10. The top three techniques and treatments used for worm control were planned preventative treatments (74%), preparing clean pastures by spelling paddocks (61%) and treat on faecal worm egg count (54%). The least popular were FAMACHA® (1%) and Barbervax® (2%). There were significant differences between Regions but not Chosen enterprise.
11. The proportion of respondents using faecal worm egg count monitoring (WEC) was 40.4%, higher than 2011 (ewes 21%, weaners 17%) and lower than 2003 (44%). This question was worded differently in 2003 to 2011, but the wording was similar for 2018 and 2011. In 2018, Tasmania reported the highest use of WEC (69.2%) with SA Peninsula the lowest (15%).
12. The mean number of WEC monitors was 3.1/year for all classes of stock and was similar across all classes (ewes 3.1, lambs and weaners 3.1). This is higher than reported for 2011 (ewes 2.86 and weaners 1.97) and similar to 2003 for ewes (ewes 2.6, weaners 3.0). The proportion of respondents requesting a larval identification with WEC was 17.3% with some differences between Regions (Central NSW 25.6%, Northern NSW/Qld 22.6%, SA Peninsula 5.0% and 4.7% in Western Australia).
13. In 2018, 65.8% of respondents treated sheep with anthelmintics with no differences between Region or Chosen enterprise.
14. Mean annual frequency of anthelmintic worm treatments was 2.1/year for adult ewes and lambs and weaners. This is similar to the treatment rate reported in 2003 (ewes 2.1 and weaners 2.2) and lower than 2011 (ewes 2.8, weaners 2.7).
15. The most common method of anthelmintic delivery was oral (84.6%) followed by injectable (12.4%) and capsule (3%).
16. The anthelmintic used most frequently was Abamectin (23.6%) followed by Levamisole (17.4%) and Moxidectin (12.5%). These three actives were also the top three actives used in 2011 (Abamectin 14.4%), Levamisole 21.9% and Moxidectin 15.4%).
17. The mean number of anthelmintic actives used in a treatment event was 1.8. The majority of anthelmintic treatments involved a single active constituent (55.4%), then triple combinations (21.5%), 2 actives (18.8%), 4 actives (3.9%) and 5 actives (0.4%). The proportion of respondents using single and 2 actives were lower than in 2011 (57% and 23%, respectively), but the use of 3 actives has increased slightly from 2011 (19.1%). Use of 4 actives has also increased from 0.4% in 2011 to 3.9% in 2018.
18. The anthelmintic actives predominantly used alone include Ivermectin (92.9% used alone), Moxidectin LA (91.3% used alone), Monepantel (80.5% used alone), and Moxidectin (74.7% used alone) this is similar to 2011.
19. The proportion of respondents who conducted any form of drench resistance test over 5 years was 36.7%, this is slightly higher than 29% reported in 2011. In any given year only 15.7% conducted a drench resistance test (Drench Test WECRT 4.0%, Drench Check 7.7% and WEC after drench 4.0%).
20. Most drench resistance tests were carried out with assistance by a Vet or consultant (41.8%) which is higher than 2011 (36%), followed by Private laboratory (20.3%) which is lower than 2011 (38%). There were large differences between regions with only 15.4% Central NSW using Vet or consultant whilst Wimmera Murray

Mallee (56.5%), Western Australia (52.9%), Tasmania (50%) and East Victoria (50%) all favoured this method of assistance.

21. The importance of factors in deciding to drench ewes in 2018 by rank out of 4 in declining order was; Planned preventative treatment (3.3), Results from WEC (3.2) Seasonal weather conditions (3.1), Time of year (3.1), Results from WEC and larval culture (2.8), Condition score (2.8), Poor exercise tolerance (2.8), Availability/quality of pasture (2.7), Daggy sheep (2.4) and Convenience (2.0). This is slightly different from 2011 where Time of year was most important followed by Seasonal weather conditions, Results from WEC.
22. There were very few differences between chosen enterprises for worm control except that Merino x Merino enterprises were significantly more likely to use 4 anthelmintic actives in combination.

Internal parasites - Liver fluke

23. Only 14.4% of respondents had tested or treated for Liver fluke in the last 5 years (2014-2018) with large differences between Regions. In declining order Central NSW (22.2%), East Victoria (21.4%), Northern NSW/Qld (20.4), Tasmania (18.2%), Wimmera Mallee Murray (6.8%), SA Peninsula (6.3%) and Western Australia (4.4%). Only those who answered 'Yes' to testing or treating Liver fluke in the last 5 years answered further questions on Liver fluke.
24. Further questions on Liver fluke showed 20.4% respondents (*n*=39) had positive Liver fluke tests, 33.1% had negative Liver fluke test and 46.5% did not test.
25. In an average year 47.3% treated for Liver fluke, whilst 55.6% had treated for Liver fluke during the past 5 years.
26. The mean annual number of Liver fluke treatments was 2.0. Most treatments for Liver fluke were given in May (22%) followed by July (15%) and August (13%). Triclabendazole used singly was the most common Liver fluke treatment (40.3%) followed by Closantel (21.0%) and Oxfendazole in combination with Triclabendazole (16.1%).
27. The most important factor when deciding to treat for Liver fluke, given a rank out of 4, was Results from a Liver fluke test (3.4), Time of year/strategic treatments (3.3) followed by Appearance of sheep (3.0), Seasonal weather conditions (3.0) and After grazing 'flukey' paddocks (2.7).

Blowfly control

28. Nationally 48.6% of respondents reported flystrike in their flock in 2018, the highest being Western Australia (54.7%) then Tasmania (53.9%), Central NSW (50.6%). This is lower than reported in 2011 (78%) and 2003 (87%) most likely due to drought conditions across much of Australia in 2018. The proportion reporting breech strike in adult ewes was 37% and body strike in adult ewes was 14.4% (2011 survey reported 78% breech strike in ewes and 68% body strike in ewes).
29. The incidence of flystrike in sheep across all types of strike and classes was 2.4% with the highest reported incidence in Central NSW (3.4%), Tasmania (3.3%) and Northern NSW/Qld (3.0%). The lowest reported incidence was in Western Australia (1.9%). The incidence of breech strike in ewes was 2.7% in 2018, lower than 2011 (4.1%) but similar to 2003 (2.3%). The incidence of body strike in ewes (2.1%) in 2018 was again lower than 2011 (5.5%) and higher than 2003 (1.0%). Poll strike had the highest incidence (7.3%) but was only reported in adult wethers and rams as was Pizzle strike (incidence was 2.8%).
30. There was a significant difference between chosen enterprises for incidence of flystrike over all types of flystrike with Merino wether enterprises having the highest reported incidence, significantly higher than Merino x Merino breeding enterprises.
31. The most popular methods used to assist with blowfly strike in descending order were: Timing of crutching (76.4%), Preventative chemical treatment (75.9%), Timing of shearing (63.1%), Mulesing sheep (46.8%), Genetic selection (46.4%), Destroy maggots (26.2%), Buying mulesed sheep (23.6%) and Fly traps (5.1%). Central NSW had a significantly greater use of genetic selection (62.1%). Merino x Merino enterprises were significantly more likely to use Mulesing (69.2%) and genetic selection (57.5%) but significantly less likely to buy mulesed sheep (15.8%). Merino x Other were less likely to mules (12.5%) and more likely to buy mulesed sheep (70.8%). Meat x Meat were significantly less likely to mules (8.5%) or use genetic selection (25.5%).

32. The most important of these methods (given a rank out of 3) was Mulesing sheep (2.8) followed by Preventative chemical treatment (2.6) and Timing of crutching (2.6). The use of preventative chemical treatment was greater in 2018 than in 2011 (46%) and 2003 (43%), comparisons may be affected by there being only 4 options in the 2011 survey.
33. The greatest change in use of methods to assist with blowfly strike was an increase in use of Genetic selection, 30.3% of respondents said they used Genetic selection more now compared with 5 years ago, 18.2% said they used Preventative chemical treatment more now and 16.1% said they used Fly traps less now, also a significant proportion of Meat x Meat producers indicated they used mulesing less now (25%).
34. There was an even spread over all months for shearing and crutching with no significant difference between months within Region or Chosen enterprise.
35. The proportion of respondents who mulesed in 2018 was 46.8%, slightly lower than that reported in 2011 (48% replacement ewes) and lower than 2003 where 91.8% mulesed.
36. For those who mulesed, the proportion of the flock mulesed in 2018 was 92.4% on average with the highest proportion mulesed in Western Australia (97.9%) and the lowest in Northern NSW/Qld (78.8%). Mean age at mulesing was 2.2 months over all Regions and classes, Northern NSW/Qld mulesed at an average of 3.3 months and Western Australia at 1.6 months. A lower proportion of flocks of Meat x Meat sheep were mulesed (77.5%) compared to Merino x Other (100%) and Merino x Merino (92.7%). Overall respondents reported a reduction in the proportion of sheep mulesed (-2.5%) in recent years with the largest reduction occurring in Northern NSW/Qld (-21.1%) and very little change in the other Regions. Merino x Other showed the largest increase in proportion mulesed (11%) with Merino wethers showing the largest reduction (-6.7%).
37. Most respondents (58.8%) reported no change in area of skin removed with 40.3% reporting a reduction in amount of skin removed.
38. A large proportion of respondents who mulesed used pain relief in ewe lambs (86.6%) with most using TriSolfen®, some using Buccalgesic® and TriSolfen® (3.4%), only 0.8% used Buccalgesic® on its own and 0% used Metacam®. Pain relief in wether lambs was similar to ewes with 90.9% using pain relief, 86.4% using TriSolfen® singly and 4.5% used TriSolfen® with Buccalgesic®. Merino x Merino was the only enterprise to use the combination of TriSolfen® and Buccalgesic®, all other enterprises used TriSolfen® alone (82.4%) if they used pain relief.
39. Overall, 54.2% of producers who mulesed left some wool on the tail for ewe lambs and 56.6% in wether lambs. There was a significant effect of Region in wethers with only 23.5% Western Australian respondents leaving wool on the tail compared to Northern NSW/Qld (88.9%).
40. The most popular treatment or prevention of flystrike was 'Only treat individually struck sheep' (67.9%) followed by Preventative treatment at the same time each year (66.3%), Preventative treatment only when risk is high (44.6%), Treat whole mob once flystrike is detected (22.2%) and Treat when unable to check sheep (18%). The month with the highest Flystrike treatments was November (24.6%) followed by October (17.3%), December (13.5%), January (12.3%) and September (11.9%).
41. The most popular active ingredient used to treat Flystrike was Dicyclanil (40%) followed by Cyromazine (24%) then Ivermectin (12%) and Spinosad (12%). The most popular active ingredients used was the same as 2011 with a slight reduction in proportion of respondents using them (Dicyclanil 54%, Cyromazine 36% and Ivermectin 14%). Backliner/Spray on was the most common method of application of Flystrike treatment (47%), followed by Wound dressing (20%) and Hand jet (19%), Cage dip was the least used method of application (1%).
42. Nationally, 4.9% of respondents suspect resistance to flystrike product, the product with the highest suspected resistance was Diazinon (50%) followed by Dicyclanil (25%) and Cyromazine, Ivermectin and Propetamphos all 8.3%.
43. Of respondents who answered questions on Blowfly Control around half used visual traits to breed for ewes (55.5%) and rams (43.7%) that are less susceptible to flystrike. The most common Visual traits used in ewes to breed for sheep less susceptible to flystrike were Cull sheep with body strike (29.1%), Cull sheep with fleece rot (27.5%), Breech wrinkle (22.1%), Wool colour (20.0%), Cull sheep with breech strike (20.0%), Dag

score (14.6%), Urine stain (12.1%) and Breech cover (12.1%). There were large differences between Regions and Chosen enterprises for Visual traits used.

44. Of respondents who answered questions on Blowfly Control 17.3% used ASBV traits for ram selection to breed for sheep that are less susceptible to flystrike, respectively. The most common ASBV trait used in Rams to breed for sheep less susceptible to flystrike was Breech Wrinkle (63.6%), Worm egg count (52.3), Breech Cover (36.4%), Scouring and Dags (36.4%) and Co-efficient of variation of Fibre Diameter (36.4%). There was a significant difference in use of Breech Wrinkle for both Region and Chosen enterprise with Wimmera Mallee Murray having a much lower use (33.3%) than all the other Regions (71.4-100%) and Meat x Meat (16.7%) lower than Merino x Merino (75.8%) and Merino Other (66.7%).

Lice control

45. In an average year 69.5% reported no lice seen, 16.5% reported sheep seen rubbing, 13.9% report live lice seen and 0.1% report ELISA detection of lice, which equates to 30.5% reporting evidence of lice in an average year. Just over half of respondents reported evidence of lice in at least one year over 5 years (55.8%) with the mean number of years that evidence of lice was reported being 1 year out of 5 years.
46. In an average year between 2014 and 2018 26.7% gave no lice treatment, 50.1% treated off shears, 16.6% treated on short wool and 6.6% treated on long wool. Over the 5 years, most respondents treated for lice at least once (87.5%). The mean number of years respondents treated for lice was 2.9 out of 5 years.
47. The most common method of application off shears/short wool was Backliner/Spray on (74.3%) with the other methods used less frequently; Plunge dip (9.3%), Cage dip (7.9%), Shower dip (7.0%), Hand Jet (1.4%) and Electrodip (1.4%). For Off-shears or short wool Central NSW sheep producers were more likely to use a contractor (41.7%) than other Regions (East Victoria 18.2%, Western Australia 18.2%, Wimmera Mallee Murray 15.4%, Northern NSW/Qld 6.3%, SA Peninsula 0%, Tasmania 0%).
48. For Off-shears or short wool the active ingredient most used was Imidacloprid (38.7%), then Spinosad (17.7%) and Thiacloprid (10.5%).
49. Backliner was also the most used method of application on Long wool (60.0%) with Hand jet, Plunge dip, Cage dip and electrodip all equally used (8.36%). The active ingredient most used for Long wool treatments was Spinosad (58.3%) followed by Ivermectin (25%).
50. Only 8.4% of respondents suspected resistance to lice treatment products which is lower compared with 2011 (26%). Insect growth regulators had the highest suspected resistance (50%) followed by Synthetic pyrethroids (28.6%), Organophosphates (15.5%) and Neonicotinoids (6.0%).
51. Biosecurity was the most important reported cause of reinfestation with lice with introduction of lice through fences or from purchased sheep the biggest perceived cause when ranked out of 4 (3.8). Incomplete mustering (3.4) and whole flock not treated at same time/multiple flock treatments (3.4) the next major cause of reinfestation followed by Partial flock treatment (3.0), Problems with application (2.9) and Resistance to lice products (2.8).

General parasite management

52. 57% of respondents introduced sheep into their flocks in 2018 exactly the same figure as in 2011. Fewer sheep, as a proportion of the total flock size, were introduced in 2018 (8.8%) compared with 2011 (15%) with major effects of Region and Chosen enterprise. Merino wethers and Merino x Other had significantly higher proportion of sheep introduced to the flock (29.5% and 17.3%, respectively).
53. The most common management action for introduced sheep was 'Isolated sheep for at least 2 weeks' (81.9%), followed by 'Requested an animal health history' (64.6%) and 'Applied quarantine drench for worms' (60.6%). Only 20.5% applied a quarantine lice treatment. There was a similar proportion of respondents treating introduced sheep for internal parasites in 2011 (67%) and a reduction in treatment for external parasites (50% in 2011). However, quarantining or isolating sheep increased substantially from 23% in 2011 to 82% in 2018. The list of management options for this question was slightly different in 2018 and 2011.

54. Other farmer or member of my staff was ranked (out of 4) the highest for importance of sources of information (2.7), WormBoss ranked second (2.6) with a significant Regional difference. East Victoria (3.1) and Tasmania (3.2) ranked WormBoss higher than those in Central NSW (2.4).
55. When making specific parasite control decisions for worms respondents ranked Self (3.0) as most important (out of 3) followed by WormBoss Drench Decision Guide (2.1) and other staff on farm (2.1). For Flies and Lice, Self (3.0) and Other staff on farm (2.1) and Manager (2.0) were most important.
56. Faecal worm egg counts were regarded as the most important change to their management for worm control in the last 5 years (22.5%), rotate drenches (7.5%) and genetic selection (6.3%) where the next popular. The most important change for flystrike control was breeding for genetic resistance (21.1%) followed by Preventative chemical treatment (7%) and Cease mulesing (5.3%). For Lice, the most important change was to Rotate actives (20.6%) then Maintain Boundary fences (14.7%) followed by Biosecurity (4%). This question had a low response rate worms *n*=80, flies *n*=57, lice *n*=68.
57. When asked about the usefulness of the WormBoss website, 27.6% used the site to make changes, 35.6% respondents actually visited the site (equating to 63.2% of respondents visiting WormBoss), 23.6% have only heard of it and 13.3% have never heard of it. Meat x Meat producers were significantly more likely to use WormBoss website to make changes (42.9%) whilst many Wool x Other producers had never heard of it (38.5%) or only heard of it (26.9%).
58. For FlyBoss, 17.7% of respondents had used the site to make changes, 40.9% had actually visited the FlyBoss website, 25.9% had only heard of it, and 15.5% had never heard of it. A total of 58.6% had visited the FlyBoss website.
59. LiceBoss website had 19.7% used site to make changes, 37.6% actually visit the site, 26.1% only heard of it, and 16.5% have never heard of it. A total of 57.3% having visited the LiceBoss website.
60. Only 11.6% used the AWI site to make changes, respondents mostly visited the AWI website (59.3%).
61. Respondents mostly estimated the dollar value of the changes they had made using the ParaBoss websites to be between $1000-5000 (43.3%), 29.9% estimated between $0-1000, 17.9% between $5000-10,000 and 9.0% more than $10,000. There was a significantly higher than expected estimation of the dollar value of changes in Northern NSW/Qld with 28.6% selecting more than $10,000.
62. The respondent's preferred method of delivery of information on parasite control was Face to Face workshops (53.3%) followed by websites (23.4%). The area for further information or research that was most popular was Breeding resistant animals, a quicker way to do worm monitoring, accountability for producers not controlling lice, race side test for WEC, more research for lice in long wool sheep, having a social license to produce animal products and WEC training.

1. Introduction

Australian Wool Innovation (AWI) commissioned this third Benchmarking Australian Sheep Parasite Control survey to benchmark the sheep parasite control practices of Australian Wool producers. Collectively, sheep parasites cost the Australian sheep industry an estimated $715 million in lost productivity, prevention and treatment costs (Figure 1, Lane *et al.* 2015). Australian sheep producers continue to find ways to manage parasites amidst concerns about the development of parasite resistance to chemical actives (James *et al.* 2008; Playford *et al.* 2014; Heath and Levot 2015), wool residues (Savage 1998), occupational health and safety, animal welfare and environmental contamination (Zhang *et al.* 2018). Producer surveys allow industry to measure change in parasite incidence and control and provide a benchmark against which producers can measure their parasite incidence and control practices. Recent surveys of Australian sheep producers collected limited data on parasitology as part of broader sheep production and husbandry surveys (Jones *et al.* 2014; Sloane 2018). The Benchmarking Australian Sheep Parasite Control Practices Survey was commissioned by Australian Wool Innovation Ltd. (AWI) and is the third in a series of surveys specifically targeting the parasite control practices of sheep producers. The previous two parasite control surveys were conducted in 2004 (surveying the year 2003) and 2012 (surveying the year 2011) and formed part of the Integrated Parasite Management – sheep (IPM-s) project (Reeve and Thompson 2005; Walkden-Brown *et al.* 2006; Kahn and Woodgate 2012; Reeve and Walkden-Brown 2014). Some of the question structure of the previous surveys was maintained to enable measurement of changes in parasite control practices. This survey was the first in the series of three to move from mail out format to an online platform. Survey fatigue is a major concern with an increasing number of surveys delivered to the inbox of sheep producers, this, coupled with ongoing drought during 2018 and 2019, were expected to potentially lower the response rate to the current survey. For the first time, this survey compared the parasite control practices of wool sheep with meat sheep and cross-bred sheep.

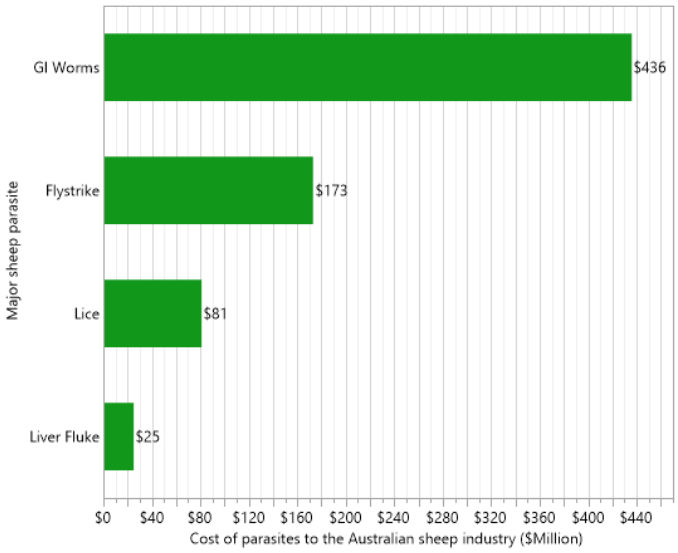


Figure 1: Annual costs of parasites to the Australian sheep industry (from data presented in Lane *et al.* 2015).

2. Project Objectives

- Documenting wool growers' current parasite control practices and attitudes.
- Measuring change in producer control practices and attitudes since the two previous surveys were done (2003 and 2011).
- Providing a benchmark against which to measure future parasite control practices and attitudes.
- Promoting the findings to scientific, advisory and producer sectors.

3. Success in Achieving Objectives

All the objectives of the project were achieved and for the first time we were able to measure differences between wool and meat producers' parasite incidence and control. The survey response was lower than in the two previous Benchmarking Australian sheep parasite control surveys with an exponential fall in response rate from the first survey conducted in 2004 (2004, n=1365; 2012, n=575; 2019, n=354). However, the results of the short survey

measuring non-response bias (n=250) lends support to the results being a good representation of Australian wool growers' parasite control practices. Comparison with the 2003 and 2011 survey results also strengthens this assumption with a large number of similarities in results between the surveys. Wool growers can compare their parasite incidence and control practices with those in their region and across Australia. The findings have already been widely reported in industry publications and have been accepted for publication in a scientific journal paper.

4. Methodology

Survey

The 2019 Australian Sheep Parasite Survey was largely based on the questionnaires used in previous parasite control benchmarking surveys, and was designed with input from an industry steering committee. Approval for the survey was given by the University of New England Human Ethics Committee (approval number HE18-286). The survey was arranged into five sections; Property and Operation Details, Internal Parasites - Worms and Liver fluke, Blowfly Control, Lice Control and General Parasite Management (Appendix 2). Information gathered in the Property and Operation details included location, rainfall, property size, % income on farm, land use, cattle numbers and sheep numbers, class, type (meat or wool) and breeds. The classes of sheep for the survey were defined as in Table 1. In order to potentially measure differences in parasite control practices between meat producers and wool producers, participants were asked to select a sheep enterprise that they would then refer to for their answers for the three sections of the survey on worms and liver fluke, flystrike and lice. The selection of enterprises were a) merino ewes joined to merino rams (Merino x Merino), b) merino wethers (Merino wethers) c) merino ewes joined to other (e.g. meat) rams (Merino x Other), d) meat ewes joined to meat rams (Meat x Meat), and e) other enterprises (e.g. feedlotting), please specify (Other enterprise). These will be referred to in the results as Chosen Enterprise (CE). Respondent post code was used to allocate responses to the Meat and Livestock Australia (MLA) Reporting Regions using corresponding post codes for the MLA Reporting Regions provided by MLA. These regions will be referred to throughout the report as "Region". The MLA Regions encompassed within the MLA Reporting Region are presented in Table 2.

Table 1: Definition of sheep class categories for responses to the 2018 survey.

Sheep class name	Sheep class definition
Adult ewes	Ewes greater than 2 years
Maiden ewes	Ewes from joining to weaning, 1 to 2 years
Lambs	Up to 12 months
Unmated hoggets/Yearlings	Unmated 2 tooth, 1 to 2 years
Adult wethers	Greater than 2 years
Rams	Greater than 2 years

The survey was built using the online survey platform SurveyGizmo and consisted of a maximum of 45 questions. Only sheep producers with 100 sheep or more were asked to complete the survey. Logic was used to minimise the number of questions for respondents. This allowed the survey to be less onerous to those not needing to answer certain questions. There was a mix of closed and open questions to allow respondents to specify the differences in their operations. The survey could be accessed in three ways, via a link that was emailed with an invitation to participate to approximately 6500 sheep producers whose emails were registered with AWI, via a link on the websites wool.com, paraboss.com.au, wormboss.com.au, liceboss.com.au and flyboss.com.au or via a paper copy with reply paid return envelope mailed to participants on request. The survey was available online for 10 weeks from 5 February 2019 to 16 April 2019 (Table 3). A short five question survey was emailed to the same email cohort at the end of the survey period to evaluate non-response bias in the responses to the main survey (Appendix 3).

A total of 354 usable responses were obtained for the main survey with a further 250 usable responses for the short survey (Table 4). Not all questions were attempted by all respondents hence the number of respondents per question will be presented with the data, a table of respondents per question is also included (Appendix 1). The survey response rate for the main survey was lower than the previous two surveys which received 1365 responses in

2004 and 575 in 2012. Survey fatigue, the length of the questionnaire, severe drought in a large part of the country and presentation of the questionnaire as an online survey were all possible contributors to the low response rate.

Table 2: Meat and Livestock Australia (MLA) Regions included within MLA Reporting Region referred to as Region in this report.

MLA Reporting Region	MLA Regions
Central NSW	Central West Murray and Murrumbidgee South Eastern South Eastern Extra
East Victoria	Barwon and Central Highlands Barwon Central Highlands Extra Gippsland Loddon and Goulburn Ovens Murray
Northern NSW/Qld	Central Qld Central QLD Extra Hunter and Northern North Western Southern Qld Western Division
SA Peninsula	Eyre Yorke and North Eyre Yorke and North Extra
Tasmania	Tasmania
Western Australia	WA South Central Midlands Central Midlands Extra
Wimmera Mallee Murray	Western District Wimmera and Mallee South East Outer Adelaide Murray Lands

Table 3: Benchmarking Australian Sheep Parasite Control Survey Australian Wool Innovation email campaign performance.

Email Name	Date sent	Emails sent	Emails delivered	% Delivered	Bounced	Opened	% Opened	Clicked Email	% Clicked Email	Clicked to Opened Ratio	Accessed main survey*
Email 1	05/02/19	6724	6460	96.1%	264	2084	32.3%	153	2.4%	7.3%	127
Reminder 1	05/03/19	6684	6431	96.2%	253	1872	29.1%	101	1.6%	5.4%	70
Reminder 2	19/03/19	6670	6413	96.1%	257	1882	29.3%	151	2.4%	8.0%	106
Reminder 3	30/03/19	6322	6048	95.7%	274	1986	32.8%	153	2.5%	7.7%	118
Short survey	16/04/19	6657	6406	96.2%	251	2214	34.6%	331	5.2%	15.0%	
Total		**33057**	**31758**	**96.1%**	**1299**	**10038**	**31.6%**	**889**	**2.8%**	**8.9%**	**421**
Averages		**6611**	**6352**	**96.1%**	**260**	**2008**	**31.6%**	**178**	**2.8%**	**8.7%**	

* Accessed main survey from AWI email based on referrer identifier from SurveyGizmo data

Table 4: Number of respondents with usable survey responses for the main survey and short survey (Region can't be applied to short survey as post codes were not collected).

Region	Total	Main survey					Short survey			
		Complete		Partial-usable		Partial-Unusable (N)	Complete		Partial-unusable	
	N	N	% of Total	N	% of Total		N	% of Total	N	% of Total
Central NSW	83	54	15.3%	29	8.2%	-	-	-	-	-
East Vic	44	26	7.3%	18	5.1%	-	-	-	-	-
Northern NSW/Qld	62	40	11.3%	22	6.2%	-	-	-	-	-
SA Peninsula	20	13	3.7%	7	2.0%	-	-	-	-	-
Tasmania	13	10	2.8%	3	0.8%	-	-	-	-	-
Western Australia	53	35	9.9%	18	5.1%	-	-	-	-	-
Wimmera Mallee Murray	79	54	15.3%	25	7.0%	-	-	-	-	-
National	**354**	**232**	**65.6%**	**122**	**34.4%**	**179**	**250**	**100%**	**45**	**0%**

Statistical analysis

Data quality control was embedded into the online survey where possible, consistency checks were completed on questions regarding use of parasite control methods and importance ranking of the method. Data were analysed using the statistical package JMP15.0 (SAS Institute Inc, NC, USA). Continuous data that met the assumptions for normality were analysed using ANOVA with Tukey HSD post hoc tests. Where continuous data did not meet the assumption of normality a non-parametric Kruskal-Wallis test was used with Dunns all pairs for joint ranks pair-wise comparisons where a dichotomous response was apparent. The data for number of worm egg count monitors (WEC) per year was transformed using cubed root transformation and fitted with a Generalised Linear Model with Poisson distribution and Log link function. Chi-square tests were used on nominal data, where questions had a dichotomous response, and sample sizes permitted, analysis of means for proportions was used to identify particular Regions, or CE that were significantly different from the national proportions. Multiple response nominal data were analysed using multiple response by ID categorical analyses. Integer data indicating importance, effectiveness or usefulness of a parasite control technique were given a rank for analysis using Kruskal-Wallis tests for each technique and Dunns All pairs for joint ranks pair-wise comparisons to test differences between Regions or CE. Supplementary analyses of the 2011 survey data were carried out for the purposes of comparison with the current survey. Results from the short 5 question survey were compared to the main survey to measure non-response bias, there were very few differences between the two surveys. Of the 36 tests performed on the components of the questions only 3 were significantly different. Short survey respondents had a higher mean number of cattle (179 cattle) compared to the main survey respondents (83 cattle, $P<0.0001$). Main survey respondents were more likely than short survey respondents to use planned preventative treatment for flystrike (75.9% main survey, 67.2% short survey, $P=0.0035$) and less likely to destroy maggots (26.2% main survey, 34% short survey $P=0.0340$).

Interpretation of graphs and tables

Figure 1 below contains a mosaic plot representing the proportion of respondents who requested a worm species identification with their faecal worm egg count (WEC). In the mosaic plot, the proportion of respondents who requested the test are represented by the "Yes" at the bottom of the column for each Region, those who didn't are represented by the "No" proportion. The width of the columns in the mosaic plot represents the number of respondents in a Region as a proportion of the total number of respondents who answered that question. The wider the column the larger the number of respondents from that Region, conversely, narrow columns represent fewer respondents in a Region.

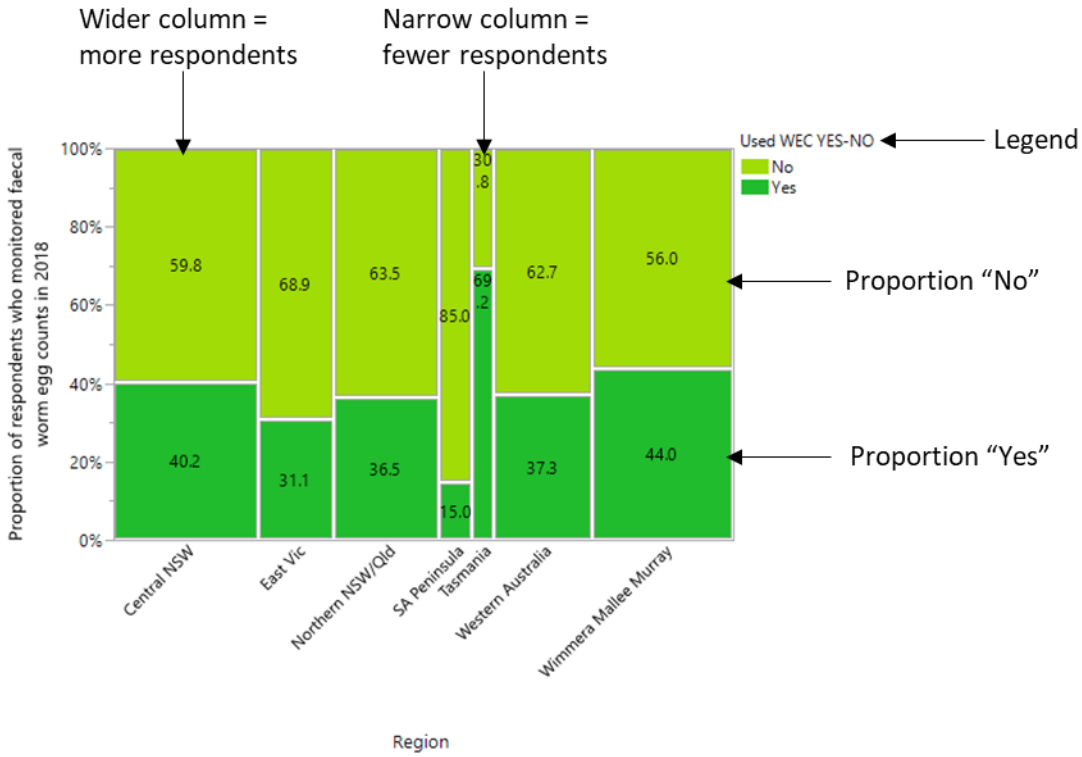


Figure 1: How to interpret a mosaic plot of proportions.

Figure 2 represents the analysis of means for proportions which shows the differences between Regions of those who used larval identification ("Yes") and whether the differences are significant. The horizontal line in the middle of the shaded area is the average (or mean) proportion who answered "Yes" (in this example it is also the National average as it is a mean of all Regions). There is an upper decision limit (UDL) and a lower decision limit (LDL) which indicates the decision limits in each Region. Regions with larger numbers of respondents will have a narrower range of UDL and LDL (shaded blue area), areas with fewer respondents have larger range between UDL and LDL. The vertical black lines ending in a dot indicate the Region mean distance from the overall mean, a red dot indicates the mean is significantly different from the overall mean, a green dot indicates the mean does not differ significantly from the overall mean. The α = 0.05 (bottom left) is a standard statistical measure of whether observed differences are large enough for us to conclude they also occur in the population from which the sample was drawn.

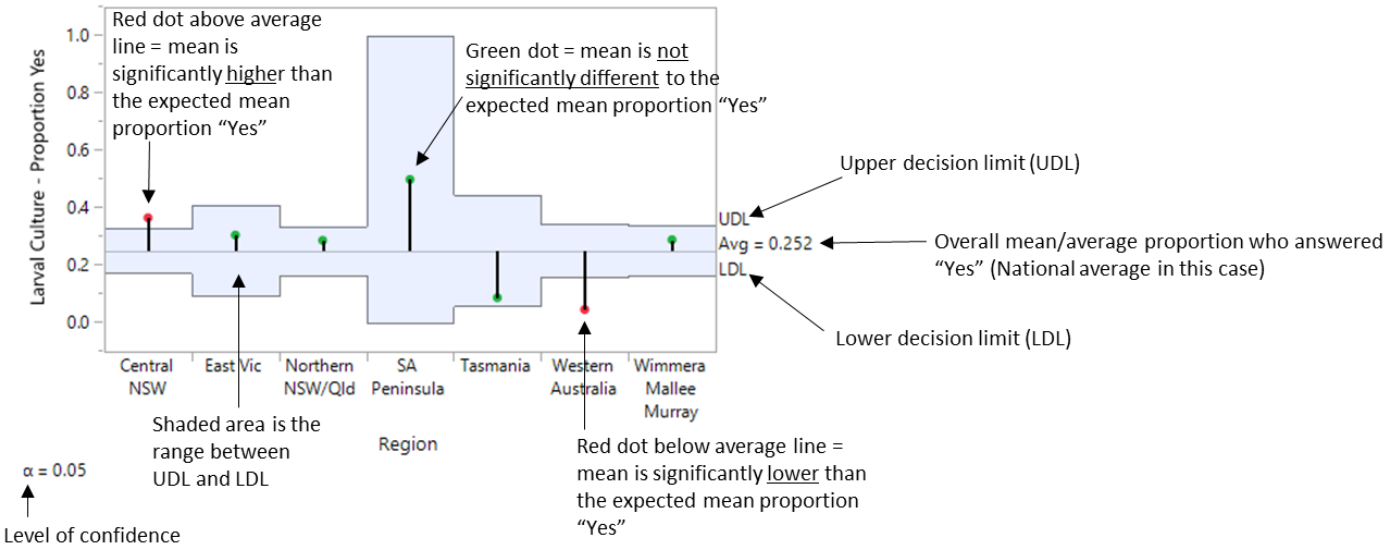


Figure 2: How to interpret an Analysis of Mean for Proportions graph which accompany the mosaic plots.

Figure 3 is a share chart and represents the share of responses to the question “Pain relief used around mulesing” by Region. Each row represents a Region, the amount of each colour in the row indicates the share of the total for that answer (e.g. dark green represents the share of respondents who selected “No” pain relief as a proportion of the total responses in each Region).

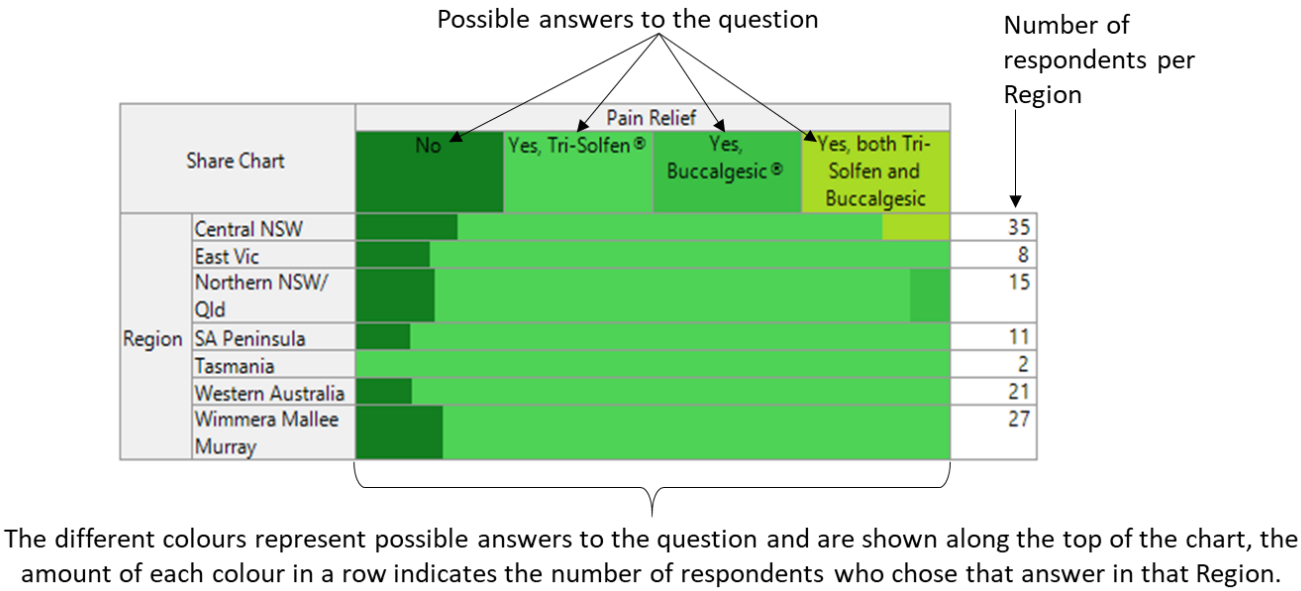


Figure 3: How to interpret a share chart.

5. Results

Q1 In which postcode is your reporting property located?

1.1 Location of respondents by MLA Reporting Region

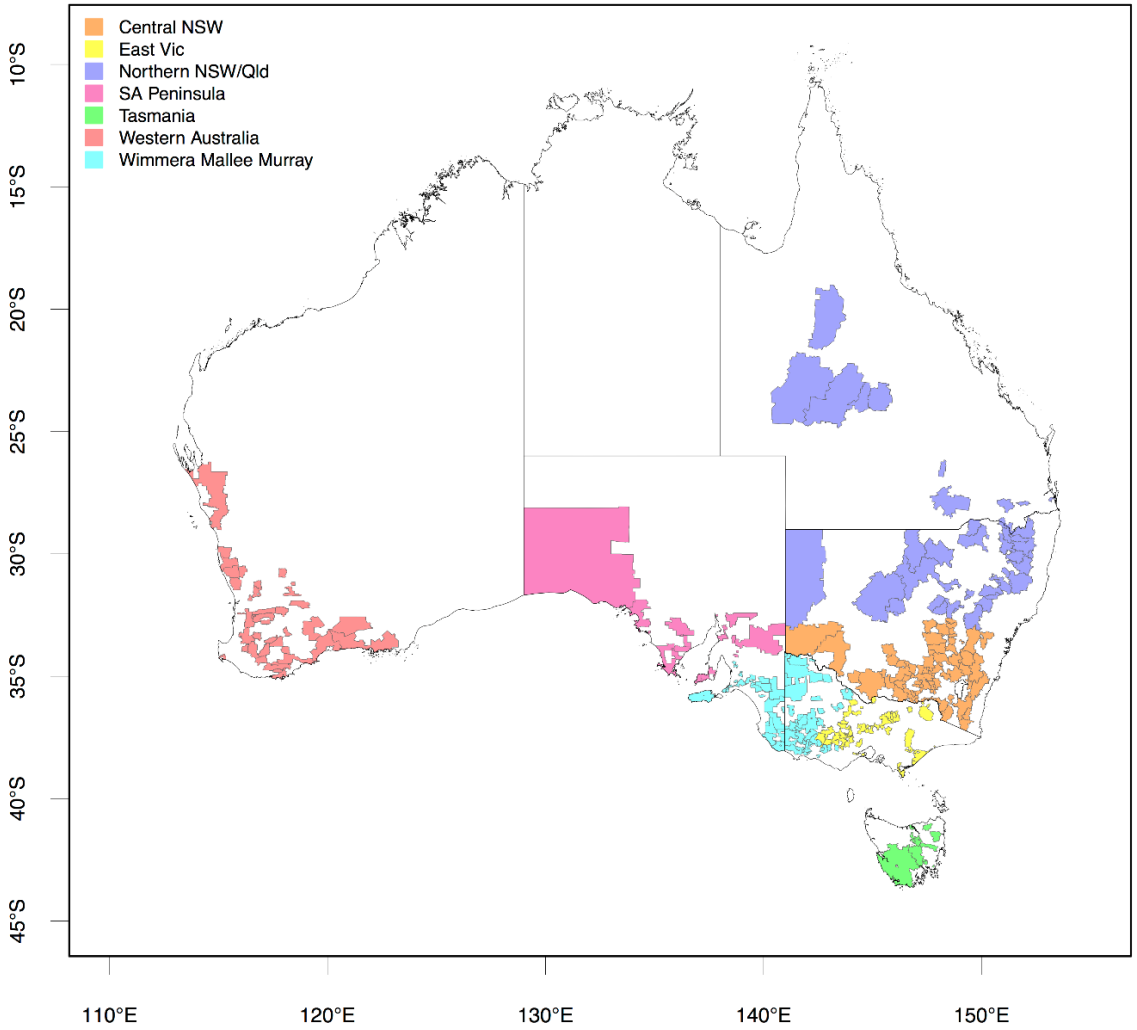


Figure 1-1: Location of survey respondents within MLA Reporting Region.

Q1 In which postcode is your reporting property located?

1.2 Number of respondents by location

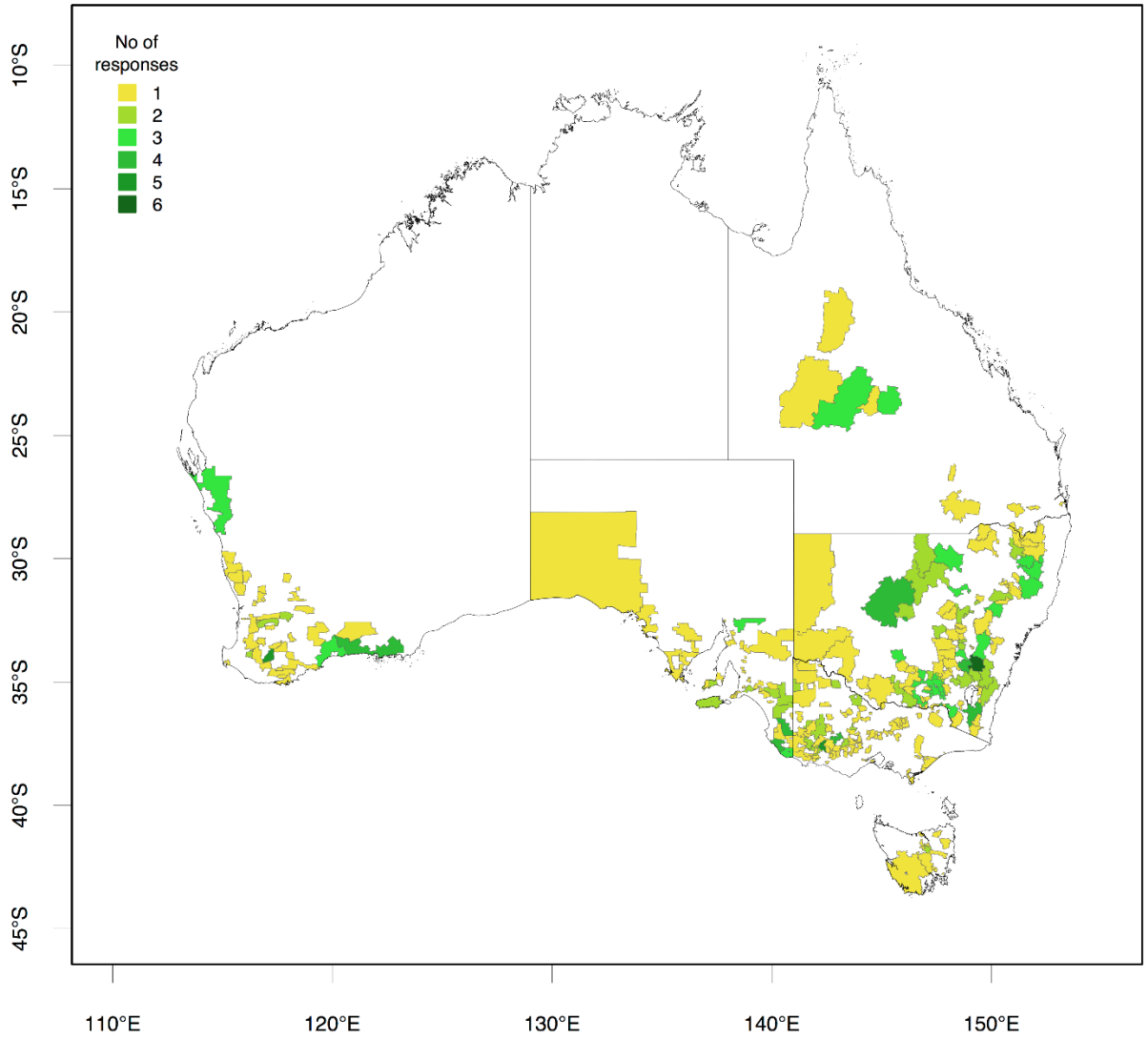


Figure 1-2: Number of respondents per postcode.

Q2 Please indicate your recorded rainfall for 2018 and the average annual rainfall for your reporting property:

Q2 Please indicate your recorded rainfall for 2018 and the average annual rainfall for your reporting property:

	Rainfall	Please select a unit	
		mm	inches
Rainfall in 2018		○	○
Average annual rainfall		○	○

2.1 Recorded rainfall for 2018 and Average annual rainfall

Table 2-1: Reported rainfall in 2018 and reported average annual rainfall (mm) by Region, total number respondents *n*=339.

	2018 Rainfall mm			Average rainfall mm		
Region	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
Central NSW	378	65	648	588	250	900
East Victoria	431	165	900	588	325	950
Northern NSW/Qld	350	30	960	593	152	1200
SA Peninsula	273	140	381	394	260	536
Tasmania	603	320	1140	652	500	1050
Western Australia	418	170	864	490	270	914
Wimmera Mallee Murray	464	102	850	548	250	900
National*	**407**	**30**	**1140**	**557**	**152**	**1200**

*National mean rainfall 2018 by national average rainfall ANOVA df=1, P<0.0001.

Mean reported rainfall in 2018 was lower than 2003 (610mm) and 2011 (650mm).

Q2 Please indicate your recorded rainfall for 2018 and the average annual rainfall for your reporting property:

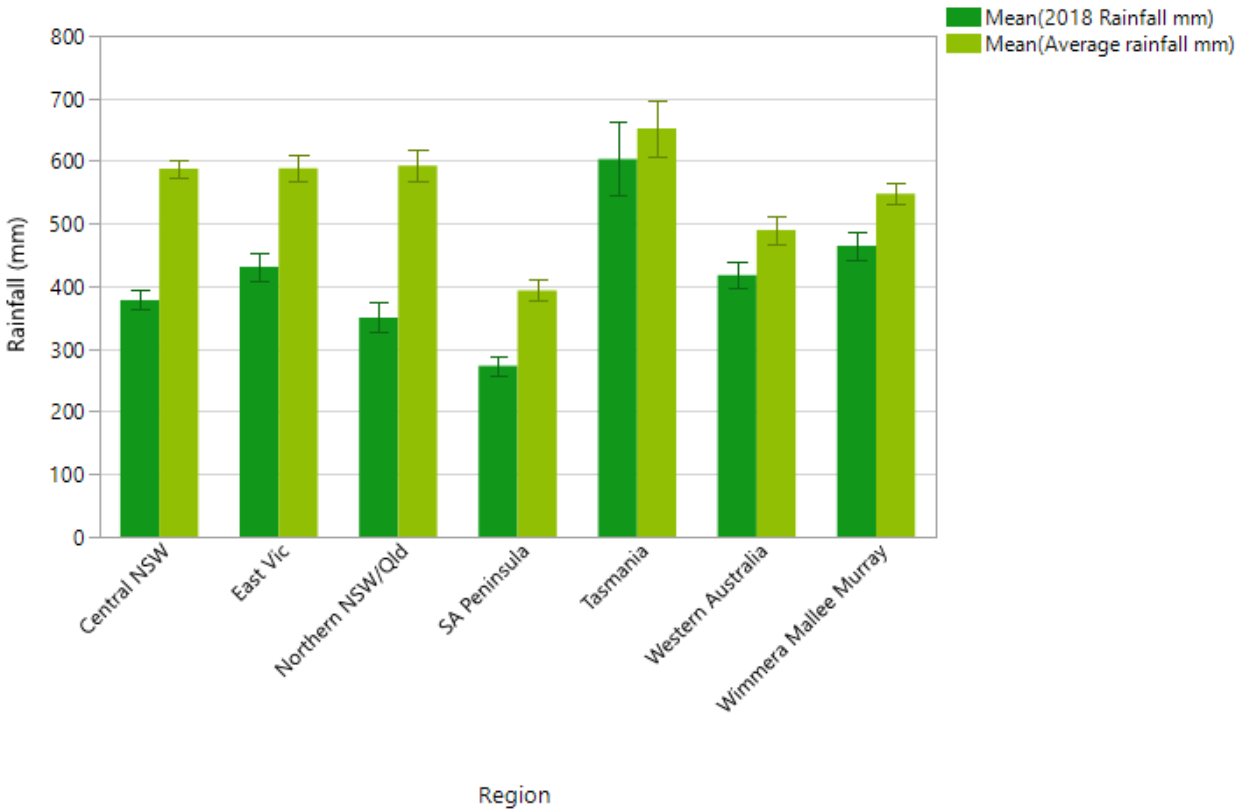


Figure 2-1: Mean rainfall recorded in 2018 (±SE) and the mean Average annual rainfall (±SE) by Region.

Q2 Please indicate your recorded rainfall for 2018 and the average annual rainfall for your reporting property:

2.2 Recorded rainfall for 2018 as a proportion of Average annual rainfall

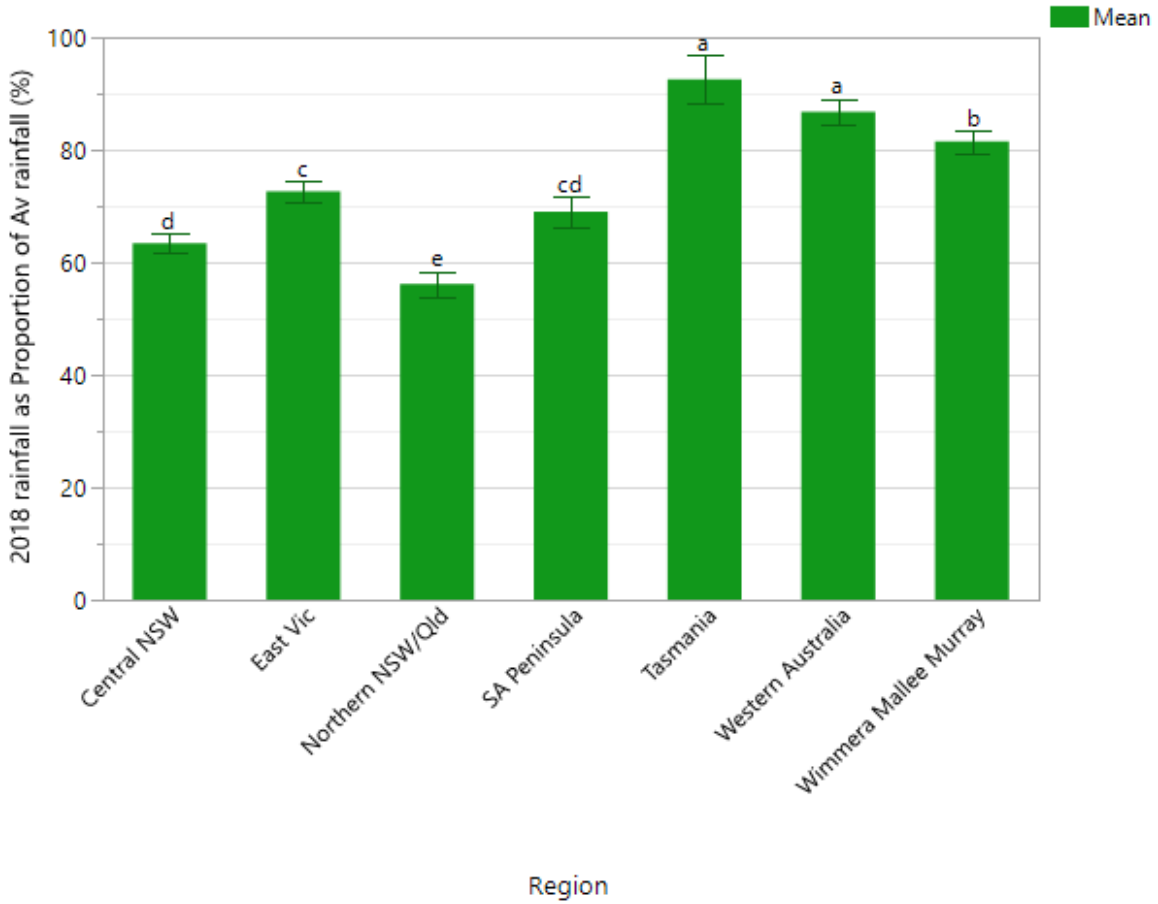


Figure 2-2: Mean 2018 rainfall as a proportion of Average annual rainfall by Region (±SE), P<0.0001. Letters indicate significant differences between regions.

Q3 What is the size of your reporting property?

	Area	Please select a unit	
		hectares	acres
Property size		○	○

3.1 Property size by Region

Table 3-1: Median reported property size by Region.

	Property size Ha			
Region	***n***	**Median**	**Min**	**Max**
Central NSW	83	780[a]	49	37636
East Vic	44	513[b]	36	4000
Northern NSW/Qld	62	1670[c]	20	66600
SA Peninsula	20	1750[cd]	500	16931
Tasmania	13	445[b]	129	2000
Western Australia	53	2000[d]	81	13000
Wimmera Mallee Murray	78	870[abd]	45	40469
National	**353**	**1012**	**20**	**66600**

Kruskal-Wallis test for Region H=52.4503, df=6, P<0.0001.
Values within column not sharing a letter in the superscript are significantly different.

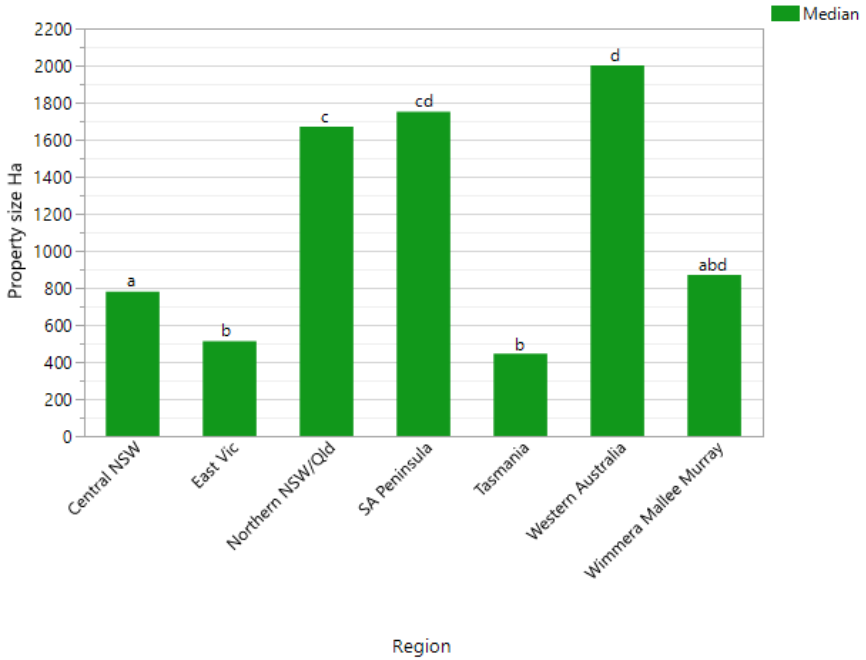


Figure 3-1: Median property size by Region, Wilcoxon/Kruskal-Wallis test was significant for Region H=52.4503, df=6, P<0.0001. Values not sharing a letter in the superscript are significantly different.

Q4 What is the proportion of income from the various enterprises on your reporting property in 2018?

4.1 Income on reporting properties by Region

Table 4-1: Proportion of income of respondents from various enterprises (number of respondents *n*=354) by Region.

Income enterprise	Percentage (%) income of respondents by Region								
	Central NSW	**East Vic**	**Northern NSW/Qld**	**SA Peninsula**	**Tasmania**	**Western Australia**	**Wimmera Mallee Murray**	**National**	**P-value**
Wool sheep	49.5^{a}	35.1^{ab}	49.8^{a}	40.7^{ab}	53.0^{ab}	37.5^{ab}	32.1^{b}	**41.7**	0.0041
Meat sheep	22.9^{c}	40.8^{a}	22.1^{c}	19.4^{bc}	25.4^{abc}	18.7^{c}	37.8^{ab}	**27.6**	<0.0001
Cattle	13.6^{a}	10.5^{ab}	14.3^{a}	0.5^{b}	14.6^{ab}	8.2^{ab}	13.9^{ab}	**11.9**	0.0043
Cropping	9.6^{b}	8.8^{b}	5.7^{b}	36.9^{a}	6.2^{b}	25.7^{a}	12.2^{b}	**13.2**	<0.0001
Other	4.2	3.1	1.5	1.5	0.8	9.5	6.0	**4.5**	0.0871
Goats	0.5^{a}	1.7^{a}	4.6^{b}	1.0^{ab}	0.0^{a}	0.4^{a}	0.0^{a}	**1.3**	<0.0001
n	**83**	**44**	**62**	**20**	**13**	**53**	**79**	**354**	

Values within rows not sharing a letter in the superscript are significantly different.

2017 Merino Husbandry Practices Survey reported that income from sheep was 59.6%, nationally, which is lower than the combined wool and meat sheep income reported in this survey (69.3%).

Q5 About what percentage of your reporting property is: Improved pasture, Non-improved pasture, Crop (Not for grazing) Fodder crops, Undeveloped, other.

% Improved pasture

% Non-Improved pasture

% Crop (not primarily for grazing)

% Fodder crops (primarily for grazing)

% Undeveloped

% Other (please describe in comments box below)

0 out of 100 Total

Comments

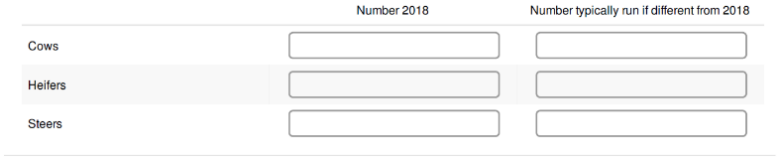
5.1 Land use on reporting properties by Region

Table 5-1: Proportion of land use of respondents (n=354) by Region.

Income enterprise	Percentage (%) income of respondents by Region								
	Central NSW	**East Vic**	**Northern NSW/Qld**	**SA Peninsula**	**Tasmania**	**Western Australia**	**Wimmera Mallee Murray**	**National**	**P-value**
Improved pasture	42.5^{a}	45.4^{a}	18.5^{b}	20.5^{b}	55.1^{a}	40.5^{a}	48.1^{a}	**38.8**	<0.0001
Non-Improved pasture	31.4^{b}	29.3^{bc}	45.9^{a}	22.5^{bcd}	30.3^{abcd}	11.9^{d}	21.7^{cd}	**28.0**	<0.0001
Crop (not for grazing)	10.9^{c}	13.0^{bc}	9.7^{c}	36.4^{a}	4.6^{c}	29.9^{a}	19.7^{b}	**17.0**	<0.0001
Fodder crops	8.3	2.7	4.4	9.5	1.8	5.9	5.6	**5.8**	0.2483
Undeveloped	7.9	6.8	13.6	6.2	7.4	6.4	4.0	**7.6**	0.3172
Other	3.3	0.8	6.3	5.0	0.8	3.3	0.9	**3.0**	0.8769
n	**83**	**44**	**62**	**20**	**13**	**53**	**79**	**354**	

Values within rows not sharing a letter in the superscript are significantly different.

Q6 How many cattle did you have at calf weaning time for reproducing herds or in November 2018 for non-reproducing herds?



6.1 Mean number of cattle run by respondents by Region

Table 6-1: Mean number of cattle run in 2018 and mean number of cattle typically run by respondents by Region.

	Mean number of cattle 2018				Mean number of cattle typically Run			
Regions	**Cows**	**Heifers**	**Steers**	**Total**	**Cows**	**Heifers**	**Steers**	**Total**
Central NSW	50.6	22.0	19.2	91.8 (0-1080) [ab]	30.6	13.2	12.7	56.5 (0-1000) [ab]
East Vic	30.5	10.4	17.5	58.4 (0-906) [ab]	7.5	0.7	17.3	25.5 (0-540) [b]
Northern NSW/Qld	72.8	29.2	28.8	130.9 (0-1166) [a]	90.5	19.5	27.0	137.0 (0-820) [a]
SA Peninsula	0.7	0.8	0.3	1.8 (0-25) [b]	1.3	1.3	0.5	3.0 (0-50) [ab]
Tasmania	27.2	11.6	8.4	47.2 (0-200) [ab]	10.8	0.0	0.0	10.8 (0-140)[ab]
Western Australia	28.2	8.9	26.9	63.4 (0-1200) [b]	1.9	0.8	0.2	3.0 (0-145) [b]
Wimmera Mallee Murray	48.9	22.8	56.8	128.5 (0-2550) [ab]	2.7	2.0	13.0	17.8 (0-1000) [b]
National	**44.6**	**18.5**	**28.8**	**91.7 (0-2550)**	**25.3**	**7.2**	**12.9**	**45.4 (0-1820)**
Short survey results	-	-	-	**179 (0-1500)***	-	-	-	-

Main survey: Total cattle numbers 2018 P=0.0014. Total cattle typically run P<0.0001. *Main survey mean versus short survey mean, ANOVA P<0.0001. Values within columns not sharing a letter in the superscript are significantly different

6.2 Proportion of respondents who ran cattle by Region

Table 6-2: Proportion of respondents who ran cattle in 2018 and who typically ran cattle.

Region	**Ran cattle in 2018 %**	**Ran cattle typically %**
Central NSW	38.6[b]	24.1[b]
East Vic	31.8[b]	11.4[b]
Northern NSW/Qld	54.8[a]	35.5[a]
SA Peninsula	10.0[b]	10.0[b]
Tasmania	38.5[b]	7.7[b]
Western Australia	20.8[b]	3.8[b]
Wimmera Mallee Murray	30.4[b]	5.1[c]
National	**34.5**	**15.8**

Ran cattle in 2018: chi-square=22.53, P=0.0010. Ran cattle typically: chi-square=36.72, P<0.0001. Values within columns not sharing a letter in the superscript are significantly different

Proportion of respondents who ran cattle typically was higher in 2003 (53%) and 2011 (47%) than in 2018 (15.8%).

Q7 In 2018, how many sheep of different *types* and *classes* did you have at weaning time in 2018 (or in November 2018 if you only run wethers)? Indicate if the total number you typically run is different to the number you had in 2018.

	Adult ewes (over 2 yrs)	Maiden ewes (12mths to 2 yrs)	Lambs and weaners (up to 2 years)	Unmated hoggets/ yearlings (12 mths to 2 yrs)	Adult wethers (over 2 yrs)	Rams (over 2 yrs)	Breeds	Typical total sheep numbers in last 5 years were:		
								More	Same	Less
Wool										
Meat										
Dual purpose										
Cross-breeds										

7.1 Mean number of sheep DSEs and flock size run by respondents by Region

Table 7-1: Mean total sheep DSEs and mean number of sheep per flock (range) in 2018 by Region.

Regions	**Main survey**		
	n	**Mean DSE (range)**	**Mean number of sheep per flock**
Central NSW	83	5056 (80-32545)	3861 (100-27010)
East Vic	44	3559 (0-14870)	2604 (0-12900)
Northern NSW/Qld	62	4205 (0-35457)	3040 (0-25085)
SA Peninsula	20	4288 (635-19072)	3349 (485-15710)
Tasmania	13	3865 (860-10859)	2801 (700-8457)
Western Australia	53	7144(12-29654)	5501 (8-24155)
Wimmera Mallee Murray	79	5168 (0-31310)	3800 (0-23660)
National	**354**	**4971 (0-35457)**	**3490 (0-27010)**
Short survey results	**238**	**-**	**3777 (90-29000)**

Region by total sheep DSEs in 2018 P=0.1276. Kruskal-Wallis test used to compare main survey with short survey sheep numbers H=1.2183, df=1, P=0.2697.

Mean national sheep DSE in 2018 (4971) was slightly higher than the 2003 (4753) and 2011 surveys (4454 DSE). Short survey sheep numbers were not significantly different from the main survey sheep numbers (P=0.2697). However, the mean number of sheep per flock in all three parasite surveys are much higher than reported in Priority list of endemic diseases for the red meat industry-MLA final report 2015 of 2671 for Pastoral; zone, 1545 Sheep/Wheat zone and 1647 High Rainfall zone.

7.2 Changes in typical sheep numbers over the last 5 years (2014-2018)

Table 7-2: Changes in typical Wool sheep numbers run by respondents over the last five years by Region, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Region		Change in typical Wool sheep numbers over 5 years			
		More	Same	Less	Total Responses
Central NSW	*n*	12	34	18	64
	Percentage	18.8%	53.1%	28.1%	
	Chisq PValue	0.1586	0.64275	0.37698	
East Vic	*n*	9	12	7	28
	Percentage	32.1%	42.9%	25.0%	
	Chisq PValue	0.68574	0.63917	0.81156	
Northern NSW/Qld	*n*	23	18	11	52
	Percentage	44.2%	34.6%	21.2%	
	Chisq PValue	0.02808	0.1369	0.79845	
SA Peninsula	*n*	2	11	5	18
	Percentage	11.1%	61.1%	27.8%	
	Chisq PValue	0.1741	0.46557	0.66159	
Tasmania	*n*	4	6	0	10
	Percentage	40.0%	60.0%	0.0%	
	Chisq PValue	0.47732	0.6215	0.13066	
Western Australia	*n*	12	19	12	43
	Percentage	27.9%	44.2%	27.9%	
	Chisq PValue	0.98194	0.64794	0.48752	
Wimmera Mallee Murray	*n*	13	31	8	52
	Percentage	25.0%	59.6%	15.4%	
	Chisq PValue	0.67419	0.27735	0.26028	
National	*n*	**75**	**131**	**61**	**267**
	Percentage	**28.1%**	**49.1%**	**22.8%**	

Table 7-3: Changes in typical Meat sheep numbers run by respondents over the last five years by Region p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Region		Change in typical Meat sheep numbers over 5 years			
		More	Same	Less	Total Responses
Central NSW	*n*	6	24	5	35
	Percentage	17.1%	68.6%	14.3%	
	Chisq PValue	0.9315	0.93877	0.93745	
East Vic	*n*	1	17	5	23
	Percentage	4.3%	73.9%	21.7%	
	Chisq PValue	0.15026	0.80671	0.30485	
Northern NSW/Qld	*n*	3	9	3	15
	Percentage	20.0%	60.0%	20.0%	
	Chisq PValue	0.74271	0.65412	0.51745	
SA Peninsula	*n*	0	4	1	5
	Percentage	0.0%	80.0%	20.0%	
	Chisq PValue	0.36297	0.78166	0.70862	
Tasmania	*n*	1	4	0	5
	Percentage	20.0%	80.0%	0.0%	
	Chisq PValue	0.84968	0.78166	0.40628	
Western Australia	*n*	3	17	3	23
	Percentage	13.0%	73.9%	13.0%	
	Chisq PValue	0.6792	0.80671	0.92288	
Wimmera Mallee Murray	*n*	10	26	3	39
	Percentage	25.6%	66.7%	7.7%	
	Chisq PValue	0.16295	0.82305	0.30496	
National	*n*	**24**	**101**	**20**	**145**
	Percentage	**16.6%**	**69.7%**	**13.8%**	

Table 7-4: Changes in typical Dual purpose sheep numbers run by respondents over the last five years by Region, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Region		Change in typical Dual purpose sheep numbers over 5 years			
		More	Same	Less	Total Responses
Central NSW	*n*	1	14	2	17
	Percentage	5.9%	82.4%	11.8%	
	Chisq PValue	0.15733	0.3635	0.85265	
East Vic	*n*	0	7	0	7
	Percentage	0.0%	100.0%	0.0%	
	Chisq PValue	0.21513	0.24448	0.33253	
Northern NSW/Qld	*n*	7	5	3	15
	Percentage	46.7%	33.3%	20.0%	
	Chisq PValue	0.04104	0.13158	0.4862	
SA Peninsula	*n*	0	4	2	6
	Percentage	0.0%	66.7%	33.3%	
	Chisq PValue	0.25112	0.95062	0.18282	
Tasmania	*n*	0	2	0	2
	Percentage	0.0%	100.0%	0.0%	
	Chisq PValue	0.50759	0.53387	0.60448	
Western Australia	*n*	6	10	2	18
	Percentage	33.3%	55.6%	11.1%	
	Chisq PValue	0.30268	0.63187	0.7896	
Wimmera Mallee Murray	*n*	4	11	2	17
	Percentage	23.5%	64.7%	11.8%	
	Chisq PValue	0.88954	0.99706	0.85265	
National	*n*	**18**	**53**	**11**	**82**
	Percentage	**22.0%**	**64.6%**	**13.4%**	

Table 7-5: Changes in typical Cross bred sheep numbers run by respondents over the last five years by Region, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Region		Change in typical Cross bred sheep numbers over 5 years			
		More	Same	Less	Total Responses
Central NSW	*n*	4	12	3	19
	Percentage	21.1%	63.2%	15.8%	
	Chisq PValue	0.63958	0.76877	0.8905	
East Vic	*n*	1	8	1	10
	Percentage	10.0%	80.0%	10.0%	
	Chisq PValue	0.60558	0.66788	0.70429	
Northern NSW/Qld	*n*	1	7	2	10
	Percentage	10.0%	70.0%	20.0%	
	Chisq PValue	0.60558	0.96198	0.65376	
SA Peninsula	*n*	1	9	0	10
	Percentage	10.0%	90.0%	0.0%	
	Chisq PValue	0.60558	0.41769	0.2272	
Tasmania	*n*	1	4	0	5
	Percentage	20.0%	80.0%	0.0%	
	Chisq PValue	0.85513	0.76159	0.39315	
Western Australia	*n*	3	9	2	14
	Percentage	21.4%	64.3%	14.3%	
	Chisq PValue	0.66252	0.84034	0.97674	
Wimmera Mallee Murray	*n*	5	17	6	28
	Percentage	17.9%	60.7%	21.4%	
	Chisq PValue	0.87737	0.60808	0.34287	
National	*n*	**16**	**66**	**14**	**96**
	Percentage	**16.7%**	**68.8%**	**14.6%**	

7.3 Proportions of classes as a total of sheep numbers

7.3.1 Ewes as a proportion of the total sheep numbers

Table 7-6: Mean percentage of Ewes as a proportion of total sheep numbers by Region.

Regions	Mean Ewes as proportion of total sheep numbers	
	n	Mean (%)
Central NSW	83	56.7 (0-100)
East Vic	43	55.9 (0-100)
Northern NSW/Qld	61	57.1 (0-100)
SA Peninsula	20	56.1 (36-100)
Tasmania	13	60.2 (35-100)
Western Australia	53	56.6 (30-98)
Wimmera Mallee Murray	77	56.1 (24-100)
National	**350**	**56.2 (0-100)**

H=2.9139, df=6, P=0.8196.

Ewes as a proportion of the total flock is slightly lower than 2011 (65%), proportion of lambs and weaners is slightly higher than 2011 (23%).

7.3.2 Lambs and weaners as a proportion of the total sheep numbers

Table 7-7: Mean percentage of Lambs and Weaners as a proportion of total sheep numbers by Region.

Regions	Mean Lambs and Weaners as proportion of total sheep numbers	
	n	Mean (%)
Central NSW	83	32.2 (0-100) [a]
East Vic	43	29.9 (0-61) [ab]
Northern NSW/Qld	61	20.7 (0-100) [b]
SA Peninsula	20	33.7 (0-56) [ab]
Tasmania	13	27.6 (0-60) [ab]
Western Australia	53	30.5 (0-53) [ab]
Wimmera Mallee Murray	77	33.8 (0-58) [a]
National	**350**	**29.9 (0-100)**

H=25.0558, df=6, P=0.0003, values within the column not sharing a letter in the superscript are significantly different.

Q8 Choose the sheep enterprise you will refer to for the rest of the survey:

This will be your chosen sheep enterprise. *

Choose the sheep enterprise you will refer to for the rest of the survey: *

- ☐ Merino ewes joined to Merino rams
- ☐ Merino ewes joined to Other (e.g. meat) rams
- ☐ Meat ewes joined to Meat rams
- ☐ Merino wethers
- ☐ Other enterprise (e.g. feedlotting), please specify in 'Comments' box below

Is your chosen sheep enterprise a commercial or stud operation?

- ☐ Commercial
- ☐ Stud
- ☐ Both

8.1 Proportion of respondents by selected Chosen enterprise and Commercial/Stud

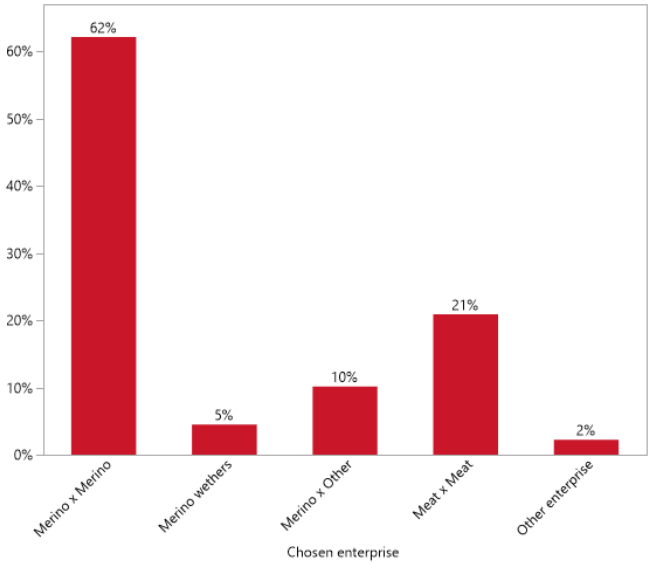


Figure 8-1: Proportion of respondents by Chosen enterprise.

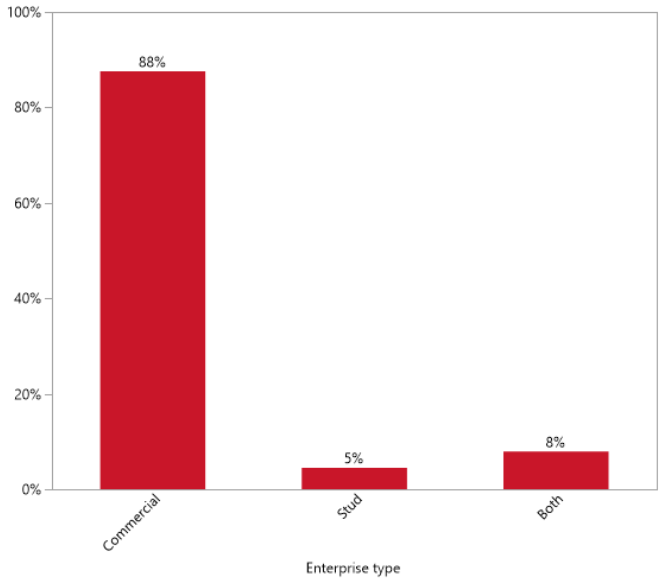


Figure 8-2: Proportion of respondents by Commercial/Stud.

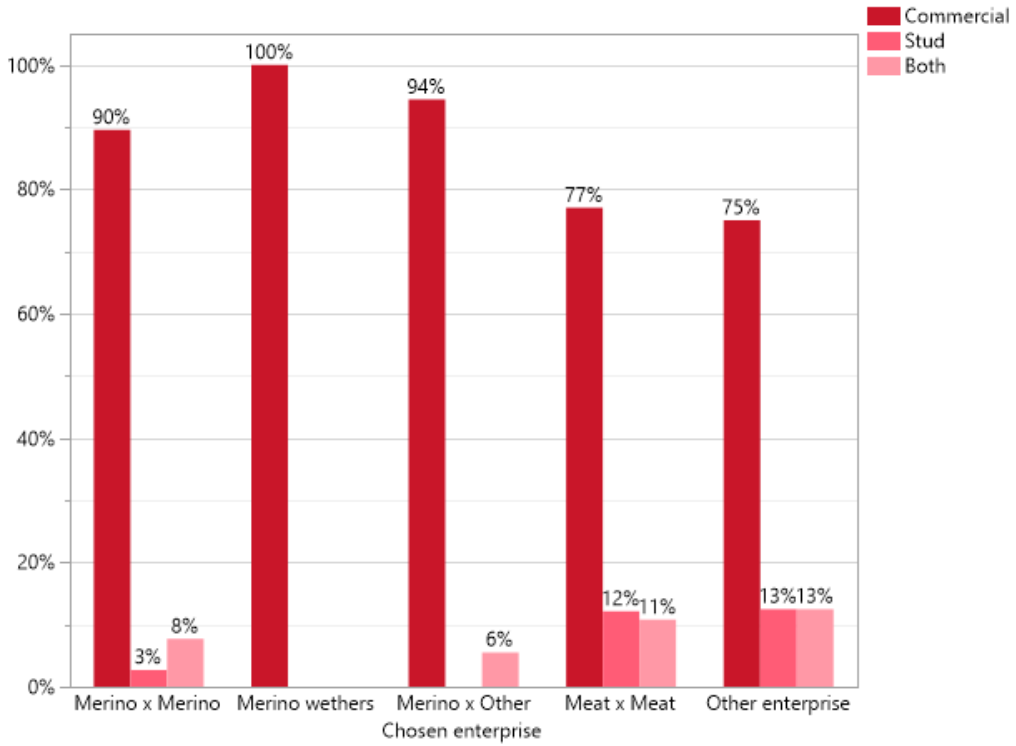


Figure 8-3: Proportion of respondents by Commercial/Stud and Chosen enterprise.

8.2 Chosen enterprise by Region and Enterprise type by Region.

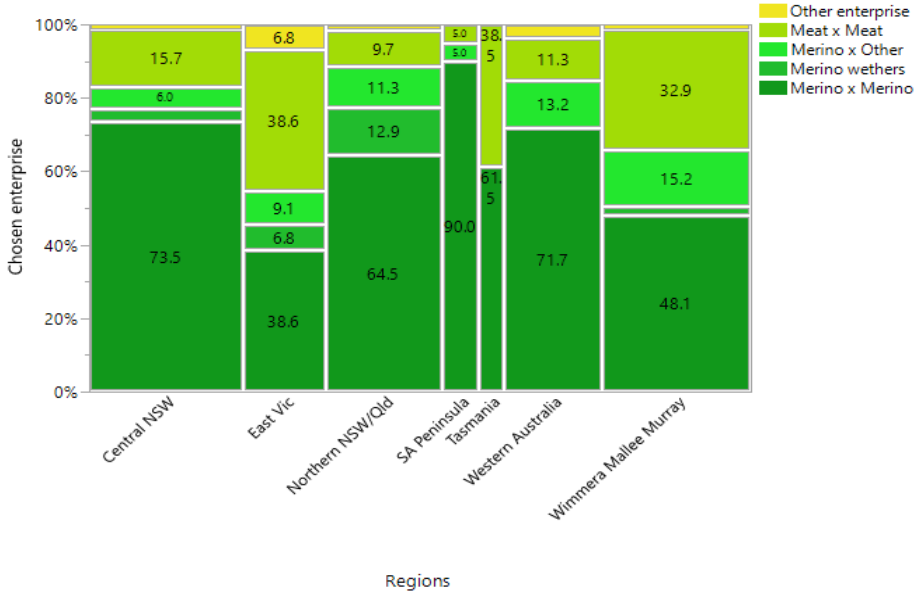


Figure 8-4: Proportion of Chosen enterprise by Region, Chi-square=63.853, df=24, P<0.0001.

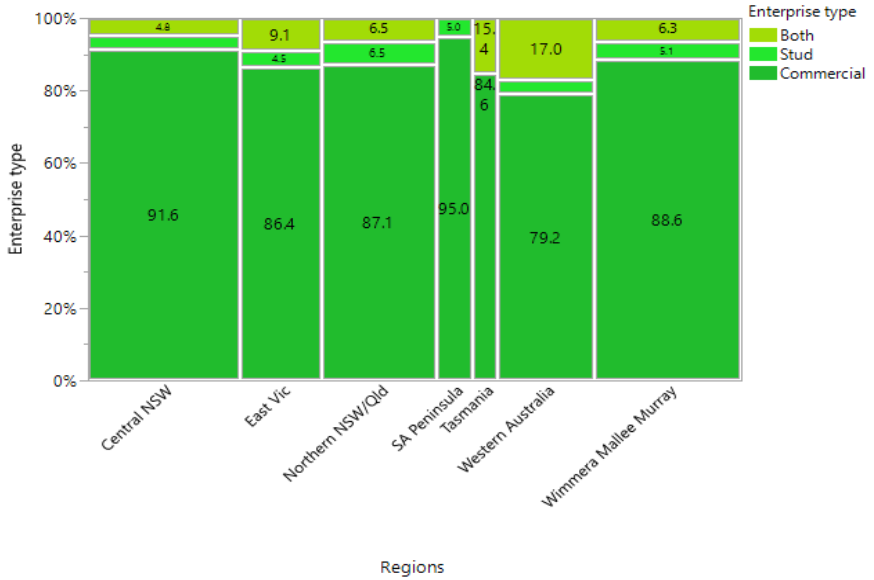


Figure 8-5: Proportion of Enterprise Type by Region, Chi-square=12.358, df=12, P=0.42.

Q9 For your chosen enterprise, in which months did you lamb and wean in 2018?

	Not applicable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Month of lambing	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Month of weaning lambs	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

9.1 Month of lambing and weaning as a proportion of the total number - National

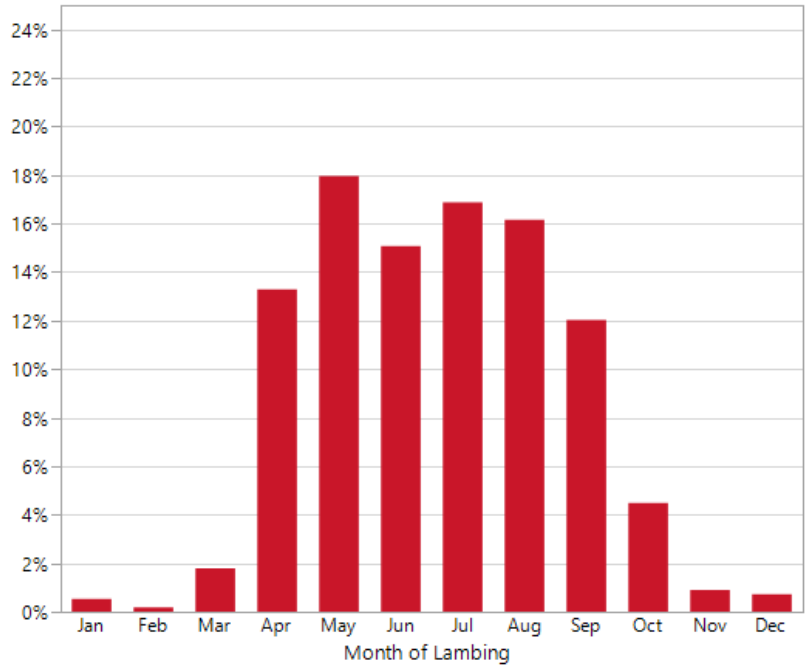


Figure 9-1: Month of lambing as a proportion of the total number lambing.

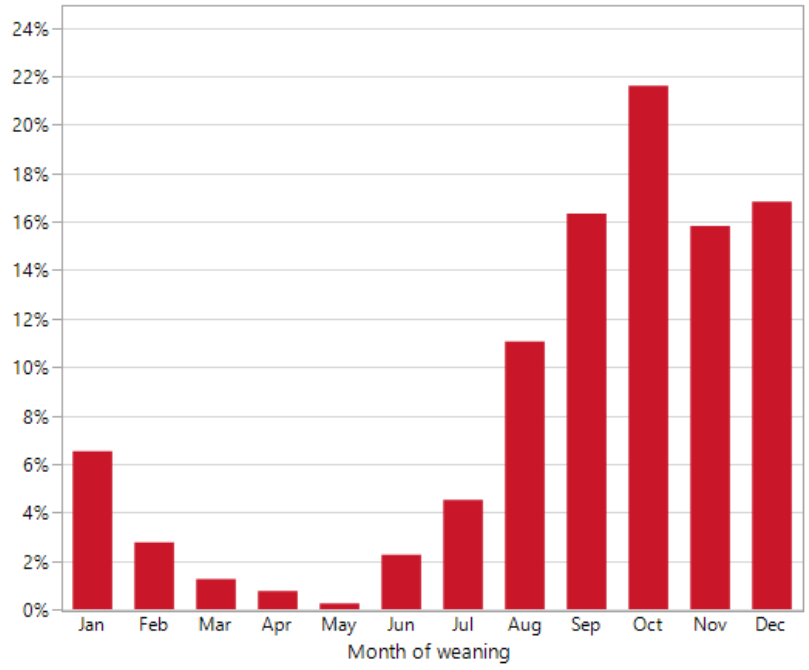


Figure 9-2: Month of weaning as a proportion of the total number lambing.

9.2 Month of lambing by Region

Table 9-1: Proportion of the month of lambing by Region. Share is the proportion of all responses to the question and Rate is the proportion of respondents who selected the particular option within the question.

Region		Month of Lambing													
		Jan	**Feb**	**Mar**	**Apr***	**May***	**Jun***	**Jul***	**Aug**	**Sep***	**Oct***	**Nov**	**Dec**	**Total Responses**	**Total Respondents**
Central NSW	*n*	1	0	2	21	24	14	20	20	16	11	1	1	131	80
	Share	0.8%	0.0%	1.5%	16.0%	18.3%	10.7%	15.3%	15.3%	12.2%	8.4%	0.8%	0.8%		
	Rate	1.3%	0.0%	2.5%	26.3%	30.0%	17.5%	25.0%	25.0%	20.0%	13.8%	1.3%	1.3%		
East Vic	*n*	1	0	0	9	17	10	14	17	6	1	1	1	77	41
	Share	1.3%	0.0%	0.0%	11.7%	22.1%	13.0%	18.2%	22.1%	7.8%	1.3%	1.3%	1.3%		
	Rate	2.4%	0.0%	0.0%	22.0%	41.5%	24.4%	34.1%	41.5%	14.6%	2.4%	2.4%	2.4%		
Northern NSW/Qld	*n*	1	1	3	11	11	6	8	12	17	11	3	1	85	50
	Share	1.2%	1.2%	3.5%	12.9%	12.9%	7.1%	9.4%	14.1%	20.0%	12.9%	3.5%	1.2%		
	Rate	2.0%	2.0%	6.0%	22.0%	22.0%	12.0%	16.0%	24.0%	34.0%	22.0%	6.0%	2.0%		
SA Peninsula	*n*	0	0	0	11	12	2	4	2	1	0	0	0	32	20
	Share	0.0%	0.0%	0.0%	34.4%	37.5%	6.3%	12.5%	6.3%	3.1%	0.0%	0.0%	0.0%		
	Rate	0.0%	0.0%	0.0%	55.0%	60.0%	10.0%	20.0%	10.0%	5.0%	0.0%	0.0%	0.0%		
Tasmania	*n*	0	0	0	0	0	0	1	4	13	0	0	0	18	13
	Share	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.6%	22.2%	72.2%	0.0%	0.0%	0.0%		
	Rate	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.7%	30.8%	100.0%	0.0%	0.0%	0.0%		
Western Australia	*n*	0	0	1	5	10	29	22	16	0	0	0	1	84	53
	Share	0.0%	0.0%	1.2%	6.0%	11.9%	34.5%	26.2%	19.0%	0.0%	0.0%	0.0%	1.2%		
	Rate	0.0%	0.0%	1.9%	9.4%	18.9%	54.7%	41.5%	30.2%	0.0%	0.0%	0.0%	1.9%		
Wimmera Mallee Murray	*n*	0	0	4	17	26	23	25	19	14	2	0	0	130	77
	Share	0.0%	0.0%	3.1%	13.1%	20.0%	17.7%	19.2%	14.6%	10.8%	1.5%	0.0%	0.0%		
	Rate	0.0%	0.0%	5.2%	22.1%	33.8%	29.9%	32.5%	24.7%	18.2%	2.6%	0.0%	0.0%		
All Regions	*n*	**3**	**1**	**10**	**74**	**100**	**84**	**94**	**90**	**67**	**25**	**5**	**4**	**557**	**334**
	Share	**0.5%**	**0.2%**	**1.8%**	**13.3%**	**18.0%**	**15.1%**	**16.9%**	**16.2%**	**12.0%**	**4.5%**	**0.9%**	**0.7%**		
	Rate	**0.9%**	**0.3%**	**3.0%**	**22.2%**	**29.9%**	**25.1%**	**28.1%**	**26.9%**	**20.1%**	**7.5%**	**1.5%**	**1.2%**		

* Indicates significant difference between Regions, P<0.01.

9.3 Month of lambing by Chosen enterprise

Table 9-2: Proportion of the month of lambing by Chosen enterprise. Share is the proportion of all responses to the question and Rate is the proportion of respondents who selected the particular option within the question.

Chosen enterprise		Month of Lambing													
		Jan	**Feb**	**Mar***	**Apr**	**May**	**Jun***	**Jul***	**Aug***	**Sep***	**Oct***	**Nov**	**Dec**	**Total Responses**	**Total Respondents**
Merino x Merino	*n*	1	0	3	45	60	47	52	53	51	22	4	2	340	218
	Share	0.3%	0.0%	0.9%	13.2%	17.6%	13.8%	15.3%	15.6%	15.0%	6.5%	1.2%	0.6%		
	Rate	0.5%	0.0%	1.4%	20.6%	27.5%	21.6%	23.9%	24.3%	23.4%	10.1%	1.8%	0.9%		
Merino x Other	*n*	1	1	4	12	13	8	8	5	1	0	0	1	54	36
	Share	1.9%	1.9%	7.4%	22.2%	24.1%	14.8%	14.8%	9.3%	1.9%	0.0%	0.0%	1.9%		
	Rate	2.8%	2.8%	11.1%	33.3%	36.1%	22.2%	22.2%	13.9%	2.8%	0.0%	0.0%	2.8%		
Meat x Meat	*n*	1	0	3	15	26	25	30	28	14	2	1	1	146	73
	Share	0.7%	0.0%	2.1%	10.3%	17.8%	17.1%	20.5%	19.2%	9.6%	1.4%	0.7%	0.7%		
	Rate	1.4%	0.0%	4.1%	20.5%	35.6%	34.2%	41.1%	38.4%	19.2%	2.7%	1.4%	1.4%		
Other enterprise	*n*	0	0	0	2	1	4	4	4	1	1	0	0	17	7
	Share	0.0%	0.0%	0.0%	11.8%	5.9%	23.5%	23.5%	23.5%	5.9%	5.9%	0.0%	0.0%		
	Rate	0.0%	0.0%	0.0%	28.6%	14.3%	57.1%	57.1%	57.1%	14.3%	14.3%	0.0%	0.0%		
All Enterprises	*n*	**3**	**1**	**10**	**74**	**100**	**84**	**94**	**90**	**67**	**25**	**5**	**4**	**557**	**334**
	Share	**0.5%**	**0.2%**	**1.8%**	**13.3%**	**18.0%**	**15.1%**	**16.9%**	**16.2%**	**12.0%**	**4.5%**	**0.9%**	**0.7%**		
	Rate	**0.9%**	**0.3%**	**3.0%**	**22.2%**	**29.9%**	**25.1%**	**28.1%**	**26.9%**	**20.1%**	**7.5%**	**1.5%**	**1.2%**		

* Indicates significant difference between Chosen enterprises, P<0.01

9.4 Month of weaning by Region

Table 9-3: Proportion of the month of weaning by Region. Share is the proportion of all responses to the question and Rate is the proportion of respondents who selected the particular option within the question.

Region		Month of Weaning													
		Jan*	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug***	**Sep**	**Oct**	**Nov***	**Dec***	**Total Responses**	**Total Respondents**
Central NSW	*n*	6	4	2	1	0	3	6	12	20	19	9	19	101	79
	Share	5.9%	4.0%	2.0%	1.0%	0.0%	3.0%	5.9%	11.9%	19.8%	18.8%	8.9%	18.8%		
	Rate	7.6%	5.1%	2.5%	1.3%	0.0%	3.8%	7.6%	15.2%	25.3%	24.1%	11.4%	24.1%		
East Vic	*n*	3	1	0	0	0	0	2	7	6	10	11	12	52	39
	Share	5.8%	1.9%	0.0%	0.0%	0.0%	0.0%	3.8%	13.5%	11.5%	19.2%	21.2%	23.1%		
	Rate	7.7%	2.6%	0.0%	0.0%	0.0%	0.0%	5.1%	17.9%	15.4%	25.6%	28.2%	30.8%		
Northern NSW/Qld	*n*	9	3	1	2	1	3	5	2	6	6	6	9	53	42
	Share	17.0%	5.7%	1.9%	3.8%	1.9%	5.7%	9.4%	3.8%	11.3%	11.3%	11.3%	17.0%		
	Rate	21.4%	7.1%	2.4%	4.8%	2.4%	7.1%	11.9%	4.8%	14.3%	14.3%	14.3%	21.4%		
SA Peninsula	*n*	1	0	1	0	0	0	1	9	6	4	1	1	24	20
	Share	4.2%	0.0%	4.2%	0.0%	0.0%	0.0%	4.2%	37.5%	25.0%	16.7%	4.2%	4.2%		
	Rate	5.0%	0.0%	5.0%	0.0%	0.0%	0.0%	5.0%	45.0%	30.0%	20.0%	5.0%	5.0%		
Tasmania	*n*	3	1	1	0	0	0	0	0	0	0	3	7	15	13
	Share	20.0%	6.7%	6.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	20.0%	46.7%		
	Rate	23.1%	7.7%	7.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	23.1%	53.8%		
Western Australia	*n*	0	1	0	0	0	1	2	4	13	26	10	4	61	53
	Share	0.0%	1.6%	0.0%	0.0%	0.0%	1.6%	3.3%	6.6%	21.3%	42.6%	16.4%	6.6%		
	Rate	0.0%	1.9%	0.0%	0.0%	0.0%	1.9%	3.8%	7.5%	24.5%	49.1%	18.9%	7.5%		
Wimmera Mallee Murray	*n*	4	1	0	0	0	2	2	10	14	21	23	15	92	73
	Share	4.3%	1.1%	0.0%	0.0%	0.0%	2.2%	2.2%	10.9%	15.2%	22.8%	25.0%	16.3%		
	Rate	5.5%	1.4%	0.0%	0.0%	0.0%	2.7%	2.7%	13.7%	19.2%	28.8%	31.5%	20.5%		
All Regions	*n*	**26**	**11**	**5**	**3**	**1**	**9**	**18**	**44**	**65**	**86**	**63**	**67**	**398**	**319**
	Share	**6.5%**	**2.8%**	**1.3%**	**0.8%**	**0.3%**	**2.3%**	**4.5%**	**11.1%**	**16.3%**	**21.6%**	**15.8%**	**16.8%**		
	Rate	**8.2%**	**3.4%**	**1.6%**	**0.9%**	**0.3%**	**2.8%**	**5.6%**	**13.8%**	**20.4%**	**27.0%**	**19.7%**	**21.0%**		

*Indicates significant differences between Regions.

9.5 Month of weaning by Chosen enterprise

Table 9-4: Proportion of the month of weaning by Chosen enterprise. Share is the proportion of all responses to the question and Rate is the proportion of respondents who selected the particular option within the question.

Chosen enterprise		Month of Weaning													
		Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep***	**Oct**	**Nov**	**Dec**	**Total Responses**	**Total Respondents**
Merino x Merino	*n*	16	9	5	3	0	5	13	33	36	52	32	40	244	206
	Share	6.6%	3.7%	2.0%	1.2%	0.0%	2.0%	5.3%	13.5%	14.8%	21.3%	13.1%	16.4%		
	Rate	7.8%	4.4%	2.4%	1.5%	0.0%	2.4%	6.3%	16.0%	17.5%	25.2%	15.5%	19.4%		
Merino x Other	*n*	1	0	0	0	1	2	2	3	13	9	9	4	44	35
	Share	2.3%	0.0%	0.0%	0.0%	2.3%	4.5%	4.5%	6.8%	29.5%	20.5%	20.5%	9.1%		
	Rate	2.9%	0.0%	0.0%	0.0%	2.9%	5.7%	5.7%	8.6%	37.1%	25.7%	25.7%	11.4%		
Meat x Meat	*n*	8	2	0	0	0	2	2	7	16	24	19	21	101	71
	Share	7.9%	2.0%	0.0%	0.0%	0.0%	2.0%	2.0%	6.9%	15.8%	23.8%	18.8%	20.8%		
	Rate	11.3%	2.8%	0.0%	0.0%	0.0%	2.8%	2.8%	9.9%	22.5%	33.8%	26.8%	29.6%		
Other enterprise	*n*	1	0	0	0	0	0	1	1	0	1	3	2	9	7
	Share	11.1%	0.0%	0.0%	0.0%	0.0%	0.0%	11.1%	11.1%	0.0%	11.1%	33.3%	22.2%		
	Rate	14.3%	0.0%	0.0%	0.0%	0.0%	0.0%	14.3%	14.3%	0.0%	14.3%	42.9%	28.6%		
All Enterprises	*n*	**26**	**11**	**5**	**3**	**1**	**9**	**18**	**44**	**65**	**86**	**63**	**67**	**398**	**319**
	Share	**6.5%**	**2.8%**	**1.3%**	**0.8%**	**0.3%**	**2.3%**	**4.5%**	**11.1%**	**16.3%**	**21.6%**	**15.8%**	**16.8%**		
	Rate	**8.2%**	**3.4%**	**1.6%**	**0.9%**	**0.3%**	**2.8%**	**5.6%**	**13.8%**	**20.4%**	**27.0%**	**19.7%**	**21.0%**		

* Indicates significant difference between Chosen enterprises, P<0.01.

Q10 In the last 5 years, which of the following treatments or techniques have you used for worm control in your chosen enterprise? Please indicate if these were effective.

	Did you do this?		If used, how effective was this technique?				
	Yes	No	Very effective	Effective	Somewhat effective	Not effective	Not sure
Planned preventative treatments	○	○	○	○	○	○	○
Treatment based on worm egg count (WEC)	○	○	○	○	○	○	○
Treatment based on worm egg count (WEC) and worm species identification (larval culture)	○	○	○	○	○	○	○
Prepare clean pastures by spelling/resting paddock ('long spelling')	○	○	○	○	○	○	○
Prepare clean pastures by cropping paddock	○	○	○	○	○	○	○
Prepare clean pastures by intensive rotational grazing	○	○	○	○	○	○	○
Prepare clean pastures by 'Smart Grazing' techniques*	○	○	○	○	○	○	○
Prepare clean paddocks using sheep treated with drench capsules or long acting injectable	○	○	○	○	○	○	○
Prepare clean pasture or dilute sheep parasites using cattle	○	○	○	○	○	○	○
Leave some sheep undrenched	○	○	○	○	○	○	○
Feeding strategy	○	○	○	○	○	○	○
Use rams selected for resistance to worms using Australian Sheep Breeding Value for worm egg count (WEC)	○	○	○	○	○	○	○
Barbervax® vaccine	○	○	○	○	○	○	○
FAMACHA® eye colour chart	○	○	○	○	○	○	○

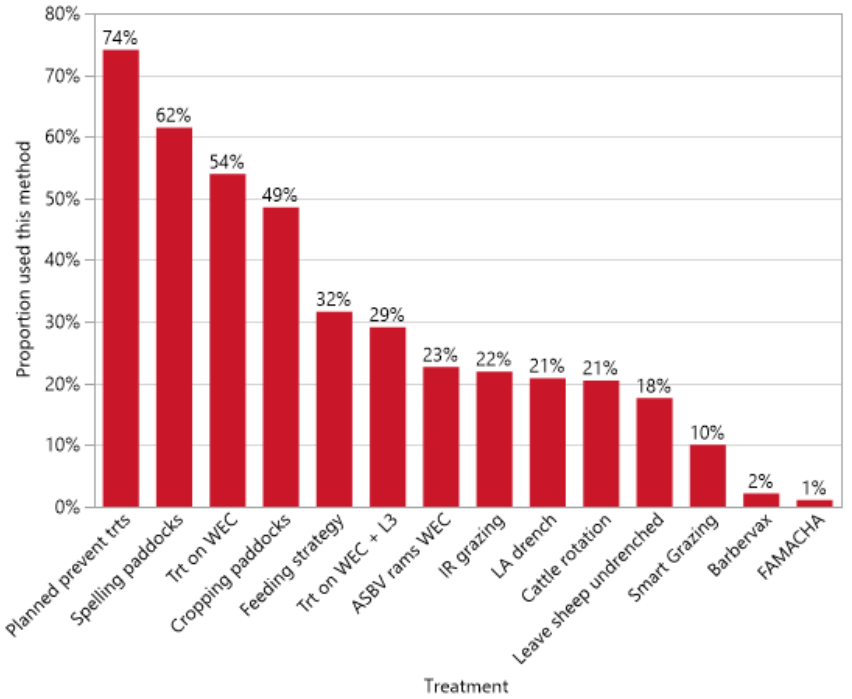


Figure 10-1: National proportion of respondents using worm control techniques or treatments.

10.1 Proportion of respondents who used techniques and treatments for worm control over the last five years (2014-2018) by Region

Table 10-1: Proportion of respondents using techniques and treatments for worm control over the last 5 years (2014-2018) by Region. P values are for a chi-square test, for each treatment, that the incidence of the treatment is independent of region. Shaded cells indicate proportion of respondents that are significantly higher than the national proportion (red) or significantly lower (blue). N= number of responses per Region.

Worm control techniques and treatments	Proportion (%) respondents using treatment by Region								
	Central NSW	East Vic	Northern NSW/Qld	SA Peninsula	Tasmania	Western Australia	Wimmera Mallee Murray	National	P-value
Planned preventative treatments	73.8	88.9	66.7	75.0	66.7	82.2	69.4	**74.1**	0.2562
Prepare clean pastures by spelling paddocks	56.9	63.0	54.9	68.8	75.0	66.7	62.9	**61.5**	0.7534
Treat on faecal worm egg count (WEC)	60.0	51.9	47.1	12.5	66.7	51.1	64.5	**54.0**	0.0065
Prepare clean pastures by Cropping paddocks	55.4	40.7	27.5	68.8	25.0	73.3	43.5	**48.6**	<.0001
Feeding strategy	44.6	22.2	21.6	6.3	16.7	40.0	33.9	**31.7**	0.0071
Treat on faecal worm egg count (WEC) and larval culture	33.8	29.6	31.4	18.8	25.0	22.2	30.6	**29.1**	0.8109
Using rams selected for resistance to worms ASBV-WEC	18.5	3.7	21.6	6.3	8.3	37.8	32.3	**22.7**	0.0014
Prepare clean pastures by Intensive Rotational grazing	18.5	37	19.6	25.0	50.0	6.7	25.8	**21.9**	0.0100
Prepare clean pastures by using sheep treated with LA drench	15.4	14.8	13.7	12.5	41.7	26.7	29.0	**20.9**	0.1150
Prepare clean pastures by Cattle rotation	26.2	7.4	29.4	0.0	33.3	11.1	22.6	**20.5**	0.0053
Leave some sheep un-drenched	15.4	14.8	9.8	6.3	0.0	37.8	19.4	**17.6**	0.0032
Prepare clean pastures by Smart Grazing	12.3	3.7	7.8	12.5	16.7	11.1	9.7	**10.1**	0.8278
Barbervax® vaccine	4.6	0.0	5.9	0.0	0.0	0.0	0.0	**2.2**	0.0959
FAMACHA® eyes colour chart	3.1	0.0	2.0	0.0	0.0	0.0	0.0	**1.1**	0.4894
N	**65**	**27**	**51**	**16**	**12**	**45**	**62**	**278**	

Low proportion of SA Peninsula respondents treating on WEC (12.5%) is consistent with the low proportion in that region who used WEC (15%, see section 11.1) and the low proportion of those who drenched their sheep (15.4%, see section 13.1).
2011 survey results showed treat for worms was used by 87%, spelling or resting paddocks by 62%, feeding strategy was used by 15%, leave some sheep un-drenched by 8%, use of rams selected for resistance to worms using ASBV-WEC 8%.
2003 survey use of rams selected for resistance to worms using ASBV-WEC 10.2%, 20% used feeding strategy, 30% used smart grazing, 33% using other grazing techniques.
Barbervax® controls worms in summer rainfall areas which is consistent with reports on use of the vaccine in Northern NSW/Qld and Central NSW Regions.

10.2 Proportion of respondents who used these techniques and treatments for worm control over the last five years (2014-2018) by Chosen enterprise

Table 10-2: Proportion of respondents using techniques and treatments for worm control over the last 5 years by Chosen enterprise. P values are for a chi-square test, for each treatment, that the incidence of the treatment is independent of enterprise. Shaded cells indicate percentages of respondents that are significantly higher than the proportion across all enterprises (red) or significantly lower (blue). N= number of responses per Chosen enterprise.

Worm control treatments and techniques	Proportion (%) respondents using treatment by Chosen enterprise						
	Merino x Merino	Merino wethers	Merino x Other	Meat x Meat	Other enterprise	All enterprises	P-value
Planned preventative treatments	74.4	75.0	69.2	74.1	80	**74.1**	0.9718
Prepare clean pastures by spelling paddocks	59.9	68.8	76.9	55.6	70.0	**61.5**	0.3460
Treat on faecal worm egg count (WEC)	55.8	37.5	30.8	63.0	60.0	**54.0**	0.0473
Prepare clean pastures by Cropping paddocks	50.6	25.0	50.0	42.6	80.0	**48.6**	0.0605
Feeding strategy	28.5	25.0	30.8	38.9	60.0	**31.7**	0.2136
Treat on faecal worm egg count (WEC) and larval culture	29.1	37.5	15.4	33.3	30.0	**29.1**	0.4534
Using rams selected for resistance to worms ASBV-WEC	24.4	0.0	11.5	31.5	10.0	**22.7**	0.0074
Prepare clean pastures by Intensive Rotational grazing	17.4	31.3	23.1	33.3	20.0	**21.9**	0.157
Prepare clean pastures by using sheep treated with LA drench	20.3	12.5	19.2	25.9	20.0	**20.9**	0.8028
Prepare clean pastures by Cattle rotation	19.8	12.5	11.5	24.1	50.0	**20.5**	0.1406
Leave some sheep un-drenched	18.0	31.3	19.2	14.8	0.0	**17.6**	0.1993
Prepare clean pastures by Smart Grazing	8.7	6.3	15.4	7.4	40.0	**10.1**	0.0914
Barbervax® vaccine	2.3	0.0	0.0	1.9	10.0	**2.2**	0.4866
FAMACHA® eyes colour chart	1.7	0.0	0.0	0.0	0.0	**1.1**	0.5745
N	**172**	**16**	**26**	**54**	**10**	**278**	

10.3 Effectiveness of worm control techniques and treatments by Region

As the questions asks "If used, how effective was this technique?" respondents who selected that they didn't use this treatment and offered an effectiveness score were excluded from analyses.

Table 10-3: Effectiveness of worm control treatments and techniques by Region. The figures in cells are the means with Not Effective scored as 1, Somewhat Effective as 2, Effective as 3 and Very effective as 4.

Worm control treatments and techniques	Mean effectiveness of treatments by Region								
	Central NSW	East Vic	Northern NSW/Qld	SA Peninsula	Tasmania	Western Australia	Wimmera Mallee Murray	National	P-value
Treat on faecal worm egg count (WEC)	3.4	3.3	3.5	3.7	3.3	3.5	3.6	**3.5**	0.8902
Treat on faecal worm egg count (WEC) and larval culture	3.3	3.5	3.5	3.5	3.6	3.5	3.5	**3.4**	0.6971
Prepare clean pastures by Cropping paddocks	3.1	3.1	3.3	3.4	3.3	3.5	3.5	**3.3**	0.2714
Prepare clean pastures by using sheep treated with LA drench	3.0	3.3	3.5	3.0	4.0	3.4	3.3	**3.3**	0.4192
Planned preventative treatments	3.2	3.1	3.2	3.0	3.3	3.3	3.2	**3.2**	0.7977
Prepare clean pastures by Spelling paddocks	3.2	3.1	3.1	3.2	3.0	3.1	3.0	**3.1**	0.9388
Prepare clean pastures by Intensive Rotational grazing	3.3	2.9	3.4	3.0	3.2	2.5	3.0	**3.1**	0.2904
Feeding strategy	3.2	2.8	3.3	2.0	4.0	2.8	2.8	**3.0**	0.101
Prepare clean pastures by Smart Grazing	3.0	3.0	2.8	2.0	3.0	2.4	3.2	**2.8**	0.5185
Leave some sheep un-drenched	3.0	3.0	2.3	-	-	2.9	2.7	**2.8**	0.7299
Barbervax® vaccine	3.5	-	2.3	-	-	-	-	**2.8**	0.1967
Prepare clean pastures by Cattle rotation	2.6	2.5	2.7	-	1.5	3.5	2.9	**2.7**	0.1008
Using rams selected for resistance to worms ASBV-WEC	2.6	2	2.9	-	-	2.9	2.6	**2.7**	0.6953
FAMACHA® eyes colour chart	2	-	-	-	-	-	-	**2.0**	-
N	**260**	**100**	**170**	**44**	**41**	**184**	**246**	**1045**	

N = number of responses, this is larger than the 278 responses in the first part of Q10 as respondents could rate multiple treatments.

10.4 Effectiveness of worm control techniques and treatments by Chosen enterprise

Table 10-4: Effectiveness of worm control treatments and techniques by Chosen enterprise. The figures in cells are the means with Not Effective scored as 1, Somewhat Effective as 2, Effective as 3 and Very effective as 4.

Worm control treatments and techniques	Mean effectiveness of treatments by Chosen enterprise						
	Merino x Merino	Merino wethers	Merino x Other	Meat x Meat	Other enterprise	All enterprises	P-value
Treat on faecal worm egg count (WEC)	3.4	4.0	4.0	3.3	3.7	**3.5**	0.0612
Treat on faecal worm egg count (WEC) and larval culture	3.4	3.6	3.8	3.4	3.5	**3.4**	0.5086
Prepare clean pastures by Cropping paddocks	3.3	3.3	3.3	3.3	3.0	**3.3**	0.8567
Prepare clean pastures by using sheep treated with LA drench	3.4	4.0	3.5	2.9	4.0	**3.3**	0.1553
Planned preventative treatments	3.2	2.8	3.4	3.0	3.3	**3.2**	0.1834
Prepare clean pastures by Spelling paddocks	3.1	2.9	3.2	3.1	3.1	**3.1**	0.8833
Prepare clean pastures by Intensive Rotational grazing	3.1	3.0	3.3	3.1	3.0	**3.1**	0.9097
Feeding strategy	3.0	2.0	3.4	2.9	3.2	**3.0**	0.212
Prepare clean pastures by Smart Grazing	2.8	3.0	3.3	2.8	2.3	**2.8**	0.5459
Leave some sheep un-drenched	2.9	1.7	3.5	3.0	-	**2.8**	0.0471
Barbervax® vaccine	2.3	-	-	3.0	4.0	**2.8**	0.2636
Prepare clean pastures by Cattle rotation	2.7	-	2.7	2.7	3.0	**2.7**	0.8735
Using rams selected for resistance to worms ASBV-WEC	2.8	-	2.5	2.8	2.0	**2.7**	0.7622
FAMACHA® eyes colour chart	2.0	-	-	-	-	**2.0**	-
N	**633**	**45**	**84**	**232**	**51**	**1045**	

N = number of responses, this is larger than the 278 responses in the first part of Q10 as respondents could rate multiple treatments.

Q11 If you monitored worm egg counts in 2018, please indicate in the table below which class of sheep you monitored in which month and if you requested worm species identification. If you monitored the same class of sheep more than once in a month please add the details in the comments box below.

	Worm egg counts						Did you request worm species identification tests (larval culture) with these worm egg counts?		
	Adult ewes	Maiden ewes	Lambs and weaners	Unmated hoggets/ yearlings	Adult wethers	Rams	Yes	No	Don't know
Jan	☐	☐	☐	☐	☐	☐	○	○	○
Feb	☐	☐	☐	☐	☐	☐	○	○	○
Mar	☐	☐	☐	☐	☐	☐	○	○	○
Apr	☐	☐	☐	☐	☐	☐	○	○	○
May	☐	☐	☐	☐	☐	☐	○	○	○
Jun	☐	☐	☐	☐	☐	☐	○	○	○
Jul	☐	☐	☐	☐	☐	☐	○	○	○
Aug	☐	☐	☐	☐	☐	☐	○	○	○
Sep	☐	☐	☐	☐	☐	☐	○	○	○
Oct	☐	☐	☐	☐	☐	☐	○	○	○
Nov	☐	☐	☐	☐	☐	☐	○	○	○
Dec	☐	☐	☐	☐	☐	☐	○	○	○

2014 Sheep CRC producer survey found 42% of sheep producers used WEC Nationally.
2017 Merino Husbandry Practices Survey found 41% of wool producers used WEC monitoring.
Proportion of respondents using WEC was higher in 2018 than 2011 (17%, lambs and weaners, 21% ewes) and similar to 2003 when 44% reported using WEC.

11.1 Proportion of respondents using faecal worm egg count monitors (WEC) in 2018 by Region and Chosen enterprise

Table 11-1: Proportion of respondents using faecal worm egg count monitoring (WEC) in 2018 by Region.

Region	***n***	**Proportion respondents using WEC (%)**
Central NSW	83	42.2
East Vic	44	31.8
Northern NSW/Qld	62	37.1
SA Peninsula	20	15.0
Tasmania	13	69.2
Western Australia	53	41.5
Wimmera Mallee Murray	79	46.8
National	**354**	**40.4**

Chi-Sq=13.674, df=6, P=0.0335, post hoc test showed no difference due to small numbers in SA Peninsula and Tasmania.

Table 11-2: Proportion of respondents using faecal worm egg count monitoring (WEC) in 2018 by Chosen enterprise.

Chosen enterprise	***n***	**Proportion respondents using WEC (%)**
Merino x Merino	220	41.4
Merino wether	16	43.8
Merino x Other	36	22.2
Meat x Meat	68	45.6
Other enterprise	14	42.9
All enterprises	**354**	**40.4**

Chi-Sq=6.288, df=4, P=0.1786

11.2 Proportion of respondents who monitored faecal worm egg counts (WEC) in 2018 by Region

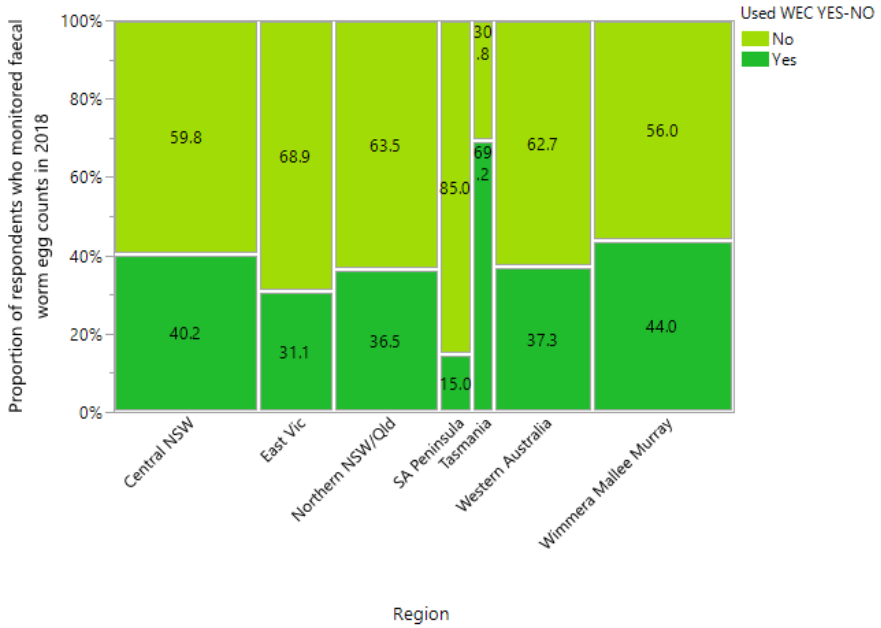


Figure 11-1: Proportion of respondents monitoring faecal worm egg counts (WEC) in 2018 by Region (total number of survey respondents n= 354). Width of the columns is in proportion to the total number of respondents for that region, numbers in the columns represent the percentage of a given response (See "Interpretation of graphs" in Methods section). Chi-square = 12.764. P=0.0469.

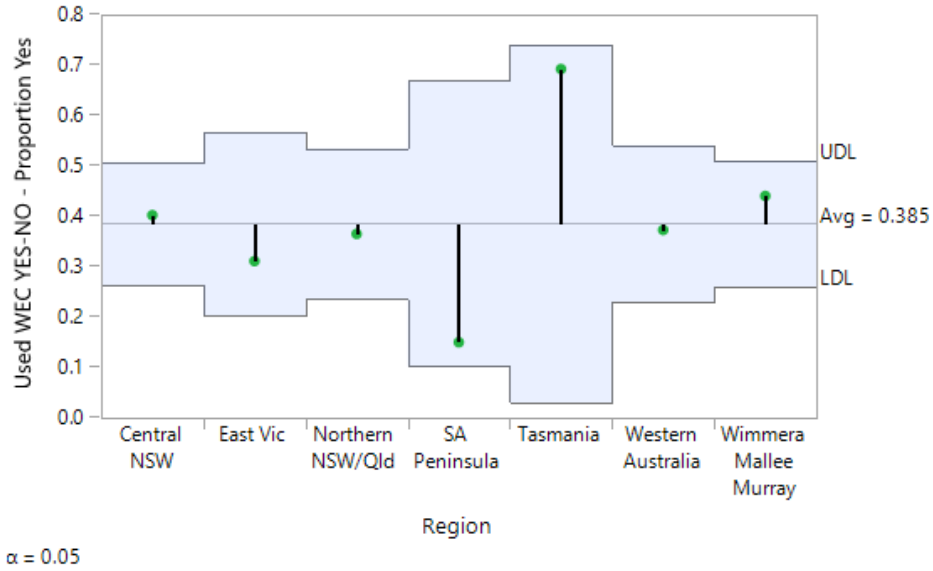


Figure 11-2: Analysis of means for proportions of respondents monitoring faecal worm egg counts by Region. Black line indicates the Region mean distance from the overall mean, red dot indicates the mean is significantly different from the overall mean, green dot indicates the mean does not differ significantly from the overall mean. (See "Interpretation of graphs" in Methods section)

11.3 Proportion of respondents who monitored faecal worm egg counts (WEC) in 2018 by Chosen enterprise

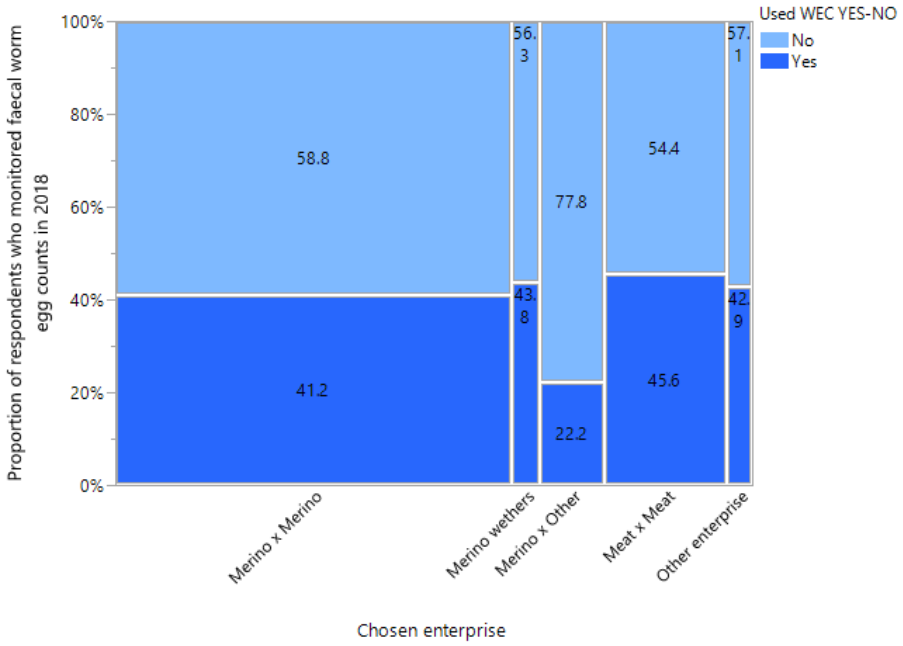


Figure 11-3: Proportion of respondents monitoring faecal worm egg counts (WEC) in 2018 by Chosen enterprise (total number of survey respondents n= 354). Width of the columns is in proportion to the total number of respondents for that region, numbers in the columns represent the percentage of a given response. Chi-square = 5.84, P=0.2118.

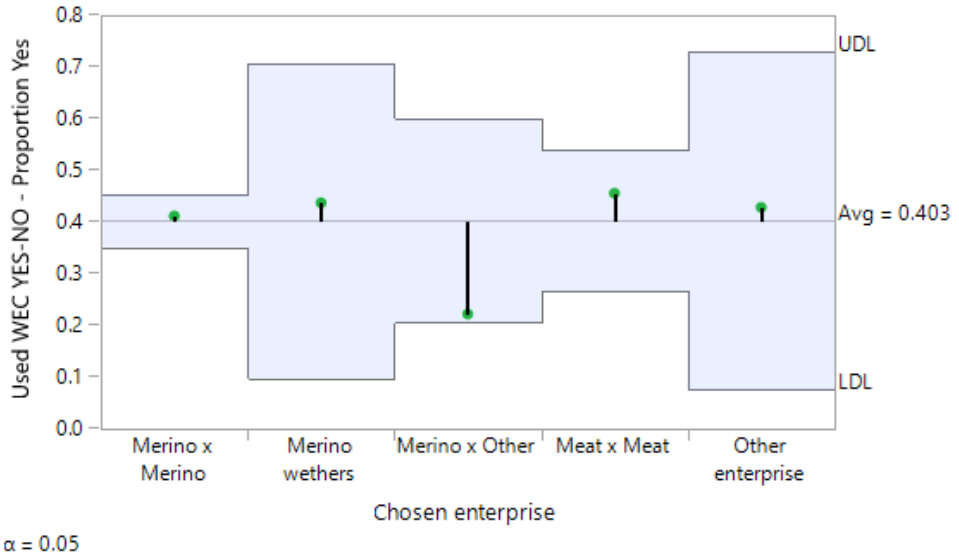


Figure 11-4: Analysis of means for proportions of respondents monitoring faecal worm egg counts by Chosen enterprise. Black line indicates the Chosen enterprise mean distance from the overall mean, red dot indicates the mean is significantly different from the overall mean, green dot indicates the mean does not differ significantly from the overall mean.

11.4 Mean number of faecal worm egg count monitors of those respondents who monitored.

Table 11-3: Number of times faecal worm egg count was monitored in 2018 for those respondents (n= 143) who used worm egg counts, across all classes and Regions.

	Mean number of worm egg count monitors													
	All Classes		Adult Ewes		Adult wethers		Hoggets		Lambs & Weaners		Maiden Ewes		Rams	
Region	*N*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Central NSW	*90*	**3.0 (1-12)**	*26*	3.1 (1-12)	*5*	1.8 (1-3)	*8*	3.0 (1-9)	*26*	2.6 (1-12)	18	3.3 (1-12)	*7*	3.7 (1-12)
East Vic	*37*	**2.6 (1-8)**	*10*	3.1 (1-8)	*4*	1.8 (1-3	*3*	2.3 (2-3)	*9*	2.8 (1-7)	8	2.4 (1-3)	*3*	2.0 (1-3)
Northern NSW/Qld	*68*	**3.0 (1-10)**	*18*	3.4 (1-10)	*5*	2.8 (2-3)	*8*	3.1 (1-6)	*15*	2.7 (1-6)	18	2.9 (1-10)	*4*	2.8 (2-4)
SA Peninsula	*7*	**1.4 (1-2)**	*3*	1.3 (1-2)	*0*	-	*1*	2.0 (2-2)	*0*	-	3	1.3 (1-2)	*0*	-
Tasmania	*20*	**3.1 (1-8)**	*5*	2.8 (1-5)	*1*	2.0 (2-2)	*2*	3.5 (2-5)	*8*	3.5 (1-8)	4	2.8 (2-4)	*0*	-
Western Australia	*75*	**3.7 (1-12)**	*18*	3.8 (1-12)	*4*	4.5 (1-12)	*8*	5.1 (1-12)	*19*	3.5 (1-12)	17	3.5 (1-12)	*9*	3.0 (1-9)
Wimmera Mallee Murray	*109*	**3.1 (1-12)**	*33*	2.9 (1-12)	*6*	3.7 (1-9)	*13*	2.5 (1-12)	*30*	3.4 (1-12)	23	3.0 (1-12)	*4*	4.3 (1-9)
All Regions	***406***	**3.1**	***113***	**3.1**	***25***	**2.9**	***43***	**3.2**	***107***	**3.1**	***91***	**3.0**	***27***	**3.2**

n = total responses, whole model df=15, class df=5 P=0.9999, Regions df=6 P=0.9945.

Table 11-4: Number of times worm egg count was monitored in 2018 for those respondents (n=) who used worm egg counts, across all classes and Chosen enterprise.

	Mean number of worm egg count monitors													
	All Classes		Adult Ewes		Adult wethers		Hoggets		Lambs & Weaners		Maiden Ewes		Rams	
Chosen enterprise	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Merino ewes joined to Merino rams	283	**3.2 (1-12)**	*73*	3.1 (1-12)	*17*	3.4 (1-12)	*36*	3.5 (1-12)	*70*	3.3 (1-12)	66	2.9 (1-12)	21	3.2 (1-12)
Merino wethers	11	**2.9 (1-6)**	*1*	5.0 (5-5)	*6*	2.2 (1.-3)	*0*	-	*3*	4.0 (2-6)	1	2.0 (2-2)	0	-
Merino ewes joined to Other rams	19	**3.1 (1-10)**	*7*	3.6 (1-10)	*0*	-	*1*	4.0 (4-4)	*6*	1.8 (1-4)	4	3.8 (1-10)	1	3.0 (3-3)
Meat ewes joined to Meat rams	75	**2.8 (1-12)**	*26*	3.1 (1-12)	*1*	1.0 (1-1)	*4*	1.8 (1-2)	*23*	2.6 (1-8)	18	3.1 (1-11)	3	1.7 (1-2)
Other enterprise	18	**3.1 (1-9)**	*6*	3.0 (1-9)	*1*	1.0 (1-1)	*2*	1 (1-1)	*5*	2.8 (1-6)	2	4.5 (2-7)	2	5.5 (2-9)
All Enterprises	***406***	**3.1**	***113***	**3.1**	***25***	**2.9**	***43***	**3.2**	***107***	**3.1**	***91***	**3.0**	***27***	**3.2**

n = total responses, whole model df=15, class df=5 P=0.9999, Chosen enterprise df=4 P=0.9984.

Frequency of WEC monitors increased in 2018 compared to 2003 (2.6 WEC/yr adult ewes, 3.0 WEC/yr weaners) and 2011 (adult ewes/maiden ewes 2.9 WEC/yr, weaners 1.7 WEC/year).
2017 Merino Husbandry Practices Survey reported mixed age ewes were monitored for WEC 2.1 times/yr and young ewes 2.5 times/yr.

11.5 Proportion of respondents who requested worm species identification (Larval culture) with faecal worm egg counts in 2018 by Region.

Table 11-5: Proportion of respondents requesting worm species identification (Larval culture) in 2018 by Region

Region	***n***	**Proportion respondents using Larval culture**
Central NSW	83	25.6
East Vic	44	15.9
Northern NSW/Qld	62	22.6
SA Peninsula	20	5.0
Tasmania	13	15.4
Western Australia	53	7.5
Wimmera Mallee Murray	79	15.4
National	**354**	**17.3**

Chi-Sq=12.057, df=6, P=0.0607.

Table 11-6: Proportion of respondents requesting worm species identification (Larval culture) in 2018 by Chosen enterprise.

Chosen enterprise	***n***	**Proportion respondents using Larval culture**
Merino x Merino	220	15.9
Merino wether	16	26.7
Merino x Other	36	11.4
Meat x Meat	68	20.6
Other enterprise	14	28.6
All enterprises	**354**	**17.3**

Chi-Sq=3.631, df=4, P=0.4583.

Q12 If you used worm egg counts, who carried out the worm egg counts you listed above?

- ☐ Self or employee
- ☐ Government laboratory
- ☐ Private laboratory
- ☐ Your vet or consultant
- ☐ Other - Write In

12.1 Which person or agency carried out worm egg counts in 2018 by Region

Table 12-1: Percentage of which person or agency carried out worm egg counts in 2018 by Region. Share is the proportion of all responses to the question and rate is the proportion of respondents who selected the particular option within the question. Asterisk (*) indicates significant difference between Regions P<0.001.

Region		Self or employee*	Government lab*	Private lab*	Your vet or consultant*	Other	Total Responses	Total Respondents
Central NSW	*n*	10	9	14	6	0	39	36
	Share	25.6%	23.1%	35.9%	15.4%	0.0%		
	Rate	27.8%	25.0%	38.9%	16.7%	0.0%		
East Vic	*n*	4	1	8	2	0	15	15
	Share	26.7%	6.7%	53.3%	13.3%	0.0%		
	Rate	26.7%	6.7%	53.3%	13.3%	0.0%		
Northern NSW/Qld	*n*	9	3	12	1	0	25	24
	Share	36.0%	12.0%	48.0%	4.0%	0.0%		
	Rate	37.5%	12.5%	50.0%	4.2%	0.0%		
SA Peninsula	*n*	0	0	4	0	0	4	4
	Share	0.0%	0.0%	100.0%	0.0%	0.0%		
	Rate	0.0%	0.0%	100.0%	0.0%	0.0%		
Tasmania	*n*	3	3	2	1	1	10	9
	Share	30.0%	30.0%	20.0%	10.0%	10.0%		
	Rate	33.3%	33.3%	22.2%	11.1%	11.1%		
Western Australia	*n*	13	0	1	8	0	22	21
	Share	59.1%	0.0%	4.5%	36.4%	0.0%		
	Rate	61.9%	0.0%	4.8%	38.1%	0.0%		
Wimmera Mallee Murray	*n*	6	1	14	22	0	43	40
	Share	14.0%	2.3%	32.6%	51.2%	0.0%		
	Rate	15.0%	2.5%	35.0%	55.0%	0.0%		
National	*n*	**45**	**17**	**55**	**40**	**1**	**158**	**149**
	Share	**28.5%**	**10.8%**	**34.8%**	**25.3%**	**0.6%**		
	Rate	**30.2%**	**11.4%**	**36.9%**	**26.8%**	**0.7%**		

30% of respondents or their employee carried out WEC which may be indication of increased awareness of worms or significant worm problems

12.2 Which person or agency carried out worm egg counts in 2018 by Chosen enterprise

Table 12-2: Percentage of which person or agency carried out worm egg counts in 2018 by Chosen enterprise. Share is the proportion of all responses to the question and rate is the proportion of respondents who selected the particular option within the question.

Chosen enterprise		Self or employee	Government lab	Private lab	Your vet or consultant	Other	Total Responses	Total Respondents
Merino x Merino	*n*	33	8	30	24	1	96	93
	Share	34.4%	8.3%	31.3%	25.0%	1.0%		
	Rate	35.5%	8.6%	32.3%	25.8%	1.1%		
Merino wethers	*n*	2	1	5	2	0	10	10
	Share	20.0%	10.0%	50.0%	20.0%	0.0%		
	Rate	20.0%	10.0%	50.0%	20.0%	0.0%		
Merino x Other	*n*	1	1	4	3	0	9	9
	Share	11.1%	11.1%	44.4%	33.3%	0.0%		
	Rate	11.1%	11.1%	44.4%	33.3%	0.0%		
Meat x Meat	*n*	9	7	16	9	0	41	35
	Share	22.0%	17.1%	39.0%	22.0%	0.0%		
	Rate	25.7%	20.0%	45.7%	25.7%	0.0%		
Other enterprise	*n*	0	0	0	2	0	2	2
	Share	0.0%	0.0%	0.0%	100.0%	0.0%		
	Rate	0.0%	0.0%	0.0%	100.0%	0.0%		
All Enterprises	*n*	**45**	**17**	**55**	**40**	**1**	**158**	**149**
	Share	**28.5%**	**10.8%**	**34.8%**	**25.3%**	**0.6%**		
	Rate	**30.2%**	**11.4%**	**36.9%**	**26.8%**	**0.7%**		

Q13. Please indicate the number and type of drenches given to each class of sheep in 2018. You can select several sheep in a month. If you drenched the same sheep class more than once in a month please add the details in the comment box below.

	Sheep class(es)						Method of delivery			
	Adult ewes	Maiden ewes	Lambs and weaners	Unmated hoggets/ yearlings	Adult wethers	Rams	Oral drench	Injectable	Capsule	Product name(s) *
Jan	☐	☐	☐	☐	☐	☐	○	○	○	
Feb	☐	☐	☐	☐	☐	☐	○	○	○	
Mar	☐	☐	☐	☐	☐	☐	○	○	○	
Apr	☐	☐	☐	☐	☐	☐	○	○	○	
May	☐	☐	☐	☐	☐	☐	○	○	○	
Jun	☐	☐	☐	☐	☐	☐	○	○	○	
Jul	☐	☐	☐	☐	☐	☐	○	○	○	
Aug	☐	☐	☐	☐	☐	☐	○	○	○	
Sep	☐	☐	☐	☐	☐	☐	○	○	○	
Oct	☐	☐	☐	☐	☐	☐	○	○	○	
Nov	☐	☐	☐	☐	☐	☐	○	○	○	
Dec	☐	☐	☐	☐	☐	☐	○	○	○	

13.1 Proportion of respondents drenching sheep

Table 13-1: Proportion of respondents drenching sheep in 2018 by Region.

Region	*n*	Proportion drenching sheep (%)
Central NSW	83	67.5
East Vic	44	61.4
Northern NSW/Qld	62	56.5
SA Peninsula	20	70.0
Tasmania	13	76.9
Western Australia	53	73.6
Wimmera Mallee Murray	79	65.8
National	**354**	**65.8%**

Chi-Sq=5.217, df=6, P=0.5163.

Table 13-2: Proportion of respondents drenching sheep in 2018 by Chosen enterprise.

Chosen enterprise	*n*	Proportion drenching sheep (%)
Merino x Merino	220	66.4
Merino wether	16	68.8
Merino x Other	36	58.3
Meat x Meat	68	70.3
Other enterprise	14	37.5
All enterprises	**354**	**65.8%**

Chi-Sq=4.288, df=4, P=0.3685.

13.2 Proportion of respondents drenching sheep by Region.

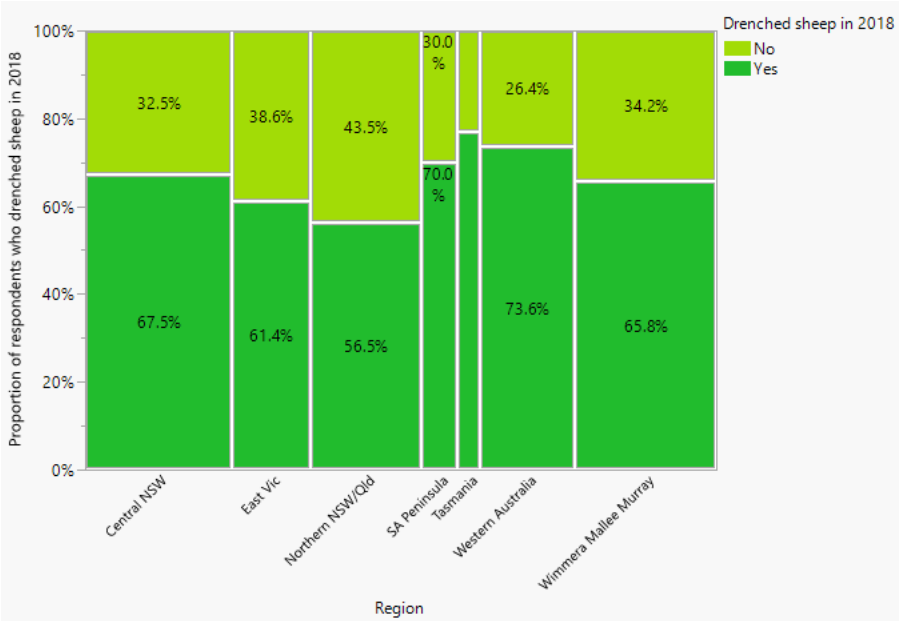


Figure 13-1: Proportion of respondents who drenched sheep of any class in 2018, by Region. Width of the columns is proportion of the total number of respondents for that region, numbers in the columns represent the percentage of a given response. Chi-Sq=5.217, df=6, P=0.5163

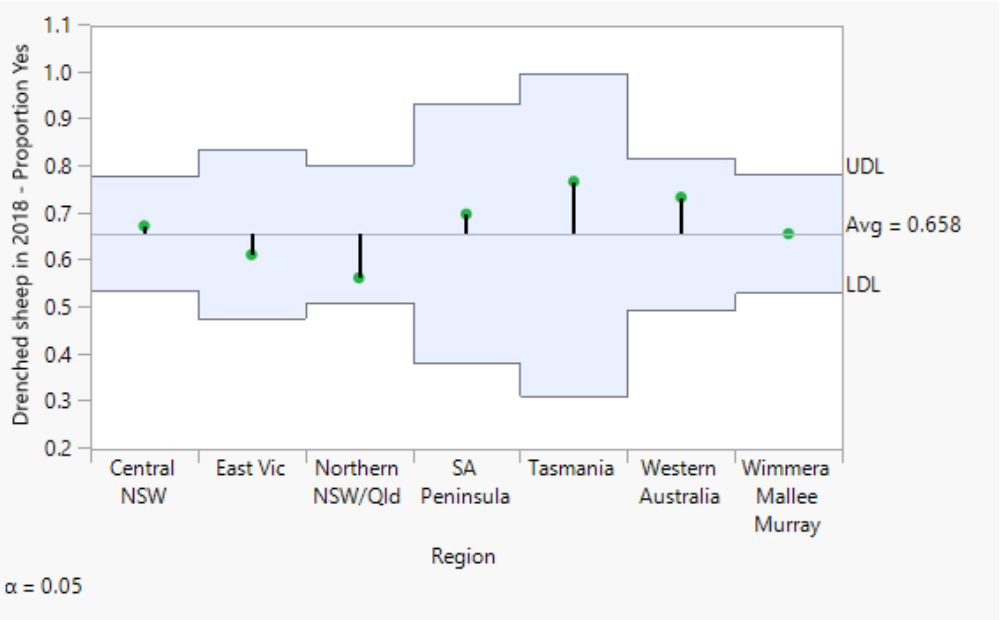


Figure 13-2: Analysis of means for proportions of respondents who drenched sheep of any class in 2018, by Region. Black line indicates the Region mean distance from the overall mean, red dot indicates the mean is significantly different from the overall mean, green dot indicates the mean does not differ significantly from the overall mean.

13.3 Proportion of respondents drenching sheep by Chosen enterprise.

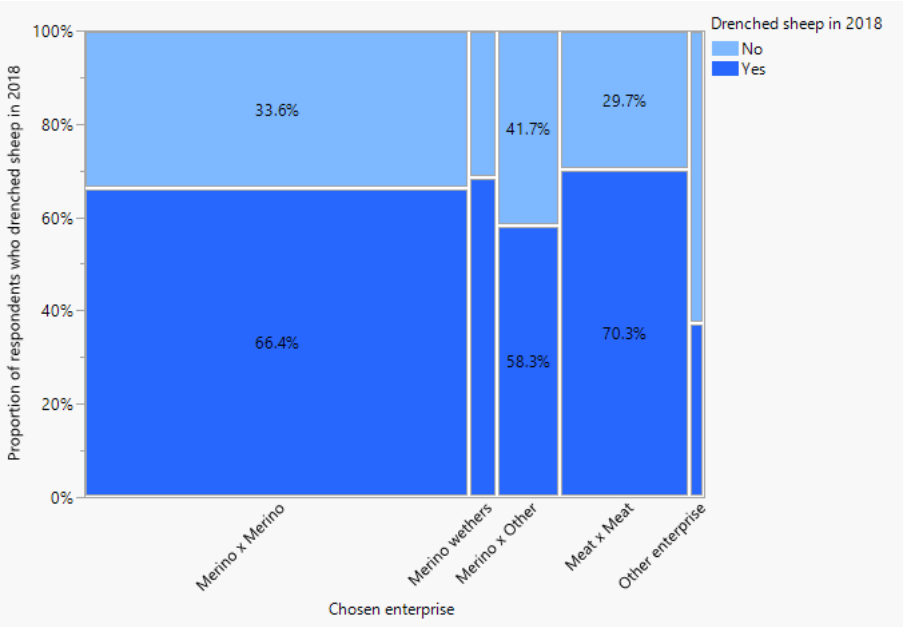


Figure 13-3: Proportion of respondents who drenched sheep of any class in 2018, by Chosen enterprise. Width of the columns is proportion of the total number of respondents for that enterprise, numbers in the columns represent the percentage of a given response. Chi-square =4.288, df=4, p=0.3685.

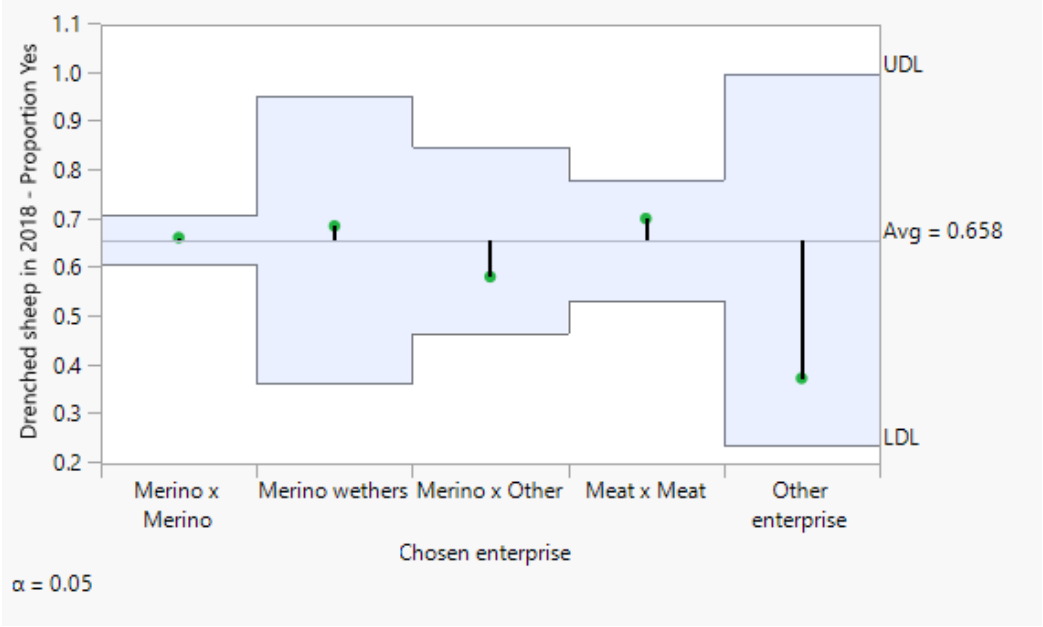


Figure 13-4: Analysis of means for proportions of respondents who drenched sheep of any class in 2018, by Chosen enterprise. Black line indicates the Region mean distance from the overall mean, red dot indicates the mean is significantly different from the overall mean, green dot indicates the mean does not differ significantly from the overall mean.

13.4 Of those who drenched - Mean number of times sheep were drenched in 2018 by Region and class

Table 13-3: Mean number of times respondents drenched sheep in 2018 (of those who drenched), across Region and Class (total number of respondents *n*=233).

	Mean number of times sheep were drenched in 2018											
	Adult Ewes		**Adult wethers**		**Hoggets**		**Lambs & Weaners**		**Maiden Ewes**		**Rams**	
Regions	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Central NSW	51	2.4 (1-8)	15	2.1 (1-5)	20	2.2 (1-5)	49	2.2 (1-6)	35	2.3 (1-6)	29	2.2 (1-5)
East Vic	23	2.5 (1-5)	7	1.7 (1-3)	7	1.9 (1-3)	22	2.1 (1-5)	18	2.2 (1-5)	17	2.1 (1-4)
Northern NSW/Qld	26	2.6 (1-7)	18	2.4 (1-5)	15	2.3 (1-5)	27	2.5 (1-7)	25	2.5 (1-7)	22	2.3 (1-7)
SA Peninsula	14	1.3 (1-2)	4	1.0 (1-1)	4	1.5 (1-2)	11	1.4 (1-2)	12	1.3 (1-2)	10	1.3 (1-2)
Tasmania	11	2.3 (1-4)	4	1.5 (1-3)	7	1.6 (1-3)	10	2.6 (1-7)	10	2.1 (1-4)	5	1.8 (1-4)
Western Australia	37	1.6 (1-7)	8	1.3 (1-2)	14	1.5 (1-4)	38	1.5 (1-4)	33	1.5 (1-5)	22	1.4 (1-4)
Wimmera Mallee Murray	47	2.1 (1-6)	9	2.7 (1-4)	21	1.7 (1-5)	42	2.5 (1-8)	44	1.9 (1-5)	29	1.5 (1-3)
All Regions	***209***	**2.1**	***65***	**2.0**	***88***	**1.9**	***199***	**2.1**	***177***	**2.0**	***134***	**1.8**

Two way ANOVA: n=233, df=11, F=23.68, P<0.0001.

2017 AWI Merino Husbandry Survey found mixed age ewes were drenched 1.9/year and young ewes 2.2/year.
2011 survey: lambs and weaners 2.8/year, maiden ewes 1.8/years, adult ewes 2.7/year, wethers 2.7/year.
2003 survey: weaners 2.2/year, maiden ewes 2.1/year, adult ewes 2.1/year, wethers 1.9/year.

13.5 Of those who drenched - Mean number of times sheep were drenched in 2018 by Chosen enterprise and class

Table 13-4: Mean number of times respondents drenched sheep in 2018 (of those who drenched), across Chosen enterprise and Class (total number of respondents n=233).

	Mean number of times sheep were drenched in 2018											
	Adult Ewes		**Adult wethers**		**Hoggets**		**Lambs & Weaners**		**Maiden Ewes**		**Rams**	
Regions	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Merino x Merino	137	2.0 (1-6)	47	1.9 (1-5)	68	1.9 (1-5)	132	2.0 (1-8)	121	2.0 (1-6)	92	1.7 (1-5)
Merino wethers	4	2.8 (1-4)	11	2.6 (1-5)	3	2.0 (1-4)	5	3.2 (1-6)	3	2.3 (1-4)	3	2.0 (1-4)
Merino x Other	18	1.8 (1-7)	1	1.0 (1-1)	4	1.8 (1-4)	16	1.7 (1-7)	13	1.8 (1-7)	11	1.8 (1-7)
Meat x Meat	47	2.6 (1-8)	5	2.0 (1-3)	11	1.5 (1-3)	43	2.6 (1-8)	37	2.0 (1-6)	26	2.3 (1-5)
Other enterprise	3	2.3 (2-3)	1	3.0 (3-3)	2	2.0 (1-3)	3	2.0 (1-3)	3	2.3 (2-3)	2	2.0 (1-3)
All Enterprises	***209***	**2.1**	***65***	**2.0**	***88***	**1.9**	***199***	**2.1**	***177***	**2.0**	***134***	**1.8**

Two way ANOVA: n=233, df=9, F=27.00, p<0.0001.

13.6 Proportions of drenching events in each month by Region

Table 13-5: Proportion of drenching events taking place in each month of 2018, across all sheep classes and by MLA Reporting region (total number of respondents who answered Q13 n=233, total number of drenching events, n=738)..

Month	Percent of drenching events in month (%)							
	Central NSW	**East Vic**	**Northern NSW/Qld**	**SA Peninsula**	**Tasmania**	**Western Australia**	**Wimmera Mallee Murray**	**National**
January	11.2	11.5	13.6	14.8	9.5	4.7	10.7	**10.6**
February	9.6	12.6	8.2	14.8	14.3	8.4	9.1	**9.9**
December	11.2	9.2	7.3	3.7	4.8	11.2	11.2	**9.8**
March	10.7	6.9	10.9	11.1	7.1	10.3	8.6	**9.5**
November	7.3	12.6	8.2	14.8	7.1	10.3	7.5	**8.8**
September	7.9	8.1	9.1	14.8	7.1	5.6	9.6	**8.4**
July	7.9	9.2	8.2	3.7	16.7	5.6	8.6	**8.3**
October	9.0	5.8	7.3	3.7	2.4	15.0	6.4	**8.0**
April	6.2	8.1	9.1	3.7	9.5	13.1	5.9	**7.9**
May	5.6	5.8	6.4	0.0	11.9	7.5	9.1	**7.1**
August	7.9	6.9	6.4	3.7	7.1	3.7	5.9	**6.2**
June	5.6	3.5	5.5	11.1	2.4	4.7	7.5	**5.7**

Chi-square =54.95, df=55, p=0.8320

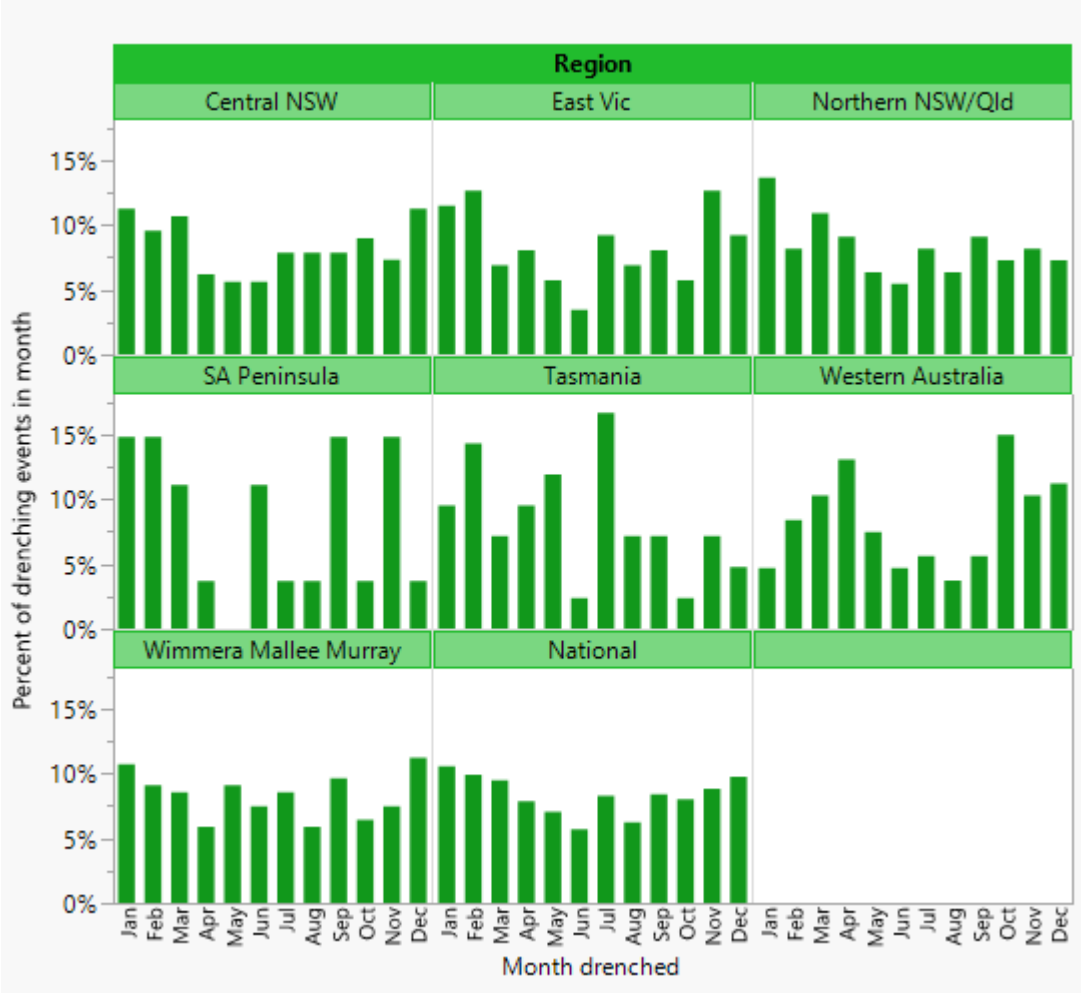


Figure 13-5*:* Proportion of drenching events taking place in each month of 2018, across all sheep classes and by Region (total respondents *n*=233, total number of drenching events, *n*=738). Chi-square =54.95, df=55, p=0.8320.

13.7 Proportions of drenching events in each month by Chosen enterprise

Table 13-6: Proportion of drenching events taking place in each month of 2018, across all sheep classes and by Chosen enterprise (total number of respondents *n*=233, total number of drenching events, n=738).

Month	Percent of drenching events in month (%)					
	Merino x Merino	**Merino wethers**	**Merino x Other**	**Meat x Meat**	**Other**	**All enterprises**
January	10.4	11.4	5.6	12.8	0.0	**10.6**
February	9.3	17.1	16.7	8.0	12.5	**9.9**
December	9.9	0.0	11.1	11.2	0.0	**9.8**
March	9.0	11.4	7.4	11.2	0.0	**9.5**
November	8.6	8.6	11.1	8.0	25.0	**8.8**
September	8.4	5.7	13	7.5	12.5	**8.4**
July	7.9	8.6	5.6	9.6	12.5	**8.3**
October	8.8	5.7	9.3	6.4	0.0	**8**
April	9.0	11.4	5.6	4.8	12.5	**7.9**
May	6.4	11.4	0.0	9.6	12.5	**7.1**
August	6.4	5.7	7.4	5.4	12.5	**6.2**
June	6.0	2.9	7.4	5.4	0.0	**5.7**

Chi-square =45.42, df=44, p=0.4126.

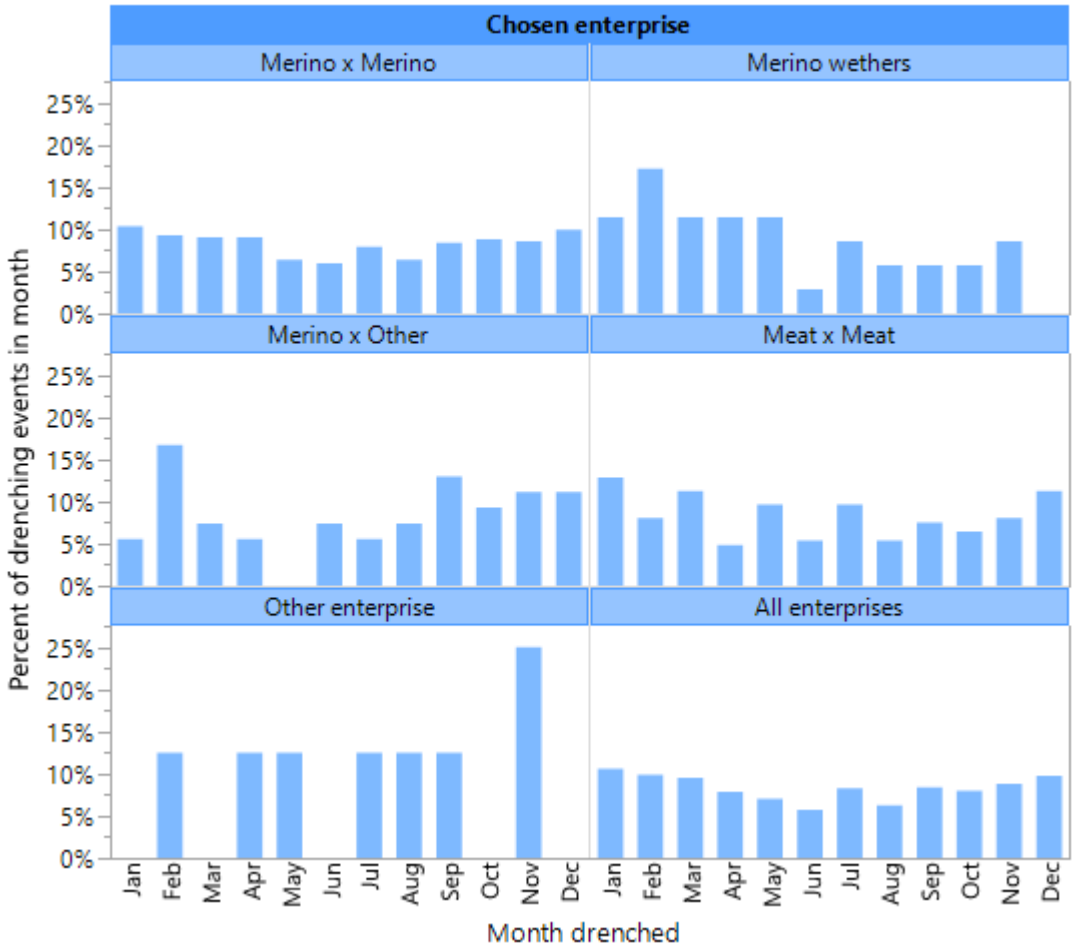


Figure 13-6: Proportion of drenching events taking place in each month of 2018, across all sheep classes and by Chosen enterprise (total number of respondents *n*=233, total number of drenching events, n=738). Chi-square =45.42, df=44, p=0.4126.

13.8 Method of delivery of anthelmintics

Table 13-7: Proportion of drenching events involving various methods of delivery for sheep of any class in 2018, by Region (total number of respondents who answered Q13 n=233, total number of drenching events, n=644). .

Method of delivery	Proportion (%) using delivery methods by Region							
	Central NSW	East Vic	Northern NSW/Qld	SA Peninsula	Tasmania	Western Australia	Wimmera Mallee Murray	National
Oral drench	86.1	94.9	88.0	72.7	81.1	81.1	80.5	**84.6**
Injectable	12.0	3.8	12.0	27.3	10.8	14.4	14.5	**12.4**
Capsule	1.9	1.3	0.0	0.0	8.1	4.4	5.0	**3.0**
n	*178*	*87*	*110*	*27*	*42*	*107*	*187*	***644***

Chi-square =25.73, df=12, p=0.0298. The significant chi square is a result of the higher than expected proportion of injectables in SA Peninsula, and the lower than expected proportion of injectables in East Vic.

Table 13-8: Proportion of drenching events involving various methods of delivery for sheep of any class in 2018, by Chosen enterprise (total number of respondents n=233, total number of drenching events, n=644).

Method of delivery	Proportion (%) using delivery methods by Chosen enterprise					
	Merino x Merino	Merino wethers	Merino x Other	Meat x Meat	Other enterprise	All enterprises
Oral drench	85.7	87.1	84.8	81.8	66.7	**84.6**
Injectable	10.8	12.9	15.2	14.9	33.3	**12.4**
Capsule	3.4	0.0	0.0	3.2	0.0	**3.0**
n	*407*	*31*	*46*	*154*	*6*	***644***

Chi-square =9.07, df=8, p=0.3365.

13.9 Proportion of anthelmintic actives used

13.9.1 Proportion of anthelmintic actives used – National

Table 13-9: Anthelmintic actives used as a proportion of drench events and as a proportion of all anthelmintics used, Nationally.

Anthelmintic group*	Active ingredient	Proportion of drench events (%)	Proportion of all anthelmintics used (%)
ML	Abamectin	41.3	23.6
	Moxidectin	21.9	12.5
	Moxidectin LA	3.1	1.8
	Ivermectin	1.9	1.1
	Doramectin	0.1	0.1
	Total proportion ML	*68.3*	*39.1*
BZ	Oxfendazole	14.7	8.4
	Albendazole	12.3	7.0
	Fenbendazole	4.3	2.5
	Triclabendazole	1.9	1.1
	Benzimidazole	0.8	0.5
	Total proportion BZ	*34.0*	*19.5*
LEV	Levamisole	30.4	17.4
SAL-P	Closantel	8.3	4.7
SPIRO	Derquantel	5.7	3.2
AAD	Monepantel	5.5	3.2
OP	Naphthalophos	2.8	1.6
ISO	Praziquantel	1.2	0.7
-	Unspecified combination	2.0	1.2
-	Unspecified drench	16.8	9.6

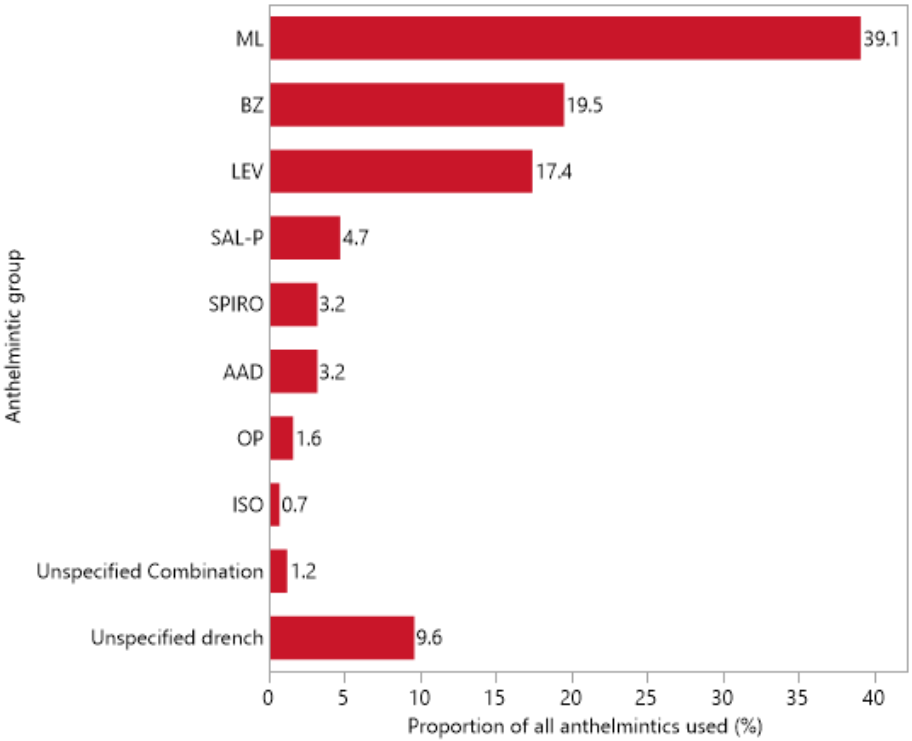


Figure 13-7: Anthelmintic group as a proportion of all anthelmintics used, Nationally*

**Anthelmintic class abbreviations – AAD: Amino-acetonitrile derivative, BZ: Benzimidazole, ISO: Isoquinolone, LEV: Levamisole, ML: Macrocyclic lactone, OP: Organophosphate, SAL-P: Salicylanilides/Phenols, SPIRO: Spiroindole. Proportion of drench events adds to more than 100% as more than one active can be used per drench event.*

13.9.2 Proportion of anthelmintic actives used by Region

Table 13-10: Anthelmintic active ingredient used as a proportion of all drenches used. Share is the proportion of all responses to the question and Rate is the proportion of respondents who selected the particular option within the question. P-values for cell chi-squares are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Drench active ingredients		Region						
		Central NSW	East Vic	Northern NSW/Qld	SA Peninsula	Tasmania	Western Australia	Wimmera Mallee Murray
AAD Monepantel	Freq	4	0	12	0	2	13	10
	Share	1.2%	0.0%	6.8%	0.0%	2.9%	8.1%	3.0%
	Rate	2.2%	0.0%	10.9%	0.0%	4.8%	12.1%	5.3%
	Chisq P-Value	0.0439	0.01825	0.00689	0.2433	0.88452	0.00042	0.84495
BZ Albendazole	Freq	28	12	11	2	2	12	24
	Share	8.4%	6.8%	6.2%	4.7%	2.9%	7.5%	7.1%
	Rate	15.6%	13.8%	10.0%	7.4%	4.8%	11.2%	12.8%
	Chisq P-Value	0.34164	0.91676	0.6835	0.55672	0.18814	0.82144	0.93616
BZ Benzimidazole	Freq	3	2	1	0	0	0	0
	Share	0.9%	1.1%	0.6%	0.0%	0.0%	0.0%	0.0%
	Rate	1.7%	2.3%	0.9%	0.0%	0.0%	0.0%	0.0%
	Chisq P-Value	0.24075	0.1896	0.84251	0.65534	0.56902	0.38924	0.21214
BZ Fenbendazole	Freq	8	5	4	0	4	1	10
	Share	2.4%	2.8%	2.3%	0.0%	5.7%	0.6%	3.0%
	Rate	4.5%	5.7%	3.6%	0.0%	9.5%	0.9%	5.3%
	Chisq P-Value	0.93649	0.75493	0.85817	0.30263	0.08431	0.13742	0.55583
BZ Oxfendazole	Freq	19	23	8	6	8	7	38
	Share	5.7%	13.1%	4.5%	14.0%	11.4%	4.4%	11.3%
	Rate	10.6%	26.4%	7.3%	22.2%	19.0%	6.5%	20.3%
	Chisq P-Value	0.08813	0.03343	0.07391	0.21079	0.38513	0.07802	0.06762
BZ Triclabendazole	Freq	11	1	2	0	0	0	0
	Share	3.3%	0.6%	1.1%	0.0%	0.0%	0.0%	0.0%
	Rate	6.1%	1.1%	1.8%	0.0%	0.0%	0.0%	0.0%
	Chisq P-Value	0.0001	0.51284	0.95015	0.49536	0.38435	0.18845	0.05666
ISO Praziquantel	Freq	2	1	2	0	0	0	3
	Share	0.6%	0.6%	1.1%	0.0%	0.0%	0.0%	0.9%
	Rate	1.1%	1.1%	1.8%	0.0%	0.0%	0.0%	1.6%
	Chisq P-Value	0.96822	0.93331	0.38596	0.60627	0.5108	0.32013	0.52115
LEV Levamisole	Freq	61	41	25	7	16	16	59
	Share	18.3%	23.3%	14.1%	16.3%	22.9%	10.0%	17.6%
	Rate	34.1%	47.1%	22.7%	25.9%	38.1%	15.0%	31.6%
	Chisq P-Value	0.67947	0.0595	0.29955	0.86318	0.27112	0.02523	0.93516
ML Abamectin	Freq	71	43	38	14	19	46	74
	Share	21.3%	24.4%	21.5%	32.6%	27.1%	28.8%	22.0%
	Rate	39.7%	49.4%	34.5%	51.9%	45.2%	43.0%	39.6%
	Chisq P-Value	0.40157	0.80996	0.56794	0.22365	0.53589	0.17549	0.56377
ML Doramectin	Freq	0	0	0	0	0	1	0
	Share	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%
	Rate	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	0.0%
	Chisq P-Value	0.61209	0.71238	0.7116	0.85541	0.81615	0.01265	0.61049
ML Ivermectin	Freq	1	2	3	2	2	1	3
	Share	0.3%	1.1%	1.7%	4.7%	2.9%	0.6%	0.9%
	Rate	0.6%	2.3%	2.7%	7.4%	4.8%	0.9%	1.6%
	Chisq P-Value	0.17059	0.94377	0.4322	0.02435	0.15296	0.579	0.74002

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Table 13-10 (contd): Anthelmintic active ingredient used as a proportion of all drenches used. Share is the proportion of all responses to the question and Rate is the proportion of respondents who selected the particular option within the question. P-values for cell chi-squares are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Drench active ingredients		Region						
		Central NSW	East Vic	Northern NSW/Qld	SA Peninsula	Tasmania	Western Australia	Wimmera Mallee Murray
ML Moxidectin	Freq	40	15	23	10	4	30	40
	Share	12.0%	8.5%	13.0%	23.3%	5.7%	18.8%	11.9%
	Rate	22.3%	17.2%	20.9%	37.0%	9.5%	28.0%	21.4%
	Chisq P-Value	0.79737	0.1348	0.85533	0.04633	0.10795	0.02563	0.75391
ML Moxidectin LA	Freq	6	0	4	0	2	3	8
	Share	1.8%	0.0%	2.3%	0.0%	2.9%	1.9%	2.4%
	Rate	3.4%	0.0%	3.6%	0.0%	4.8%	2.8%	4.3%
	Chisq P-Value	0.97188	0.07706	0.6291	0.38217	0.49733	0.92518	0.40542
OP Naphthalophos	Freq	5	0	11	0	0	3	2
	Share	1.5%	0.0%	6.2%	0.0%	0.0%	1.9%	0.6%
	Rate	2.8%	0.0%	10.0%	0.0%	0.0%	2.8%	1.1%
	Chisq P-Value	0.86333	0.09114	<0.0001	0.40369	0.28668	0.80129	0.13956
SAL-P Closantel	Freq	29	7	12	0	1	7	5
	Share	8.7%	4.0%	6.8%	0.0%	1.4%	4.4%	1.5%
	Rate	16.2%	8.0%	10.9%	0.0%	2.4%	6.5%	2.7%
	Chisq P-Value	0.00077	0.65405	0.20464	0.15468	0.20582	0.84501	0.0065
SPIRO Derquantel	Freq	9	1	11	0	1	9	11
	Share	2.7%	0.6%	6.2%	0.0%	1.4%	5.6%	3.3%
	Rate	5.0%	1.1%	10.0%	0.0%	2.4%	8.4%	5.9%
	Chisq P-Value	0.58388	0.04877	0.02815	0.23763	0.3992	0.09435	0.97518
SPIRO Praziquantel	Freq	0	0	1	0	0	0	0
	Share	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%
	Rate	0.0%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%
	Chisq P-Value	0.61209	0.71238	0.01953	0.85541	0.81615	0.72521	0.61049
Unspecified Combination	Freq	8	1	1	0	0	2	3
	Share	2.4%	0.6%	0.6%	0.0%	0.0%	1.3%	0.9%
	Rate	4.5%	1.1%	0.9%	0.0%	0.0%	1.9%	1.6%
	Chisq P-Value	0.03491	0.46697	0.46328	0.48035	0.36788	0.91418	0.6512
Unspecified drench	Freq	28	22	8	2	9	9	46
	Share	8.4%	12.5%	4.5%	4.7%	12.9%	5.6%	13.7%
	Rate	15.6%	25.3%	7.3%	7.4%	21.4%	8.4%	24.6%
	Chisq P-Value	0.49137	0.20988	0.02974	0.29672	0.37489	0.10636	0.01478
Total Responses		333	176	177	43	70	160	336
Total Cases		179	87	110	27	42	107	187
Total Cases Responding		179	87	110	27	42	107	187

Anthelmintic class abbreviations – AAD: Amino-acetonitrile derivative, BZ: Benzimidazole, ISO: Isoquinolone, LEV: Levamisole, ML: Macrocyclic lactone, OP: Organophosphate, SAL-P: Salicylanilides/Phenols, SPIRO: Spiroindole.

13.10 Number of anthelmintic actives used in combination in drenching events in 2018 for all classes by Region.

Table 13-11: Number of anthelmintic actives used in combination, as a proportion of drenching events across all sheep classes, by Region. Share is the proportion of all responses to the question and rate is the proportion of respondents who selected the particular option within the question, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Region		Number of anthelmintic actives used in combination						
		1	**2**	**3**	**4**	**5**	**Total drenching events**	**Mean number in combination**
Central NSW	Freq	91	40	32	14	2	179	1.9
	Share	50.8%	22.3%	17.9%	7.8%	1.1%		
	Chisq P-Value	0.41762	0.27519	0.29396	0.00849	0.13524		
East Vic	Freq	36	18	28	5	0	87	2.0
	Share	41.4%	20.7%	32.2%	5.7%	0.0%		
	Chisq P-Value	0.07995	0.6859	0.03193	0.39072	0.55232		
Northern NSW/Qld	Freq	62	31	15	2	0	110	1.6
	Share	56.4%	28.2%	13.6%	1.8%	0.0%		
	Chisq P-Value	0.88582	0.02342	0.07482	0.26484	0.50398		
SA Peninsula	Freq	20	0	5	2	0	27	1.6
	Share	74.1%	0.0%	18.5%	7.4%	0.0%		
	Chisq P-Value	0.19082	0.02422	0.73707	0.3609	0.74059		
Tasmania	Freq	26	5	10	1	0	42	1.7
	Share	61.9%	11.9%	23.8%	2.4%	0.0%		
	Chisq P-Value	0.5677	0.3022	0.74859	0.61364	0.67967		
Western Australia	Freq	73	16	17	1	0	107	1.5
	Share	68.2%	15.0%	15.9%	0.9%	0.0%		
	Chisq P-Value	0.07333	0.35774	0.20947	0.1185	0.50985		
Wimmera Mallee Murray	Freq	101	29	52	4	1	187	1.8
	Share	54.0%	15.5%	27.8%	2.1%	0.5%		
	Chisq P-Value	0.80624	0.29793	0.06361	0.21783	0.7822		
All Regions	Freq	**409**	**139**	**159**	**29**	**3**	**739**	**1.8**
	Share	**55.4%**	**18.8%**	**21.5%**	**3.9%**	**0.4%**		

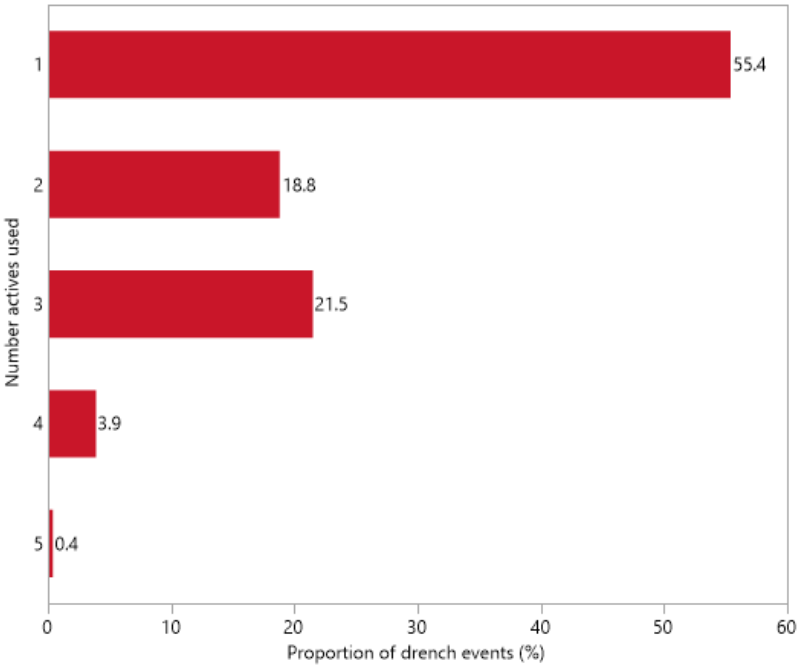

Figure 13-8: Number of anthelmintic actives used in combination as a proportion of drenching events- Nationally

SA Peninsula (74.1%) and Western Australian sheep producers are most likely to use a single active when drenching (68.2%). East Victoria has the highest rate of actives used in combination (58.6%) followed by Central NSW (49.2%) and Wimmera Mallee Murray (46.0%).
Nationally, there was a slight drop in proportion using single actives in 2018 (55.4%) compared with 2011 (57.0%).

13.11 Number of anthelmintic actives used in combination in drenching events in 2018 for all classes by Chosen enterprise.

Table 13-12: Number of anthelmintic actives used in combination, as a percentage of drenching events across all sheep classes, by Chosen enterprise. Share is the proportion of all responses to the question and rate is the proportion of respondents who selected the particular option within the question, p-values for cell chi-squares are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Chosen enterprise		Number of anthelmintics used in combination						
		1	2	3	4	5	Total drenching events	Mean number in combination
Merino x Merino	Freq	86	37	49	14	2	188	2.0
	Share	45.7%	19.7%	26.1%	7.4%	1.1%		
	Chisq P-Value	0.07683	0.78288	0.1788	0.01476	0.15685		
Merino wethers	Freq	18	8	8	1	0	35	1.8
	Share	51.4%	22.9%	22.9%	2.9%	0.0%		
	Chisq P-Value	0.75546	0.58082	0.86414	0.74997	0.70622		
Merino x Other	Freq	269	84	88	12	1	454	1.7
	Share	59.3%	18.5%	19.4%	2.6%	0.2%		
	Chisq P-Value	0.26326	0.88011	0.32734	0.16823	0.53461		
Meat x Meat	Freq	28	10	14	2	0	54	1.8
	Share	51.9%	18.5%	25.9%	3.7%	0.0%		
	Chisq P-Value	0.73006	0.96072	0.48474	0.9348	0.63964		
Other enterprise	Freq	8	0	0	0	0	8	1.0
	Share	100.0%	0.0%	0.0%	0.0%	0.0%		
	Chisq P-Value	0.08955	0.21994	0.18953	0.57527	0.85699		
All Enterprises	Freq	**409**	**139**	**159**	**29**	**3**	**739**	**1.8**
	Share	**55.4%**	**18.8%**	**21.5%**	**3.9%**	**0.4%**		

Merino x Merino had a higher than expected use of 4 anthelmintics in combination and were more likely to use drenches in combination than the other groups.

13.12 Anthelmintic actives used singly or in combination

Table 13-13: Anthelmintic actives used singly and in combination, as a percentage of anthelmintic uses across all sheep classes Total number of respondents who answered Q13 n=233, total number of drenching events, n=739, total number of anthelmintics used, n=1295. P-values for cell chi-squares are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue). Chi-square =1223.38, df=72, p<0.0001.

Anthelmintic actives		Proportion of anthelmintics used singly or in combination with other anthelmintics					
		Singly	With 1 other	With 2 others	With 3 others	With 4 others	Total uses
AAD Monepantel	n (active uses)	33	7	0	1	0	41
	Row Percent	80.5%	17.1%	0.0%	2.4%	0.0%	
	Chisq PValue	<0.0001	0.54369	0.0001	0.16314	0.49074	
BZ Albendazole	n (active uses)	7	21	41	21	1	91
	Row Percent	7.7%	23.1%	45.1%	23.1%	1.1%	
	Chisq PValue	0.00005	0.74032	0.1963	<0.0001	0.95801	
BZ Benzimidazole	n (active uses)	0	2	4	0	0	6
	Row Percent	0.0%	33.3%	66.7%	0.0%	0.0%	
	Chisq PValue	0.16864	0.53044	0.22857	0.46349	0.79207	
BZ Fenbendazole	n (active uses)	0	15	15	2	0	32
	Row Percent	0.0%	46.9%	46.9%	6.3%	0.0%	
	Chisq PValue	0.00148	0.00192	0.34933	0.60883	0.54265	
BZ Oxfendazole	n (active uses)	0	1	97	8	3	109
	Row Percent	0.0%	0.9%	89.0%	7.3%	2.8%	
	Chisq PValue	<0.0001	<0.0001	<0.0001	0.57245	0.12204	
BZ Triclabendazole	n (active uses)	2	8	1	1	2	14
	Row Percent	14.3%	57.1%	7.1%	7.1%	14.3%	
	Chisq PValue	0.24947	0.00396	0.06718	0.82053	<0.0001	
ISO Praziquantel	n (active uses)	0	8	0	0	0	8
	Row Percent	0.0%	100.0%	0.0%	0.0%	0.0%	
	Chisq PValue	0.11194	<0.0001	0.08605	0.39726	0.76082	
LEV Levamisole	n (active uses)	14	34	145	29	3	225
	Row Percent	6.2%	15.1%	64.4%	12.9%	1.3%	
	Chisq PValue	<0.0001	0.03961	<0.0001	0.0488	0.80727	
ML Abamectin	n (active uses)	46	95	133	28	3	305
	Row Percent	15.1%	31.1%	43.6%	9.2%	1.0%	
	Chisq PValue	<0.0001	0.00026	0.05131	0.89656	0.77681	
ML Doramectin	n (active uses)	1	0	0	0	0	1
	Row Percent	100.0%	0.0%	0.0%	0.0%	0.0%	
	Chisq PValue	0.22345	0.64313	0.54391	0.76472	0.91429	
ML Ivermectin	n (active uses)	13	0	1	0	0	14
	Row Percent	92.9%	0.0%	7.1%	0.0%	0.0%	
	Chisq PValue	<0.0001	0.08299	0.06718	0.26278	0.68717	
ML Moxidectin	n (active uses)	121	10	24	5	2	162
	Row Percent	74.7%	6.2%	14.8%	3.1%	1.2%	
	Chisq PValue	<0.0001	<0.0001	<0.0001	0.01253	0.92813	
ML Moxidectin LA	n (active uses)	21	1	0	0	1	23
	Row Percent	91.3%	4.3%	0.0%	0.0%	4.3%	
	Chisq PValue	<0.0001	0.07639	0.00361	0.15119	0.15524	

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Table 13-13 (cont'd): Anthelmintic active used singly and in combination, as a percentage of anthelmintic uses across all sheep classes Total number of respondents who answered Q13 n=233, total number of drenching events, n=739, total number of anthelmintics used, n=1295. P-values for cell chi-squares are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue). Chi-square =1223.38, df=72, p<0.0001.

Anthelmintic actives		Proportion of anthelmintics used singly or in combination with other anthelmintics					
		Singly	With 1 other	With 2 others	With 3 others	With 4 others	Total uses
OP Naphthalophos	n (active uses)	3	6	12	0	0	21
	Row Percent	14.3%	28.6%	57.1%	0.0%	0.0%	
	Chisq PValue	0.1584	0.48227	0.12516	0.17021	0.62187	
SAL-P Closantel	n (active uses)	11	29	0	21	0	61
	Row Percent	18.0%	47.5%	0.0%	34.4%	0.0%	
	Chisq PValue	0.05968	<0.0001	<0.0001	<0.0001	0.40059	
SPIRO Derquantel	n (active uses)	0	40	2	0	0	42
	Row Percent	0.0%	95.2%	4.8%	0.0%	0.0%	
	Chisq PValue	0.00027	<0.0001	0.00062	0.05242	0.4855	
SPIRO Praziquantel	n (active uses)	0	0	1	0	0	1
	Row Percent	0.0%	0.0%	100.0%	0.0%	0.0%	
	Chisq PValue	0.57412	0.64313	0.29798	0.76472	0.91429	
Unspecified Combination	n (active uses)	13	1	1	0	0	15
	Row Percent	86.7%	6.7%	6.7%	0.0%	0.0%	
	Chisq PValue	0.00015	0.21602	0.05421	0.24639	0.6768	
Unspecified drench	n (active uses)	124	0	0	0	0	124
	Row Percent	100.0%	0.0%	0.0%	0.0%	0.0%	
	Chisq PValue	<0.0001	<0.0001	<0.0001	0.00086	0.23074	

Q14. Please indicate in the table below any drench resistance tests you have undertaken between 2014 and 2018

	2014	2015	2016	2017	2018
No drench resistance tests undertaken	☐	☐	☐	☐	☐
DrenchTest (formal on-farm multiple drench resistance test using worm egg count reduction WECRT)	☐	☐	☐	☐	☐
DrenchCheck (worm egg count just before drenching and again approximately 14 days after drenching)	☐	☐	☐	☐	☐
Worm egg count after drenching only (if 3 weeks or less after treatment)	☐	☐	☐	☐	☐

14.1 Proportion of respondents who undertook a drench resistance test in the last 5 years (2014-2018)

Table 14-1: Proportion of respondents who undertook a drench test in the last 5 years by Region (number respondents *n*=188). P-values for cell chi-squares are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Region	**Was a drench test taken in last 5 years**			
		Yes	**No**	**Total**
Central NSW	*n*	16	32	48
	Percentage	33.33	66.67	
East Vic	*n*	7	9	16
	Percentage	43.75	56.25	
Northern NSW/Qld	*n*	7	20	27
	Percentage	25.93	74.07	
SA Peninsula	*n*	0	14	14
	Percentage	0.00	100.00	
Tasmania	*n*	5	3	8
	Percentage	62.50	37.50	
Western Australia	*n*	13	20	33
	Percentage	39.39	60.61	
Wimmera Mallee Murray	*n*	21	21	42
	Percentage	50.00	50.00	
Total	*n*	**69**	**119**	**188**
	Percentage	**36.7%**	**63.3%**	

Chi-square=20.165 df=6, P=0.0026.

Table 14-2: Proportion of respondents who undertook a drench test in the last 5 years by Chosen enterprise, *n*=188.

Chosen enterprise	**Was a drench test taken in last 5 years**			
		Yes	**No**	**Total**
Merino x Merino	*n*	45	72	117
	Percentage	38.46	61.54	
Merino wether	*n*	4	4	8
	Percentage	50.00	50.00	
Merino x Other	*n*	2	15	17
	Percentage	11.76	88.24	
Meat x Meat	*n*	18	26	44
	Percentage	40.91	59.09	
Other enterprise	*n*	0	2	2
	Percentage	0.00	100.00	
Total	*n*	**69**	**119**	**188**
	Percentage	**36.7%**	**63.3%**	

Chi-square=8.315 df=4, P=0.0807.

14.2 Drench resistance test undertaken Nationally in any given year from 2014-2018

Table 14-3: Proportion of drench resistance tests undertaken nationally in any given year from 2014 to 2018

		Drench tests taken				
		No test taken	**DrenchTest WECRT**	**DrenchCheck**	**WEC after drench**	**Total Responses**
2014	*n*	154	15	13	6	188
	Percentage	81.9%	8.0%	6.9%	3.2%	
2015	*n*	165	8	10	5	188
	Percentage	87.8%	4.3%	5.3%	2.7%	
2016	*n*	163	4	14	7	188
	Percentage	86.7%	2.1%	7.4%	3.7%	
2017	*n*	153	6	18	11	188
	Percentage	81.4%	3.2%	9.6%	5.9%	
2018	*n*	157	5	17	9	188
	Percentage	83.5%	2.7%	9.0%	4.8%	
In any given year	*n*	**792**	**38**	**72**	**38**	**940**
	Percentage	**84.3%**	**4.0%**	**7.7%**	**4.0%**	

Q15 If you did undertake any drench resistance testing, who assisted with the testing?

- ☐ Vet or consultant
- ☐ Government agency advisor (e.g. Ag Departments, Local Land Services)
- ☐ Drug company representative
- ☐ Private laboratory
- ☐ Rural Merchandise retailer
- ☐ Other - Write In

15.1 Who assisted with drench resistance testing by Region

Table 15-1: Proportion of agencies who assisted with drench resistance testing by Region Share is the proportion of all responses to the question and rate is the proportion of respondents who selected the particular option within the question. Asterisk (*) indicates significant difference between Regions P<0.01.

Region		Vet or consult	Govt Agency	Drug Rep	Private Lab*	Rural Merchandiser	Other	Total Responses	Total Respondents
Central NSW	*n*	2	3	2	4	1	2	14	13
	Share	14.3%	21.4%	14.3%	28.6%	7.1%	14.3%		
	Rate	15.4%	23.1%	15.4%	30.8%	7.7%	15.4%		
East Vic	*n*	4	0	1	3	1	0	9	8
	Share	44.4%	0.0%	11.1%	33.3%	11.1%	0.0%		
	Rate	50.0%	0.0%	12.5%	37.5%	12.5%	0.0%		
Northern NSW/Qld	*n*	3	2	3	4	0	1	13	12
	Share	23.1%	15.4%	23.1%	30.8%	0.0%	7.7%		
	Rate	25.0%	16.7%	25.0%	33.3%	0.0%	8.3%		
SA Peninsula	*n*	0	0	0	2	1	0	3	2
	Share	0.0%	0.0%	0.0%	66.7%	33.3%	0.0%		
	Rate	0.0%	0.0%	0.0%	100.0%	50.0%	0.0%		
Tasmania	*n*	2	0	0	1	1	0	4	4
	Share	50.0%	0.0%	0.0%	25.0%	25.0%	0.0%		
	Rate	50.0%	0.0%	0.0%	25.0%	25.0%	0.0%		
Western Australia	*n*	9	3	0	0	3	3	18	17
	Share	50.0%	16.7%	0.0%	0.0%	16.7%	16.7%		
	Rate	52.9%	17.6%	0.0%	0.0%	17.6%	17.6%		
Wimmera Mallee Murray	*n*	13	1	2	2	6	1	25	23
	Share	52.0%	4.0%	8.0%	8.0%	24.0%	4.0%		
	Rate	56.5%	4.3%	8.7%	8.7%	26.1%	4.3%		
National	*n*	**33**	**9**	**8**	**16**	**13**	**7**	**86**	**79**
	Share	**38.4%**	**10.5%**	**9.3%**	**18.6%**	**15.1%**	**8.1%**		
	Rate	**41.8%**	**11.4%**	**10.1%**	**20.3%**	**16.5%**	**8.9%**		

15.2 Who assisted with drench resistance testing by Chosen enterprise

Table 15-2: Percentage of agencies who assisted with drench resistance testing by Chosen enterprise, Share is the proportion of all responses to the question and rate is the proportion of respondents who selected the particular option within the question.

Chosen enterprise		Vet or consult	Govt Agency	Drug Rep	Private Lab	Rural Merchandiser	Other	Total Responses	Total Respondents
Merino x Merino	*n*	18	7	4	9	12	6	56	52
	Percentage	32.1%	12.5%	7.1%	16.1%	21.4%	10.7%		
	Chisq PValue	34.6%	13.5%	7.7%	17.3%	23.1%	11.5%		
Merino wethers	*n*	2	1	0	2	0	0	5	5
	Percentage	40.0%	20.0%	0.0%	40.0%	0.0%	0.0%		
	Chisq PValue	40.0%	20.0%	0.0%	40.0%	0.0%	0.0%		
Merino x Other	*n*	4	0	1	1	0	0	6	5
	Percentage	66.7%	0.0%	16.7%	16.7%	0.0%	0.0%		
	Chisq PValue	80.0%	0.0%	20.0%	20.0%	0.0%	0.0%		
Meat x Meat	*n*	8	1	3	4	1	1	18	16
	Percentage	44.4%	5.6%	16.7%	22.2%	5.6%	5.6%		
	Chisq PValue	50.0%	6.3%	18.8%	25.0%	6.3%	6.3%		
Other enterprise	*n*	1	0	0	0	0	0	1	1
	Percentage	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
	Chisq PValue	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
National	*n*	**33**	**9**	**8**	**16**	**13**	**7**	**86**	**79**
	Share	**38.4%**	**10.5%**	**9.3%**	**18.6%**	**15.1%**	**8.1%**		
	Rate	**41.8%**	**11.4%**	**10.1%**	**20.3%**	**16.5%**	**8.9%**		

Q16 Please rank how important the following factors are when deciding whether to treat ewes and weaners for worms.

	Factors important for treating **ewes**				Factors important for treating **weaners**			
	Very important	Important	Somewhat important	Not important	Very important	Important	Somewhat important	Not important
Seasonal weather conditions	○	○	○	○	○	○	○	○
Results from faecal worm egg count	○	○	○	○	○	○	○	○
Results from faecal worm egg count AND worm species identification (larval culture)	○	○	○	○	○	○	○	○
Planned preventative treatment, e.g. summer drench, pre-lambing	○	○	○	○	○	○	○	○
Condition score/appearance of sheep	○	○	○	○	○	○	○	○
Availability/quality of pasture	○	○	○	○	○	○	○	○
Time of year	○	○	○	○	○	○	○	○
Presence of daggy sheep in mob	○	○	○	○	○	○	○	○
Weak sheep when driven (poor exercise tolerance)	○	○	○	○	○	○	○	○
Convenience, e.g. when sheep are yarded for other purposes	○	○	○	○	○	○	○	○

16.1 Factors of importance when deciding whether to drench ewes and weaners for worms by Region

16.1.1 Ewes

Table 16-1: Importance of factors when deciding to drench ewes by Region. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, Important as 3 and Very important as 4. Bolded values with superscripted letters are post hoc comparisons that identify pairs of values that were significantly different on Dunn's test (within rows). N = number of responses, this is large as respondents could rate multiple treatments.

Factors when deciding to drench ewes	Mean importance of factors by Region								
	Central NSW	**East Vic**	**Northern NSW/Qld**	**SA Peninsula**	**Tasmania**	**Western Australia**	**Wimmera Mallee Murray**	**National**	**P-value**
Planned preventative trt	3.3	3.6	3.1	3.4	3.6	3.4	3.3	**3.3**	0.359
Results from WEC	3.2	3.4	3.3	2.9	3.4	2.8	3.2	**3.2**	0.5826
Seasonal weather conditions	3.2	3.2	3.4	2.9	3.6	2.9	3.0	**3.1**	0.0825
Time of year	3.1	3.4	2.8	3.3	3.2	3.0	3.1	**3.1**	0.2333
Results from WEC+LarvalDiff	2.9^{ab}	3.1^{ab}	**3.3^{a}**	2.4^{ab}	2.7^{ab}	**2.2^{b}**	2.6^{ab}	**2.8**	0.0192
Condition score	2.7	3.0	2.9	2.8	2.6	3.0	2.8	**2.8**	0.7599
Poor exercise tolerance	2.7^{ab}	3.0^{ab}	**3.3^{a}**	2.5^{ab}	2.4^{ab}	**2.4^{b}**	2.6^{ab}	**2.8**	0.0206
Availability-quality of pasture	2.4	2.9	2.9	2.8	2.7	2.7	2.8	**2.7**	0.6192
Daggy sheep	2.3	2.9	2.3	2.0	2.5	2.4	2.3	**2.4**	0.1922
Convenience	1.8	2.3	2.2	2.2	1.7	1.9	1.8	**2.0**	0.3355
N	**511**	**207**	**355**	**101**	**93**	**371**	**454**	**2092**	

16.1.2 Weaners

Table 16-2: Importance of factors when deciding to drench weaners by Region. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, Important as 3 and Very important as 4. N = number of responses, this is large as respondents could rate multiple treatments.

Factors when deciding to drench weaners	Mean importance of factors by Region								
	Central NSW	**East Vic**	**Northern NSW/Qld**	**SA Peninsula**	**Tasmania**	**Western Australia**	**Wimmera Mallee Murray**	**National**	**P-value**
Results from WEC	3.3	3.3	3.3	2.9	3.9	3.1	3.3	**3.3**	0.7231
Planned preventative trt	3.4	3.5	3.0	3.5	3.7	3.1	3.2	**3.3**	0.2139
Seasonal weather conditions	3.1	3.5	3.5	2.9	3.5	3.1	3.1	**3.2**	0.2896
Condition score	2.9	3.1	2.9	2.9	3.1	3.2	2.8	**3.0**	0.6503
Time of year	3.2	3.3	2.8	3.3	2.9	3.0	2.9	**3.0**	0.2061
Availability-quality of pasture	2.6	3.1	3.0	2.8	3.3	2.9	2.9	**2.9**	0.769
Results from WEC+LarvalDiff	3.0	3.1	3.3	2.0	3.4	2.4	2.7	**2.8**	0.0687
Poor exercise tolerance	2.8	2.9	3.2	2.4	2.9	2.4	2.7	**2.8**	0.1179
Daggy sheep	2.6	3.1	2.6	2.3	3.0	2.5	2.5	**2.6**	0.235
Convenience	1.9	2.3	2.3	2.1	2.0	1.8	1.8	**1.9**	0.2266
N	**449**	**170**	**286**	**91**	**80**	**348**	**412**	**1836**	

16.2 Factors of importance when deciding whether to drench ewes and weaners for worms by Chosen enterprise

16.2.1 Ewes

Table 16-3: Importance of factors when deciding to drench ewes by Chosen enterprise. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, Important as 3 and Very important as 4. N = number of responses, this is large as respondents could rate multiple treatments.

Factors when deciding to drench ewes	Mean importance of factors by Chosen enterprise						
	Merino x Merino	**Merino wethers**	**Merino x Other**	**Meat x Meat**	**Other Enterprise**	**All enterprises**	**P-value**
Planned preventative trt	3.3	3.1	3.1	3.5	3.5	**3.3**	0.3892
Results from WEC	3.2	3.6	2.6	3.2	3.7	**3.2**	0.5763
Seasonal weather conditions	3.1	3.5	3.1	3.1	3.6	**3.1**	0.4305
Time of year	2.9	3.3	3.3	3.3	3.3	**3.1**	0.1235
Results from WEC+LarvalDiff	2.7	3.2	2.5	2.9	3.2	**2.8**	0.7012
Condition score	2.9	2.9	2.7	2.7	3.4	**2.8**	0.4568
Poor exercise tolerance	2.7	2.9	2.8	2.9	3	**2.8**	0.753
Availability-quality of pasture	2.7	3	2.7	2.7	3.1	**2.7**	0.7169
Daggy sheep	2.3	2.5	2.8	2.3	2.4	**2.4**	0.3727
Convenience	2	2.3	1.9	1.7	1.9	**2**	0.2266
N	**1318**	**70**	**179**	**453**	**72**	**2092**	

16.2.2 Weaners

Table 16-4: Importance of factors when deciding to drench weaners by Chosen enterprise. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, Important as 3 and Very important as 4. N = number of responses, this is large as respondents could rate multiple treatments.

Factors when deciding to drench weaners	Mean importance of factors by Chosen enterprise						
	Merino x Merino	**Merino wethers**	**Merino x Other**	**Meat x Meat**	**Other Enterprise**	**All enterprises**	**P-value**
Results from WEC	3.3	3.4	2.7	3.1	3.8	**3.3**	0.6259
Planned preventative trt	3.2	3.5	3.4	3.3	3.8	**3.3**	0.6458
Seasonal weather conditions	3.2	3.5	3.1	3.2	3.5	**3.2**	0.8993
Condition score	3	2.4	2.8	2.9	3.3	**3**	0.4505
Time of year	2.9	3.4	3.6	3.1	3.2	**3**	0.1019
Availability-quality of pasture	2.8	2.4	2.9	3	3	**2.9**	0.6224
Results from WEC+LarvalDiff	2.7	3.1	2.6	3.1	3.3	**2.8**	0.4107
Poor exercise tolerance	2.8	2.4	2.7	2.9	2.6	**2.8**	0.7628
Daggy sheep	2.6	2.5	2.9	2.7	1.8	**2.6**	0.2457
Convenience	2	2.4	2	1.7	1.8	**1.9**	0.1369
N	**1195**	**73**	**128**	**392**	**48**	**1836**	

Q17. Have you tested or treated for Liver fluke in the last 5 years in your chosen enterprise?

17.1 Proportion of respondents who tested or treated for liver fluke in the last five years (2014-2018) by Region

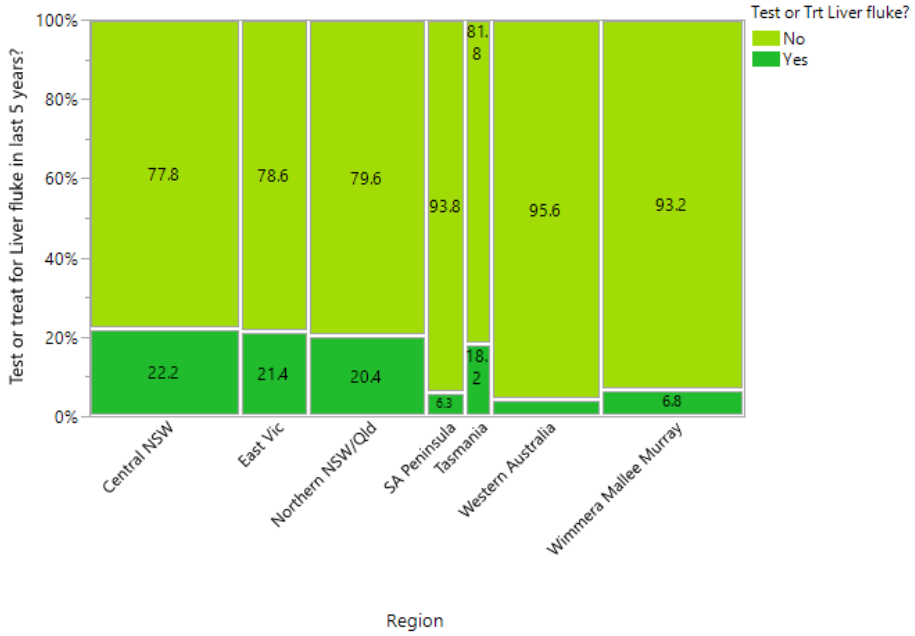


Figure 17-1: Proportion of respondents who tested or treated for Liver fluke in the last 5 years (2014-2018) by Region, total number of respondents Q17 *n*=271, chi-square=14.347, df=6, P=0.0260.

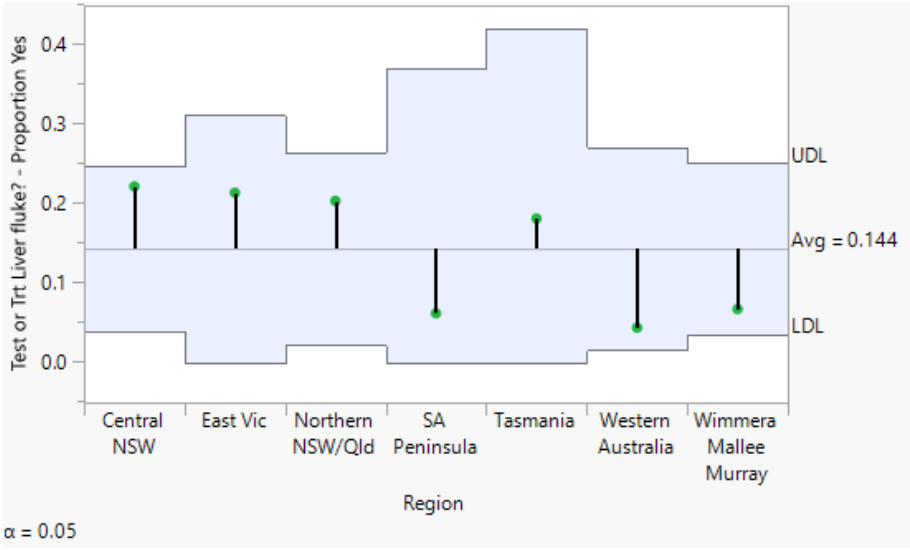


Figure 17-2: Analysis of means for proportions of respondents who tested or treated for Liver fluke in the last 5 years (2014-2018) by Region. Black line indicates the Region mean distance from the overall mean, red dot indicates the mean is significantly different from the overall mean, green dot indicates the mean does not differ significantly from the overall mean.

Table 17-1: Proportion of respondents who tested or treated for Liver fluke over 5 years (2014-2018) by Region.

Region	***n***	**Proportion who tested or treated for Liver fluke over 5 years (%)**
Central NSW	63	22.2
East Vic	28	21.4
Northern NSW/Qld	49	20.4
SA Peninsula	16	6.3
Tasmania	11	18.2
Western Australia	45	4.4
Wimmera Mallee Murray	59	6.8
All Regions	**271**	**14.4**

17.2 Proportion of respondents who tested or treated for liver fluke in the last five years (2014-2018) by Chosen enterprise

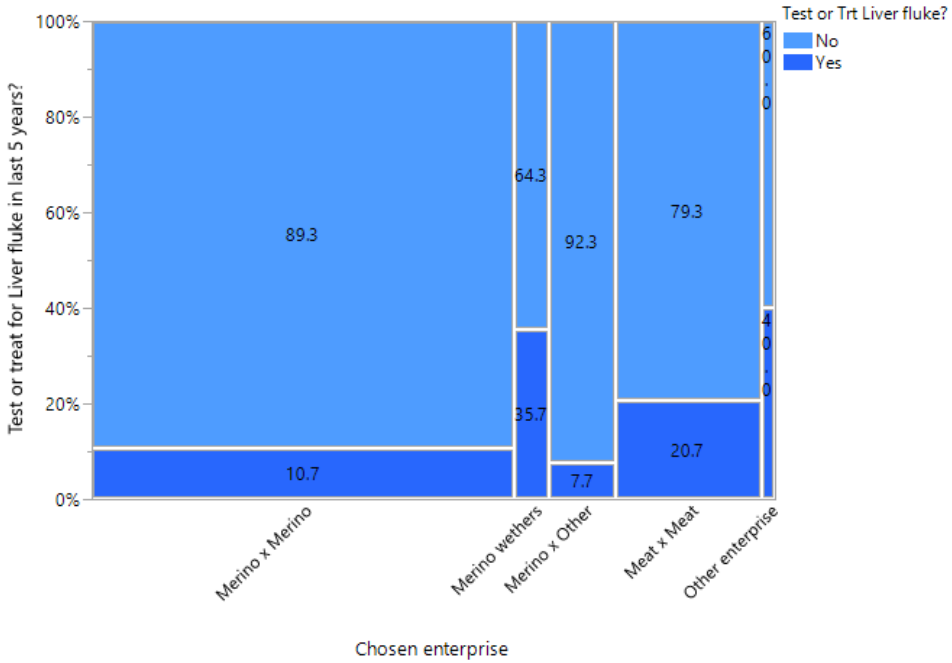


Figure 17-3: Proportion of respondents who tested or treated for Liver fluke in the last 5 years (2014-2018) by Chosen enterprise, total number of respondents Q17 *n*=271, chi-square=10.677, df=4, P=0.0304.

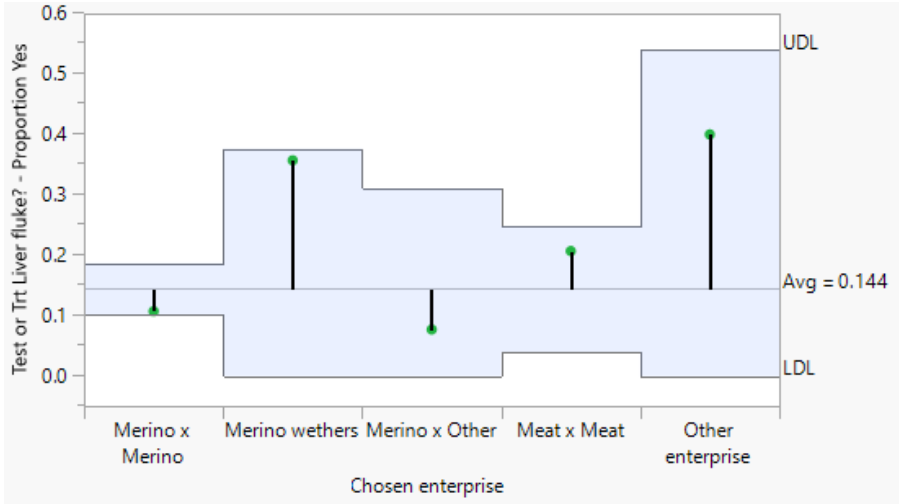


Figure 17-4: Analysis of means for proportions of respondents who tested or treated for Liver fluke in the last 5 years (2014-2018) by Chosen enterprise. Black line indicates the Region mean distance from the overall mean, red dot indicates the mean is significantly different from the overall mean, green dot indicates the mean does not differ significantly from the overall mean.

Table 17-2: Proportion of respondents who tested or treated for Liver fluke over 5 years (2014-2018) by Chosen enterprise.

Region	***n***	**Proportion who tested or treated for Liver fluke over 5 years (%)**
Merino x Merino	168	10.7
Merino wethers	14	35.7
Merino x Other	26	7.7
Meat x Meat	58	20.7
Other enterprise	5	40.0
All Regions	**271**	**14.4**

Q18. Please fill out the table below for diagnostic testing and treatments for liver fluke from 2014 to 2018:

	Did you test for Liver fluke?			Did you treat for Liver fluke?	
	Did not test	Positive test for Liver Fluke	Negative test for liver fluke	Did not treat	Treated with chemicals
2014	○	○	○	○	○
2015	○	○	○	○	○
2016	○	○	○	○	○
2017	○	○	○	○	○
2018	○	○	○	○	○

Only those who answered 'Yes" to Q17 answered further questions on liver fluke.

18.1 Testing for Liver fluke in any given year (2014 -2018) - National

Table 18-1: National proportion of respondents who tested or did not test for Liver fluke in any given year (2014-2018), total number of respondents *n*=39.

		Test for Liver fluke			
Year		**Positive test**	**Negative test**	**Did not test**	**Total Responses**
2014	*n*	6	12	12	30
	Percentage	20.0%	40.0%	40.0%	
	Chisq PValue	0.95916	0.51115	0.60271	
2015	*n*	3	8	16	27
	Percentage	11.1%	29.6%	59.3%	
	Chisq PValue	0.28433	0.75404	0.33001	
2016	*n*	8	7	12	27
	Percentage	29.6%	25.9%	44.4%	
	Chisq PValue	0.28976	0.5171	0.87677	
2017	*n*	6	11	14	31
	Percentage	19.4%	35.5%	45.2%	
	Chisq PValue	0.89534	0.81744	0.91431	
2018	*n*	6	9	12	27
	Percentage	22.2%	33.3%	44.4%	
	Chisq PValue	0.83606	0.98308	0.87677	
Average Year	*n*	**29**	**47**	**66**	**142**
	Percentage	**20.4%**	**33.1%**	**46.5%**	

18.2 Testing for Liver fluke over 5 years

18.2.1 Testing for Liver fluke over 5 years by Region

Table 18-2: Proportion of respondents who tested or did not test for Liver fluke over 5 years by Region.

Region		**Test for Liver fluke**			
		Positive test	**Negative test**	**Did not test**	**Total responses**
Central NSW	*n* Percentage Chisq PValue	6 28.6% 0.74342	6 28.6% 0.39429	9 42.9% 0.52091	21
East Victoria	*n* Percentage Chisq PValue	2 28.6% 0.85011	4 57.1% 0.48536	1 14.3% 0.36061	7
Northern NSW/Qld	*n* Percentage Chisq PValue	3 30.0% 0.75183	4 40.0% 0.98473	3 30.0% 0.80408	10
SA Peninsula	*n* Percentage Chisq PValue	0 0.0% 0.4795	1 50.0% 0.83056	1 50.0% 0.71153	2
Tasmania	*n* Percentage Chisq PValue	1 25.0% 1	1 25.0% 0.62826	2 50.0% 0.60099	4
Western Australia	*n* Percentage Chisq PValue	0 0.0% 0.4795	2 100.0% 0.18462	0 0.0% 0.40538	2
Wimmera Mallee Murray	*n* Percentage Chisq PValue	1 16.7% 0.68309	3 50.0% 0.71092	2 33.3% 0.95743	6
All Regions	*n* Percentage	**13** **25.0%**	**21** **40.4%**	**18** **34.6%**	**52**

18.2.2 Testing for Liver fluke over 5 years by Chosen enterprise

Table 18-3: Proportion of respondents who tested or did not test for Liver fluke over 5 years by Chosen enterprise.

Chosen enterprise		**Test for Liver fluke**			
		Positive test	**Negative test**	**Did not test**	**Total responses**
Merino x Merino	*n* Percentage Chisq PValue	7 30.4% 0.60217	9 39.1% 0.92459	7 30.4% 0.73327	23
Merino wethers	*n* Percentage Chisq PValue	0 0.0% 0.26355	3 60.0% 0.49007	2 40.0% 0.83785	5
Merino x Other	*n* Percentage Chisq PValue	1 20.0% 0.82306	2 40.0% 0.9892	2 40.0% 0.83785	5
Meat x Meat	*n* Percentage Chisq PValue	4 26.7% 0.89728	6 40.0% 0.9813	5 33.3% 0.93274	15
Other enterprise	*n* Percentage Chisq PValue	1 25.0% 1	1 25.0% 0.62826	2 50.0% 0.60099	4
All Regions	*n* Percentage	**13** **25.0%**	**21** **40.4%**	**18** **34.6%**	**52**

18.3 Treat for Liver fluke in any given year (2014-2018) - National

Table 18-4: National proportion of respondents who tested or did not test for Liver fluke in any given year (2014-2018). Total number of respondents *n*=31.

Year		Treated with chemicals	Did not treat	Total Responses
2014	*n* Percentage Chisq PValue	11 50.0% 0.86016	11 50.0% 0.8524	22
2015	*n* Percentage Chisq PValue	12 63.2% 0.53123	7 36.8% 0.50844	19
2016	*n* Percentage Chisq PValue	11 50.0% 0.86016	11 50.0% 0.8524	22
2017	*n* Percentage Chisq PValue	12 52.2% 0.97085	11 47.8% 0.96921	23
2018	*n* Percentage Chisq PValue	12 50.0% 0.85401	12 50.0% 0.84592	24
Average Year	*n* Percentage	**52** **47.3%**	**58** **52.7%**	**110**

18.4 Treating for Liver fluke over 5 years

Table 18-5: Proportion of respondents who treated for liver fluke in the last 5 years by Region.

Region		Treated with chemicals	Did not treat	Total Responses
Central NSW	*n* Percentage Chisq PValue	8 66.7% 0.60558	4 33.3% 0.5637	12
East Vic	*n* Percentage Chisq PValue	3 60.0% 0.89393	2 40.0% 0.8815	5
Northern NSW/Qld	*n* Percentage Chisq PValue	5 55.6% 1	4 44.4% 1	9
SA Peninsula	*n* Percentage Chisq PValue	0 -	0 -	0 -
Tasmania	*n* Percentage Chisq PValue	1 33.3% 0.60558	2 66.7% 0.5637	3
Western Australia	*n* Percentage Chisq PValue	0 0.0% 0.45606	1 100.0% 0.40466	1
Wimmera Mallee Murray	*n* Percentage Chisq PValue	3 50.0% 0.85513	3 50.0% 0.83826	6
Total	*n* Percentage	**20** **55.6%**	**16** **44.4%**	**36**

Table 18-6: Proportion of respondents who treated for liver fluke over 5 years by Chosen enterprise.

Chosen enterprise		Treated with chemicals	Did not treat	Total Responses
Merino x Merino	*n* Percentage Chisq PValue	9 52.9% 0.88501	8 47.1% 0.87155	17
Merino wether	*n* Percentage Chisq PValue	3 75.0% 0.60184	1 25.0% 0.55967	4
Merino x Other	*n* Percentage Chisq PValue	1 50.0% 0.91605	1 50.0% 0.90619	2
Meat x Meat	*n* Percentage Chisq PValue	5 50.0% 0.81366	5 50.0% 0.79215	10
Other enterprise	*n* Percentage Chisq PValue	2 66.7% 0.79625	1 33.3% 0.77283	3
Total	*n* Percentage	**20** **55.6%**	**16** **44.4%**	**36**

Q19 If you treated your sheep for Liver fluke in 2018, please give details of those treatments below.

	Month	Sheep class						Product used
		Adult ewes	Maiden ewes	Lambs and weaners	Unmated hoggets/ yearlings	Adult wethers	Rams	
1		☐	☐	☐	☐	☐	☐	
2		☐	☐	☐	☐	☐	☐	
3		☐	☐	☐	☐	☐	☐	
4		☐	☐	☐	☐	☐	☐	
5		☐	☐	☐	☐	☐	☐	
6		☐	☐	☐	☐	☐	☐	

19.1 Liver fluke treatments by month – National

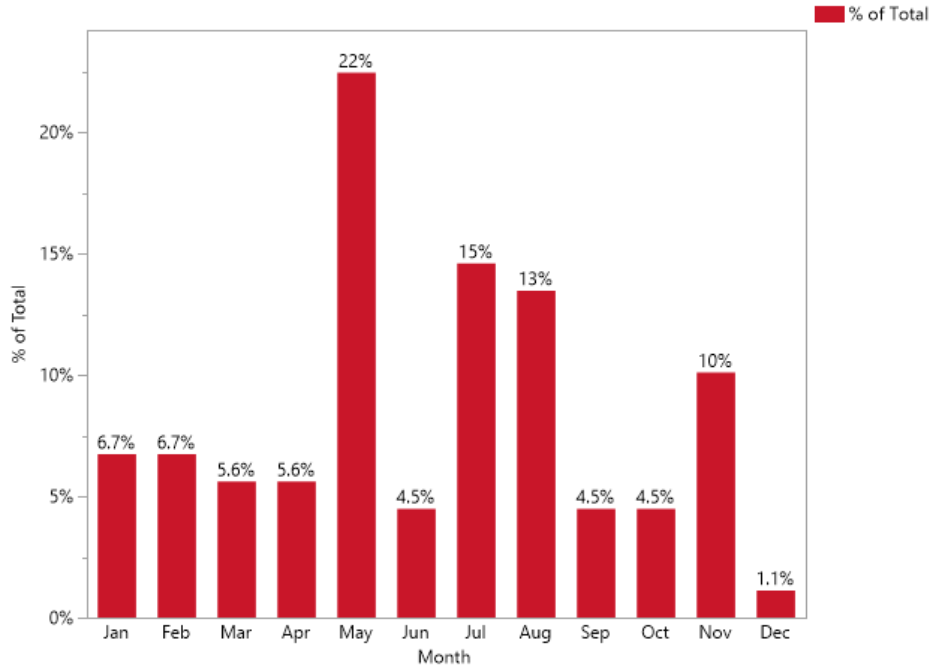


Figure 19-1: Liver fluke treatments in 2018 by month as a proportion of total treatments given over all classes, total responses *n*=89.

19.2 Liver fluke treatments in 2018 by class and Region

Table 19-1: Mean number of times Liver fluke was treated in 2018 by class and Region (Total number of respondents for this question *n*=15).

	Mean number of Liver fluke treatments													
	All Classes		**Adult Ewes**		**Adult wethers**		**Hoggets**		**Lambs & Weaners**		**Maiden Ewes**		**Rams**	
Regions	*N*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Central NSW	26	**2.4 (1-4)**	6.0	2.5(1-4)	5.0	2.0 (1-3)	3.0	2.7 (1-4)	4.0	2.3 (1-4)	3.0	2.7 (1-4)	5.0	2.6 (1-4)
East Vic	3	**1.7 (1-3)**	1.0	3.0	1.0	1.0	0.0	.	0.0	.	0.0	.	1.0	1.0
Northern NSW/Qld	12	**1.5 (1-2)**	2.0	1.5 (1-2)	1.0	2.0	2.0	1.5 (1-2)	1.0	2.0	2.0	1.5 (1-2)	4.0	1.3 (1-2)
South Australia	0	**-**	0	-	0	-	0	-	0	-	0	-	0	-
Tasmania	0	**-**	0	-	0	-	0	-	0	-	0	-	0	-
Western Australia	2	**1.0 (1-1)**	1.0	1.0	0.0	-	0.0	-	0.0	-	1.0	1.0	0.0	-
Wimmera Mallee Murray	2	**1.0 (1-1)**	1.0	1.0	0.0	-	0.0	-	0.0	-	1.0	1.0	0.0	-
All Regions	***45***	**2.0**	**11**	**2.1**	**7**	**1.9**	**5**	**2.2**	**5**	**2.2**	**7**	**1.9**	**10**	**1.9**
P-value		*0.0929*		*0.4951*		*0.5689*		*0.3743*		*1.0*		*0.5180*		*0.2947*

n = total responses

19.3 Liver fluke treatments in 2018 by class and Chosen enterprise

Table 19-2: Mean number of times Liver fluke was treated in 2018 by class and Chosen enterprise (Total number of respondents for this question *n*=15).

	Mean number of Liver fluke treatments													
	All Classes		**Adult Ewes**		**Adult wethers**		**Hoggets**		**Lambs & Weaners**		**Maiden Ewes**		**Rams**	
Chosen enterprise	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Merino ewes joined to Merino rams	18	**1.3 (1-2)**	3	1.3 (1-2)	2	1.5 (1-2)	3	1.3 (1-2)	2	1.5 (1-2)	3	1.3 (1-2)	5	1.2 (1-2)
Merino wethers	9	**2.4 (1-3)**	2	2.5 (2-3)	2	2.0 (1-3)	1	3.0	2	2.0 (1-3)	1	3.0	1	3.0
Merino ewes joined to Other rams	3	**1.0 (1-1)**	1	1.0	1	1.0	0	-	0	-	0	-	1	1.0
Meat ewes joined to Meat rams	7	**2.3 (1-4)**	3	2.7 (1-4)	1	2.0	0	-	0	-	1	1.0	2	2.5 (1-4)
Other enterprise	8	**3.1 (1-4)**	2	2.5 (1-4)	1	3.0	1	4.0	1	4.0	2	2.5 (1-4)	1	4.0
All Enterprises	***45***	**2.0**	**11**	**2.1**	**7**	**1.9**	**5**	**2.2**	**5**	**2.2**	**7**	**1.9**	**10**	**1.9**
P-value		*0.0929*		*0.5495*		*0.5884*		*0.1856*		*0.3311*		*0.5180*		*0.2751*

19.4 Active ingredients used for Liver fluke treatment in 2018.

Table 19-3: Active ingredients used to treat Liver fluke in 2018 as a proportion of the total.

Active used	% of Total
BZ Triclabendazole	40.3%
SAL-P Closantel	21.0%
BZ Oxfendazole+BZ Triclabendazole	16.1%
ML Abamectin+SAL-P Closantel	9.7%
ML Abamectin+BZ Albendazole+SAL-P Closantel+LEV Levamisole	8.1%
ML Moxidectin+BZ Triclabendazole	4.8%

Q20 Please indicate how important the following factors are when deciding to treat for liver fluke.

Q20 Please indicate how important the following factors are when deciding to treat for Liver fluke.

	Very important	Important	Somewhat Important	Not important
Results from liver fluke test (faecal test, ELISA antibody blood test or faecal antigen test)	○	○	○	○
Time of year/strategic treatments	○	○	○	○
Appearance/condition of sheep	○	○	○	○
Seasonal weather conditions	○	○	○	○
After grazing 'flukey' paddocks	○	○	○	○

20.1 Factors of importance when deciding to treat for Liver fluke by Region

Table 20-1: Importance of factors when deciding to treat for Liver fluke by Region. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, Important as 3 and Very important as 4.

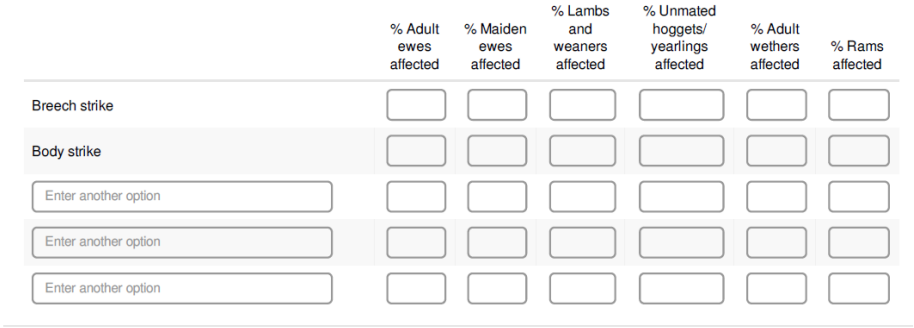
Factors when deciding to drench ewes	Mean importance of factors by Region								
	Central NSW	East Vic	Northern NSW/Qld	SA Peninsula	Tasmania	Western Australia	Wimmera Mallee Murray	National	P-value
Results from Liver fluke test	3.4	3.8	3.1	-	3.0	4.0	3.0	**3.4**	0.6869
Time of year/strategic treatments	3.2	3.4	3.3	-	3.0	-	3.5	**3.3**	0.9549
Appearance/condition of sheep	3.3	2.0	2.7	3.0	4.0	-	3.0	**3.0**	0.3757
Seasonal weather conditions	3.0	3.2	2.9	3.0	3.0	-	2.7	**3.0**	0.9640
After grazing 'flukey' paddocks	2.9	2.8	2.2	-	-	-	3.0	**2.7**	0.6649
N	**48.0**	**21.0**	**31.0**	**2.0**	**4.0**	**1.0**	**14.0**	**121**	

20.2 Factors of importance when deciding to treat for Liver fluke by Chosen enterprise

Table 20-2: Importance of factors when deciding to treat for Liver fluke by Chosen enterprise. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, Important as 3 and Very important as 4.

Factors when deciding to drench ewes	Mean importance of factors by Chosen enterprise						
	Merino x Merino	Merino wethers	Merino x Other	Meat x Meat	Other Enterprise	All enterprises	P-value
Results from Liver fluke test	3.1	3.0	4.0	3.7	3.0	**3.4**	0.7142
Time of year/strategic treatments	2.7	3.8	3.5	3.6	3.5	**3.3**	0.5145
Appearance/condition of sheep	2.8	4.0	3.0	2.6	4.0	**3.0**	0.1914
Seasonal weather conditions	2.5	3.8	3.0	3.0	4.0	**3.0**	0.1228
After grazing 'flukey' paddocks	1.9	3.3	3.0	3.1	3.5	**2.7**	0.1359
N	**48.0**	**15.0**	**9.0**	**39.0**	**10.0**	**121**	

Q21. In 2018, if you had blowfly strike on your reporting property for your chosen enterprise, please provide details below, leave blank if no sheep struck.



21.1 Proportion of respondents who reported flystrike

21.1.1 Proportion of respondents who reported flystrike - All types of flystrike

Table 21-1: Proportion of respondents reporting flystrike in 2018 by Region.

Region	*n*	Proportion reporting flystrike (%)
Central NSW	83	50.6
East Vic	44	45.5
Northern NSW/Qld	62	46.8
SA Peninsula	20	40.0
Tasmania	13	53.9
Western Australia	53	54.7
Wimmera Mallee Murray	79	46.8
National	**354**	**48.6%**

Chi-Sq=2.023, df=6, P=0.9175.

Table 21-2: Proportion of respondents reporting flystrike in 2018 by Chosen enterprise.

Chosen enterprise	*n*	Proportion reporting flystrike (%)
Merino x Merino	220	53.6
Merino wether	16	37.5
Merino x Other	36	44.4
Meat x Meat	69	37.7
Other enterprise	13	46.2
All enterprises	**354**	**48.6%**

Chi-Sq=6.647, df=4, P=0.1558.

2011 survey reported 78% reported breech strike in ewes and 45% in wethers, 68% body strike in ewes and 49% in wethers. 2018 was a drier than average year which may have resulted in lower incidence of flystrike.

21.1.2 Proportion of respondents who reported breech strike

Table 21-3: Proportion of respondents who reported breech strike by class of sheep and Region, P values are for a chi-square test, for each class. Shaded cells indicate percentages of respondents that are significantly higher than the national proportion (red) or significantly lower (blue).

	Adult ewes		Maiden ewes		Lambs and weaners		Hoggets		Wethers			Rams
Region	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Central NSW	83	37.4	83	27.7	83	36.1	83	10.8	83	6.0	83	9.6
East Vic	44	36.4	44	27.3	44	29.6	44	9.1	44	15.9	44	11.4
Northern NSW/Qld	62	27.4	62	17.7	62	22.6	62	9.7	62	4.8	62	6.5
SA Peninsula	20	25.0	20	25.0	20	15.0	20	10.0	20	5.0	20	15.0
Tasmania	13	46.2	13	46.2	13	53.9	13	15.4	13	7.7	13	15.4
Western Australia	53	50.9	53	39.6	53	50.9	53	30.2	53	13.2	53	28.3
Wimmera Mallee Murray	79	36.7	79	25.3	79	31.7	79	8.9	79	2.5	79	7.6
All Regions	**354**	**37.0**	**354**	**27.7**	**354**	**33.6**	**354**	**13.0**	**354**	**7.4**	**354**	**12.1**
P-value		*0.1978*		*0.1643*		*0.0099*		*0.0308*		*0.1074*		*0.0227*

Table 21-4: Proportion of respondents who reported breech strike by class of sheep and Chosen enterprise, P values are for a chi-square test, for each class. Shaded cells indicate percentages of respondents that are significantly higher than the national proportion (red) or significantly lower (blue).

	Adult ewes		Maiden ewes		Lambs and weaners		Hoggets		Wethers			Rams
Chosen enterprise	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Merino x Merino	220	38.6	220	32.3	220	36.8	220	17.7	220	10.5	220	15.5
Merino wethers	16	18.8	16	0.0	16	18.8	16	6.3	16	12.5	16	0.0
Merino x Other	36	41.7	36	22.2	36	33.3	36	2.8	36	0.0	36	8.3
Meat x Meat	69	31.9	69	21.7	69	27.5	69	5.8	69	1.5	69	5.8
Other enterprise	13	46.2	13	30.8	13	30.8	13	7.7	13	0.0	13	15.4
All enterprises	***354***	**37.0**	**354**	**27.7**	**354**	**33.6**	**354**	**13.0**	**354**	**7.4**	**354**	**12.1**
P-value		*0.3589*		*0.0058*		*0.4089*		*0.0084*		*0.0031*		*0.0394*

2011 survey reported 78% respondents reporting breech strike in ewes, 35% in weaners, 45% in wethers and 20% in rams
2003 survey reported 82% respondents reporting breech strike in ewes, 70% in weaners, and 50% in wethers.

21.1.2 Proportion of respondents who reported body strike

Table 21-5: Proportion of respondents who reported body strike by class of sheep and Region, P values are for a chi-square test, for each class. Shaded cells indicate percentages of respondents that are significantly higher than the national proportion (red) or significantly lower (blue).

	Adult ewes		Maiden ewes		Lambs and weaners		Hoggets		Wethers			Rams
Region	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Central NSW	83	15.7	83	12.1	83	21.7	83	6.0	83	1.2	83	6.0
East Vic	44	20.5	44	11.4	44	20.5	44	4.6	44	9.1	44	6.8
Northern NSW/Qld	62	14.5	62	6.5	62	22.6	62	6.5	62	1.6	62	1.6
SA Peninsula	20	0.0	20	5.0	20	10.0	20	10.0	20	0.0	20	0.0
Tasmania	13	15.4	13	15.4	13	15.4	13	7.7	13	0.0	13	0.0
Western Australia	53	26.4	53	22.6	53	32.1	53	15.1	53	5.7	53	13.2
Wimmera Mallee Murray	79	5.1	79	2.5	79	13.9	79	5.1	79	2.5	79	1.3
All Regions	**354**	**14.4**	**354**	**10.2**	**354**	**20.6**	**354**	**7.3**	**354**	**3.1**	**354**	**4.8**
P-value		*0.0029*		*0.0116*		*0.2213*		*0.4925*		*0.2074*		*0.0258*

Table 21-6: Proportion of respondents who reported body strike by class of sheep and Chosen enterprise, P values are for a chi-square test, for each class. Shaded cells indicate percentages of respondents that are significantly higher than the national proportion (red) or significantly lower (blue).

	Adult ewes		Maiden ewes		Lambs and weaners		Hoggets		Wethers			Rams
Chosen enterprise	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*N*	%
Merino x Merino	220	13.6		12.3		25.5		10.0		4.1		6.4
Merino wethers	16	6.3		6.3		0.0		6.3		6.3		0.0
Merino x Other	36	19.4		8.3		19.4		2.8		0.0		2.8
Meat x Meat	69	14.5		4.4		10.1		2.9		1.5		2.9
Other enterprise	13	23.1		15.4		23.1		0.0		0.0		0.0
All enterprises	***354***	**14.4**	**354**	**10.2**	**354**	**20.6**	**354**	**7.3**	**354**	**3.1**	**354**	**4.8**
P-value		*0.6376*		*0.2888*		*0.0032*		*0.0893*		*0.2947*		*0.2940*

2011 survey reported 68% respondents reporting body strike in ewes, 34% in weaners, 49% in wethers and 12% in rams
2003 survey reported 45% respondents reporting body strike in ewes, 54% in weaners and 44% in wethers

21.2 Reported incidence of flystrike

21.2.1 Reported incidence of flystrike by all types and Region

Table 21-7: Mean incidence of flystrike as a proportion of respondent's flock in 2018 by type of flystrike and Region.

	Mean incidence of flystrike (%)									
	All Flystrike		Breech strike		Body strike		Pizzle strike		Poll strike	
Region	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Central NSW	157	3.4 (0.001-100)[a]	103	3.0 (0.001-100)[a]	51	3.4 (0.1-28)[a]	0	-	3	17.3 (0.5-50)
East Vic	90	2.6 (0.4-15)[ab]	56	2.7 (0.4-15)[ab]	32	2.4 (1-10)[a]	0	-	1	0.5
Northern NSW/Qld	98	3.0 (0.01-20)[ab]	55	3.3 (0.5-20)[b]	33	1.9 (0.01-10)[ab]	4	4.75[a]	5	6.2 (0.2-10)
SA Peninsula	24	2.0 (0.1-5)[ab]	19	1.9 (0.1-5)[ab]	5	2.6 (0.2-5)[ab]	0	-	0	-
Tasmania	30	3.3 (0.1-10)[ab]	23	3.9 (1-10)[ab]	7	1.4 (0.1-3)[ab]	0	-	0	-
Western Australia	181	1.5 (0.05-10)[b]	115	1.6 (0.1-10)[c]	60	1.4 (0.1-10)[b]	4	1.3[b]	2	1.3 (1-1.5)
Wimmera Mallee Murray	115	1.9 (0.005-20)[ab]	89	1.8 (0.1-15)[c]	24	2.4 (0.005-30)[ab]	1	1[ab]	1	2.0
All Regions	***694***	**2.4**	***460***	**2.4**	***212***	**2.5**	***9***	**2.8**	***12***	**7.3**
P-value		*0.0233*		*<0.0001*		*0.0031*		*0.0416*		*0.7925*

n = total responses. Values within columns not sharing a letter in the superscript are significantly different.

21.2.2 Reported incidence of flystrike by all types and Chosen enterprise

Table 21-8: Mean incidence of flystrike as a proportion of respondent's flock in 2018 by type of flystrike and Chosen enterprise.

	Mean incidence of flystrike (%)									
	All Flystrike		Breech strike		Body strike		Pizzle strike		Poll strike	
Chosen enterprise	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Merino ewes joined to Merino rams	505	2.4 (0.005-100)[a]	331	2.4 (0.01-100)	157	2.1 (0.005-30)	7	3.0 (1-5)	9	8.4 (0.2-50)
Merino wethers	16	3.8 (0.001-10)[b]	9	3.6 (0.001-8)	4	3.4 (0.5-10)	1	4.0	2	5.7 (1.4-10)
Merino ewes joined to Other rams	57	2.6 (0.125-20)[ab]	38	2.9 (0.125-20)	18	2.0 (0.125-10)	1	0.2	0	-
Meat ewes joined to Meat rams	91	2.3 (0.01-28)[ab]	65	2.1 (0.01-15)	25	2.9 (0.1-28)	0	-	1	1.5
Other enterprise	25	2.7 (0.1-10)[ab]	17	2.4 (1-9)	8	3.4 (0.1-10)	0	-	0	-
All Enterprises	***694***	**2.4**	***460***	**2.4**	***212***	**2.5**	**9**	**2.8**	**12**	**7.3**
P-value		*0.0059*		*0.2364*		*0.7404*		*0.2771*		*0.7866*

n= total responses. Values within columns not sharing a letter in the superscript are significantly different

21.2.3 Reported incidence of Breech strike by Region

Table 21-9: Mean incidence of breech strike as a proportion of respondent's flock in 2018 by class and Region.

	Mean incidence of Breech strike (%)													
	All Classes		Adult Ewes		Adult wethers		Hoggets		Lambs & Weaners		Maiden Ewes		Rams	
Region	*N*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Central NSW	103	**3.0 (0.001-100)^{bc}**	31	4.7 (0.001-100)	4	1.4 (0.5-2)	9	2.3 (0.1-100)	29	2.3 (0.001-15)	22	1.3 (0.01-5)	8	4.9 (1-10)
East Vic	56	**2.7 (0.4-15)^{c}**	16	2.5 (0.4-6)	7	2.4 (1-5)	4	2.5 (1-5)	13	3.9 (0.5-15)	12	1.8 (1-4)	4	3.0 (1-5)
Northern NSW/Qld	55	**3.3 (0.5-20)^{ac}**	17	3.3 (1-9)	3	2.3 (1-10)	6	4.7 (1-10)	14	3.7 (1-20)	11	2.8 (1-5)	4	2.0 (1-5)
South Australia	19	**1.9 (0.1-5)^{abc}**	5	1.8 (0.2-5)	1	5.0	2	2.6 (0.2-5)	3	0.8 (1-2)	5	1.5 (0.1-5)	3	2.1 (0.2-5)
Tasmania	23	**3.9 (1-10)^{c}**	6	3.3 (1-9)	1	1.0	2	3.5 (2-5)	6	3.8 (1-8)	6	4.5 (1-10)	2	5.5 (1-10)
Western Australia	115	**1.6 (0.1-10)^{b}**	28	1.3 (0.1-5)	7	1.1 (0.5-2)	16	1.5 (0.1-5)	27	2.1 (1-10)	22	1.6 (1-5)	15	1.2 (0.2-2)
Wimmera Mallee Murray	89	**1.8 (0.1-15)^{b}**	29	1.5 (0.3-5)	2	1.1 (0.1-2)	7	1.3 (0.3-2)	25	2.2 (0.1-15)	20	1.6 (0.5-10)	6	3.0 (1-10)
All Regions	***460***	**2.4**	**132**	**2.7**	**25**	**1.8**	**46**	**2.3**	**117**	**2.6**	**98**	**1.9**	**42**	**2.7**
P-value		*<0.0001*		*0.3488*		*0.0735*		*0.3678*		*0.8862*		*0.9421*		*0.6920*

Note: n= total responses. Values within columns not sharing a letter in the superscript are significantly different.

21.2.4 Reported incidence of Body strike by Region

Table 21-10: Mean incidence of body strike as a proportion of respondent's flock in 2018 by class and Region.

	Mean incidence of Body strike (%)													
	All Classes		Adult Ewes		Adult wethers		Hoggets		Lambs & Weaners		Maiden Ewes		Rams	
Region	*N*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Central NSW	51	**3.4 (0.1-28)**	13	4.4 (0.1-28)^{ab}	1	2.0	5	2.9 (0.5-10)	18	3.2 (0.2-10)	9	1.9 (0.2-10)	5	4.6 (1-14)
East Vic	32	**2.4 (1-10)**	9	2.3 (1-5)^{a}	4	4.0 (1-10)	2	1.5 (1-2)	9	2.4 (1-10)	5	1.6 (1-2)	3	2.3 (1-5)
Northern NSW/Qld	33	**1.9 (0.01-10)**	9	1.3 (0.5-5)^{ab}	1	1.0	4	1.3 (1-2)	14	2.4 (0.01-10)	4	1.0 (1-1)	1	5.0
South Australia	5	**2.6 (0.2-5)**	0	-	0	-	2	5.0 (5-5)	2	1.1 (0.2-2)	1	1.0	0	-
Tasmania	7	**1.4 (0.1-3)**	2	0.6 (0.1-1)^{ab}	0	-	1	3.0	2	2.0 (1-3)	2	1.0 (1-1)	0	-
Western Australia	60	**1.4 (0.1-10)**	14	0.8 (0.1-1)^{ab}	3	0.7 (0.2-1)	7	1.6 (0.2-5)	17	2.0 (0.125-10)	12	1.7 (0.2-10)	7	0.9 (0.2-1)
Wimmera Mallee Murray	24	**2.4 (0.005-30)**	4	0.8 (0.005-2)^{b}	2	1.0 (1-1)	4	2.3 (0.3-5)	11	3.8 (0.1-30)	2	0.3 (0.1-0.5)	1	1.0
All Regions	***212***	**2.2**	**51**	**2.1**	**11**	**2.1**	**25**	**2.2**	**73**	**2.7**	**35**	**1.5**	**17**	**2.5**
P-value		*0.0031*		*0.0050*		*0.1680*		*0.4064*		*0.6545*		*0.1629*		*0.1143*

Note: n= total responses. Values within columns not sharing a letter in the superscript are significantly different

Mean breech strike incidence in ewes in 2011 was 4.1%, body strike was 5.5%. Again, the drier conditions in 2018 may have contributed to a reduced incidence of flystrike.
2017 AWI Merino Husbandry Practices Survey reported a national mean of 1.0% breech strike in ewes.
2003 survey reported incidence of breech strike in ewes was 2.2%, body strike was 1.0%.

21.2.3 Reported incidence of Breech strike by Region

Table 21-11: Mean incidence of breech strike as a proportion of respondent's flock in 2018 by class and Region.

	Mean incidence of Breech strike (%)													
	All Classes		Adult Ewes		Adult wethers		Hoggets		Lambs & Weaners		Maiden Ewes		Rams	
Chosen enterprise	*N*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Merino x Merino		**2.4 (0-100)**	86	2.8 (0-100)	22	1.6 (0.1-5)	39	2.2 (0.1-100)	79	2.4 (0.1-15)	72	1.9 (0-10)	33	2.9 (0.2-100)
Merino wethers		**3.6 (0-8)**	3	3.3 (0-5)	2	5.0 (5-5)	1	8.0	3	1.3 (0-2)	0	-	0	-
Merino x Other		**2.9 (0.1-20)**	15	2.7 (0.4-10)	0	-	1	2.0	12	4.1 (0.1-20)	7	1.7 (1-4)	3	2.3 (1-5)
Meat x Meat		**2.1 (0-15)**	22	1.9 (0-5)	1	1.0	4	1.1 (0.3-2)	19	2.8 (0-15)	15	2.0 (0-10)	4	1.8 (1-4)
Other enterprise		**2.4 (1-9)**	6	3.7 (1-9)	0	-	1	2.0	4	2.3 (1-5)	4	1.5 (1-2)	2	1.0 (1-1)
All enterprises	***460***	**2.4**	**132**	**2.4**	**25**	**2.7**	**46**	**2.3**	**117**	**2.6**	**98**	**1.9**	**42**	**2.7**
P-value		*0.2364*		*0.3488*		*0.0735*		*0.3678*		*0.8862*		*0.9421*		*0.6920*

Note: n= total responses.

21.2.4 Reported incidence of Body strike by Region

Table 21-12: Mean incidence of body strike as a proportion of respondent's flock in 2018 by class and Region.

	Mean incidence of Body strike (%)													
	All Classes		Adult Ewes		Adult wethers		Hoggets		Lambs & Weaners		Maiden Ewes		Rams	
Chosen enterprise	*N*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Merino x Merino	157	**2.1 (0-30)**	30	1.1 (0-4)	9	1.4 (0.2-3)	22	2.4 (0.2-10)	56	2.7 (0-30)	26	1.7 (0.2-10)	14	2.5 (0.2-14)
Merino wethers	4	**3.4 (0.5-10)**	1	1.0	1	10.0	1	2.0	0	-	1	0.5	0	-
Merino x Other	18	**2.0 (0.1-10)**	7	1.4 (0.1-5)	0	-	0	-	7	3.0 (0.1-10)	3	1.3 (1-2)	1	1.0
Meat x Meat	25	**2.9 (0.1-28)**	10	4.6 (0.1-28)	1	1.0	2	0.7 (0.3-1)	7	2.1 (1-4)	3	1.0 (1-1)	2	3.0 (1-5)
Other enterprise	8	**3.4 (0.1-10_**	3	5.0 (0.1-10)	0	-	0	-	3	3.7 (0.1-10)	2	0.6 (0.1-1)	0	-
All enterprises	***212***	**2.2**	**51**	**2.1**	**11**	**2.1**	**25**	**2.2**	**73**	**2.7**	**35**	**1.5**	**17**	**2.5**
P-value		*0.7404*		*0.1069*		*0.2112*		*0.2478*		*0.8245*		*0.3439*		*0.7175*

Note: n= total responses.

Q22. Did you use any of the following methods to assist with blowfly control in 2018? Please rate the importance of the methods you used.

	Used?		If you used this method, how important was it?				Compared to 5 years ago, in 2018 I have used this option:		
	Yes	No	Very important	Important	Somewhat important	Unsure	More	Same	Less
Mulesing replacement sheep	○	○	○	○	○	○	○	○	○
Buying mulesed sheep	○	○	○	○	○	○	○	○	○
Genetic selection	○	○	○	○	○	○	○	○	○
Preventative chemical treatments	○	○	○	○	○	○	○	○	○
Timing of shearing	○	○	○	○	○	○	○	○	○
Timing of crutching	○	○	○	○	○	○	○	○	○
Trapping flies (eg LuciTrap®)	○	○	○	○	○	○	○	○	○
Destroy maggots from infected sheep clippings	○	○	○	○	○	○	○	○	○

Comments

22.1 Methods used to assist with blowfly control in 2018

22.1.1 Methods used to assist with blowfly control in 2018 by Region

Table 22-1: Proportion of respondents who used methods to assist with blowfly control in 2018 by Region. P values are for a chi-square test, for each treatment. Shaded cells indicate percentages of respondents that are significantly higher than the national proportion (red) or significantly lower (blue). N= number of responses per Region.

Methods to assist with blowfly control	Proportion respondents using method by Region (%)								
	Central NSW	East Vic	Northern NSW/Qld	SA Peninsula	Tasmania	Western Australia	Wimmera Mallee Murray	National	P-value
Timing of crutching	81	76.9	66.7	92.9	70.0	80.6	72.2	**76.4**	0.3818
Preventative chemical treatment	77.6	76.9	74.4	78.6	80.0	77.8	72.2	**75.9**	0.993
Timing of shearing	72.4	57.7	69.2	50.0	40.0	72.2	52.8	**63.1**	0.1214
Mulesing sheep	55.2	30.8	35.9	64.3	20.0	55.6	48.1	**46.8**	0.0557
Genetic selection	62.1	7.7	48.7	50.0	20.0	55.6	44.4	**46.4**	<.0001
Destroy maggots	32.8	19.2	23.1	14.3	20.0	30.6	25.9	**26.2**	0.697
Buying mulesed sheep	19.0	38.5	20.5	50.0	10.0	13.9	25.9	**23.6**	0.065
Fly traps	5.2	3.8	12.8	0.0	10.0	2.8	1.9	**5.1**	0.2841
N	**58**	**26**	**39**	**14**	**10**	**36**	**54**	**237**	

22.1.2 Methods used to assist with blowfly control in 2018 by Chosen enterprise

Table 22-2: Proportion of respondents who used methods to assist with blowfly control in 2018 by Chosen enterprise. P values are for a chi-square test, for each treatment. Shaded cells indicate percentages of respondents that are significantly higher than the All enterprises proportion (red) or significantly lower (blue). N= number of responses per Chosen enterprise.

Methods to assist with blowfly control	Percentage respondents by Chosen enterprise (%)						
	Merino x Merino	Merino wethers	Merino x Other	Meat x Meat	Other Enterprise*	All enterprises	P-value
Timing of crutching	78.1	45.5	87.5	74.5	66.7	**76.4**	0.1113
Preventative chemical treatment	75.3	72.7	87.5	70.2	88.9	**75.9**	0.4213
Timing of shearing	59.3	45.5	75	72.3	66.7	**63.1**	0.2236
Mulesing sheep	69.2	18.2	12.5	8.5	11.1	**46.8**	<.0001
Genetic selection	57.5	27.3	25	25.5	55.6	**46.4**	0.0002
Destroy maggots	28.1	36.4	20.8	19.1	33.3	**26.2**	0.6086
Buying mulesed sheep	15.8	45.5	70.8	19.1	22.2	**23.6**	<.0001
Fly traps	3.4	0	12.5	4.3	22.2	**5.1**	0.1234
N	**146**	**11**	**24**	**47**	**9**	**237**	

Reported use of genetic selection was lower in 2018 than 2011 with 61% using some form of visual selection and 5% using ASBVs in 2011 survey.
2014 Sheep CRC producer survey found 83% merino lambs were mulesed.
2017 AWI Merino Husbandry Practices Survey found 63% mulesed wether lambs and 70% mulesed ewe lambs.

Table 22-3: Results of short survey – Proportion of respondents who used methods to assist with blowfly control in 2018 (*n*=244) and statistical comparison with corresponding question in the Main survey.

Methods to assist with blowfly control	Percentage respondents using method –National (%)	Statistical comparison of short survey with Main survey		
		Chi-square	df	P-value
Timing of crutching	78.7	12.669	1	0.5426
Preventative chemical treatments	67.2	0.32	1	0.0335*
Timing of shearing	54.9	0.981	1	0.0671
Mulesing sheep	48.8	6.336	1	0.6710
Genetic selection	48	9.404	1	0.7356
Destroy maggots	34	15.41	1	0.0601
Buying mulesed sheep	23.8	5.721	1	0.9708
Fly traps	4.9	0.653	1	0.9417

A comparison of the main survey and short survey answers to Q22 shows 7 out of 8 methods were used in similar proportions. The proportion of planned preventative treatments was significantly lower in the short survey group (67.2%) compared to main survey group (75.9%).

22.2 Importance of the methods to assist with blowfly control if used in 2018

22.2.1 Importance of the methods to assist with blowfly control if used in 2018 by Region

Table 22-4: Importance of methods to assist with blowfly control by Region. The means are derived from ranking Somewhat important as 1, Important as 2 and Very important as 3. N = number of responses.

Methods to assist with blowfly control	Mean importance of methods by Region								
	Central NSW	East Vic	Northern NSW/Qld	SA Peninsula	Tasmania	Western Australia	Wimmera Mallee Murray	National	P-value
Mulesing sheep	2.7	2.9	2.8	2.9	2.5	2.9	2.7	**2.8**	0.6942
Preventative chemical treatment	2.7	2.5	2.4	2.6	3	2.7	2.7	**2.6**	0.2758
Timing of crutching	2.7	2.7	2.6	2.8	2.8	2.5	2.6	**2.6**	0.7958
Genetic selection	2.5	2.7	2.5	2.4	-	2.6	2.4	**2.5**	0.8252
Buying mulesed sheep	2.1	2.8	2.3	2.9	-	2.3	2.3	**2.4**	0.1245
Timing of shearing	2.5	2.7	2.4	2.6	3	2.1	2.5	**2.4**	0.2897
Destroy maggots	2.1	3	2.4	2	2	2.1	2.2	**2.2**	0.9372
Fly traps	2	-	2.3	-	2	1	2	**2.1**	0.6526
N	**218**	**69**	**122**	**54**	**18**	**130**	**173**	**784**	

22.2.2 Importance of the methods to assist with blowfly control if used in 2018 by Chosen enterprise

Table 22-5: Importance of methods to assist with blowfly control by Region. The means are derived from ranking Somewhat important as 1, Important as 2 and Very important as 3. N = number of responses.

Methods to assist with blowfly control	Mean importance of methods by Chosen enterprise						
	Merino x Merino	Merino wethers	Merino x Other	Meat x Meat	Other Enterprise	All enterprises	P-value
Mulesing sheep	2.8	2	2.7	2.5	2	**2.8**	0.0394
Preventative chemical treatment	2.6	2.2	2.7	2.7	2.4	**2.6**	0.0712
Timing of crutching	2.6	2.6	2.7	2.7	2.7	**2.6**	0.7546
Genetic selection	2.5	2.2	2.4	2.3	2.8	**2.5**	0.6573
Buying mulesed sheep	2.6	1.8	2.3	2.5	2.5	**2.4**	0.1938
Timing of shearing	2.4	2.6	2.8	2.3	2.8	**2.4**	0.0711
Destroy maggots	2	2.3	2.3	2.6	3	**2.2**	0.3146
Fly traps	2	-	1.5	2.5	2.5	**2.1**	0.5282
N	**522**	**39**	**75**	**118**	**30**	**784**	

Table 22-6: Results of short survey – Importance of methods used to assist with blowfly control in 2018 (*n*=244) and statistical comparison with corresponding question in Main survey. The means are derived from ranking Somewhat important as 1, Important as 2 and Very important as 3.

Methods to assist with blowfly control	Importance rank of method used- National	Statistical comparison of short survey with Main survey		
		Chi-square	df	P-value
Mulesing sheep	3.7	4.574	2	0.5893
Preventative chemical treatment	3.3	9.736	2	0.4965
Timing of crutching	3.1	19.807	2	0.2516
Genetic selection	3.4	8.269	2	0.6718
Buying mulesed sheep	3.0	23.263	2	0.1173
Timing of shearing	3.3	13.791	2	0.7593
Destroy maggots	2.3	5.616	2	0.0709
Fly traps	2.8	27.982	2	0.0340*

A comparison of the main survey and short survey answers to Q22 shows 7 out of 8 methods were used in similar proportions. The Short survey group placed greater importance on the use of flytraps.

22.3 Change over five years in the use of methods to assist with blowfly control (2014-2018).

22.3.1 Change over five years in the use of methods to assist with blowfly control (2014-2018)-National

Table 22-7: Proportion of respondents reporting more, less or same usage of methods to assist with blowfly control in 2018 compared with 5 years earlier, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue), total number of responses for this question n=958.

Methods to assist with blowfly control		More	Same	Less	Total Responses
Mulesing sheep	*n*	6	117	15	138
	Percentage	4.3%	84.8%	10.9%	
	Chisq PValue	0.00943	0.5924	0.12155	
Buying mulesed sheep	*n*	5	74	10	89
	Percentage	5.6%	83.1%	11.2%	
	Chisq PValue	0.08205	0.79636	0.1703	
Genetic selection	*n*	36	77	6	119
	Percentage	30.3%	64.7%	5.0%	
	Chisq PValue	P<0.0001	0.05226	0.36071	
Preventative chemical treatment	*n*	31	124	15	170
	Percentage	18.2%	72.9%	8.8%	
	Chisq PValue	0.01903	0.26076	0.46445	
Timing of shearing	*n*	13	122	5	140
	Percentage	9.3%	87.1%	3.6%	
	Chisq PValue	0.35322	0.39526	0.10203	
Timing of crutching	*n*	16	144	6	166
	Percentage	9.6%	86.7%	3.6%	
	Chisq PValue	0.37902	0.38489	0.07842	
Trapping flies	*n*	2	45	9	56
	Percentage	3.6%	80.4%	16.1%	
	Chisq PValue	0.06855	0.97795	0.01525	
Destroy maggots	*n*	6	70	4	80
	Percentage	7.5%	87.5%	5.0%	
		0.24492	0.49765	0.44527	

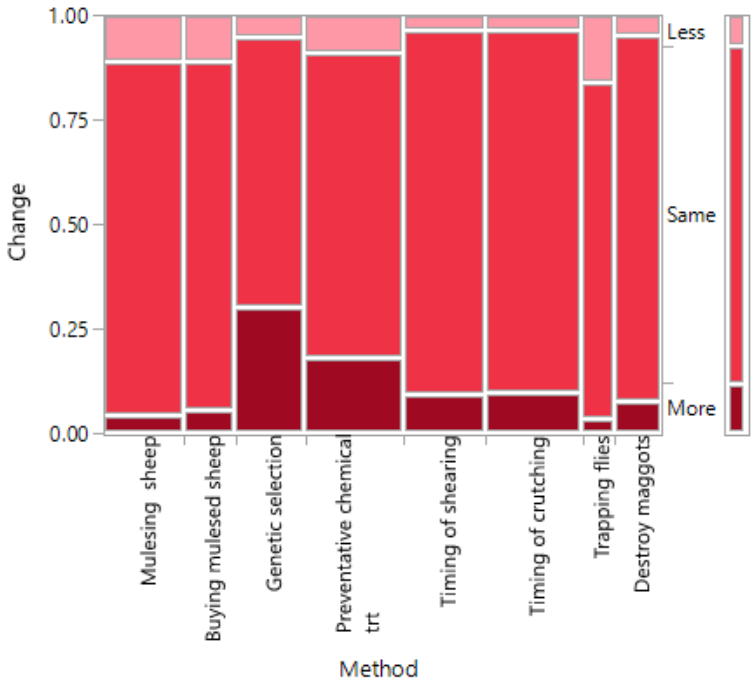


Figure 22-1: Proportions of the change in use of methods used to assist blowfly control over 5 years National (2014-2018).

Table 22-8: Results of short survey - Change over five years in the use of methods to assist with blowfly control (2014-2018) Nationally.

Methods to assist with blowfly control		More	Same	Less	Total Responses	Statistical comparison of short survey with Main survey		
						Chi-square	df	P-value
Mulesing sheep	*n* Percentage	11 3.9%	248 87.0%	26 9.1%	285	1.215	4	0.5446
Buying mulesed sheep	*n* Percentage	12 6.7%	151 84.4%	16 8.9%	179	1.714	4	0.9889
Genetic selection	*n* Percentage	77 30.8%	163 65.2%	10 4.0%	250	0.649	4	0.7230
Preventative chemical treatment	*n* Percentage	52 15.6%	253 75.7%	29 8.7%	334	1.961	4	0.3752
Timing of shearing	*n* Percentage	26 9.2%	251 88.4%	7 2.5%	284	1.467	4	0.4802
Timing of crutching	*n* Percentage	28 8.3%	301 88.8%	10 2.9%	339	1.393	4	0.4983
Trapping flies	*n* Percentage	6 4.9%	97 78.9%	20 16.3%	123	0.400	4	0.8185
Destroy maggots	*n* Percentage	13 7.2%	159 87.8%	9 5.0%	181	0.022	4	0.9889

There were no differences between responses from the short survey and main survey groups for change in use of methods to assist blowfly control.

22.3.2 Change over five years in the use of methods to assist with blowfly control (2014-2018) by Region

22.3.2.1 Central NSW

Table 22-9: Proportion of respondents reporting more, less or same usage of methods to assist with blowfly control in 2018 compared with 5 years earlier in Central NSW, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue), total number of responses for this question n=260.

Methods to assist with blowfly control		More	Same	Less	Total Responses
Mulesing sheep	*n*	4	33	2	39
	Percentage	10.3%	84.6%	5.1%	
	Chisq PValue	0.44434	0.70559	0.86763	
Buying mulesed sheep	*n*	1	20	2	23
	Percentage	4.3%	87.0%	8.7%	
	Chisq PValue	0.18716	0.67722	0.55901	
Genetic selection	*n*	15	19	1	35
	Percentage	42.9%	54.3%	2.9%	
	Chisq PValue	0.00002	0.09733	0.47321	
Preventative chemical treatment	*n*	6	33	5	44
	Percentage	13.6%	75.0%	11.4%	
	Chisq PValue	0.81533	0.75255	0.12235	
Timing of shearing	*n*	5	33	1	39
	Percentage	12.8%	84.6%	2.6%	
	Chisq PValue	0.72526	0.70559	0.40466	
Timing of crutching	*n*	4	40	1	45
	Percentage	8.9%	88.9%	2.2%	
	Chisq PValue	0.28984	0.4667	0.32187	
Trapping flies	*n*	1	11	2	14
	Percentage	7.1%	78.6%	14.3%	
	Chisq PValue	0.44781	0.97789	0.18462	
Destroy maggots	*n*	3	17	1	21
	Percentage	14.3%	81.0%	4.8%	
		0.93265	0.92937	0.8476	

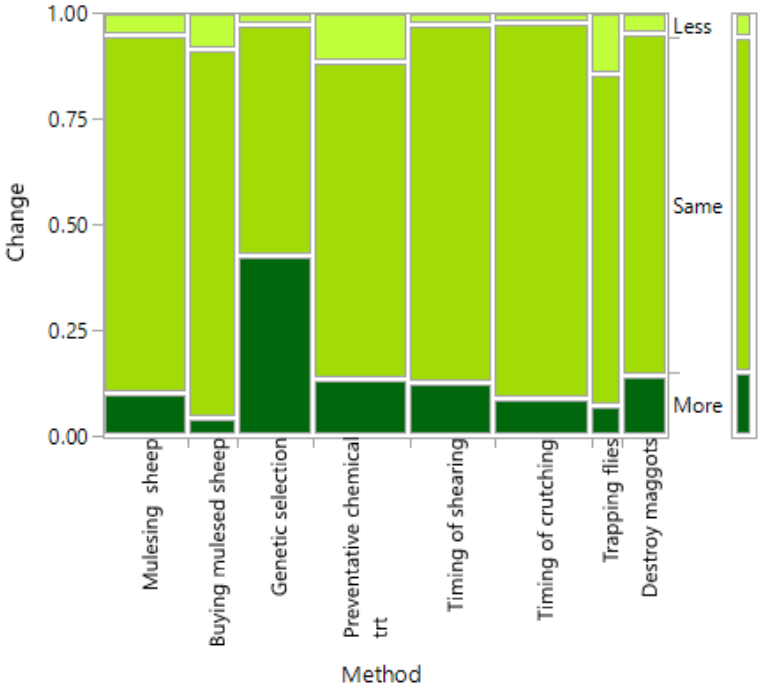


Figure 22-2: Proportions of the change in use of methods used to assist blowfly control over 5 years in Central NSW (2014-2018).

22.3.2.2 East Victoria

Table 22-10: Proportion of respondents reporting more, less or same usage of methods to assist with blowfly control in 2018 compared with 5 years earlier in East Victoria (total number of responses for this question n=95).

Methods to assist with blowfly control		More	Same	Less	Total Responses
Mulesing sheep	*n*	1	10	0	11
	Percentage	9.1%	90.9%	0.0%	
	Chisq PValue	0.35859	0.50571	0.49615	
Buying mulesed sheep	*n*	2	7	0	9
	Percentage	22.2%	77.8%	0.0%	
	Chisq PValue	0.99405	0.88624	0.53817	
Genetic selection	*n*	2	5	0	7
	Percentage	28.6%	71.4%	0.0%	
	Chisq PValue	0.71595	0.94457	0.5872	
Preventative chemical treatment	*n*	6	13	1	20
	Percentage	30.0%	65.0%	5.0%	
	Chisq PValue	0.45269	0.65095	0.86339	
Timing of shearing	*n*	3	12	2	17
	Percentage	17.6%	70.6%	11.8%	
	Chisq PValue	0.69582	0.88178	0.12904	
Timing of crutching	*n*	6	14	1	21
	Percentage	28.6%	66.7%	4.8%	
	Chisq PValue	0.52854	0.70793	0.902	
Trapping flies	*n*	0	4	0	4
	Percentage	0.0%	100.0%	0.0%	
	Chisq PValue	0.34705	0.53978	0.68152	
Destroy maggots	*n*	1	5	0	6
	Percentage	16.7%	83.3%	0.0%	
		0.77691	0.78305	0.61523	

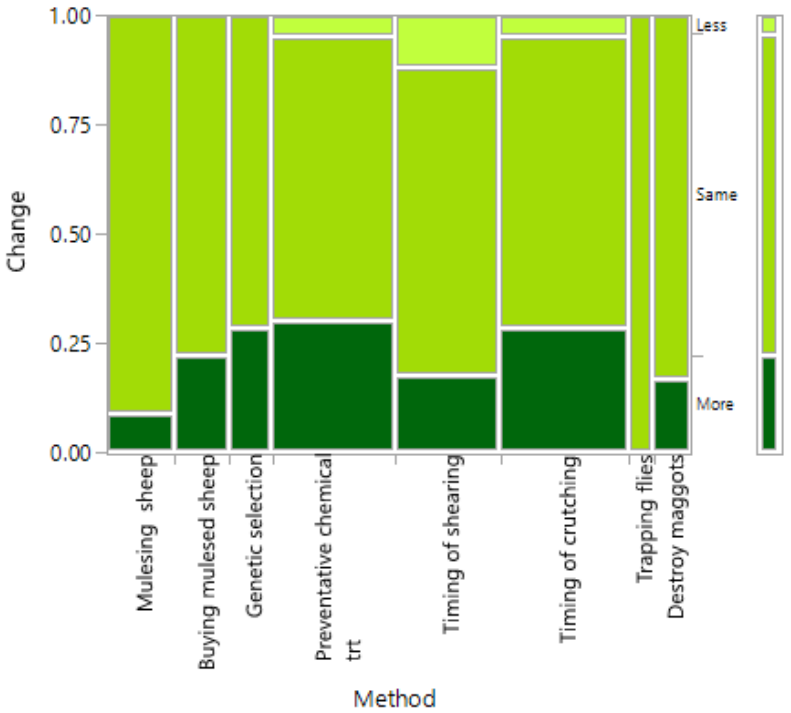


Figure 22-3: Proportions of the change in use of methods used to assist blowfly control over 5 years in East Victoria (2014-2018).

22.3.2.3 Northern NSW/Queensland

Table 22-11: Proportion of respondents reporting more, less or same usage of methods to assist with blowfly control in 2018 compared with 5 years earlier in Northern NSW/Queensland, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue), total number of responses for this question n=151).

Methods to assist with blowfly control		More	Same	Less	Total Responses
Mulesing sheep	*n*	1	16	3	20
	Percentage	5.0%	80.0%	15.0%	
	Chisq PValue	0.37003	0.89826	0.54515	
Buying mulesed sheep	*n*	1	9	1	11
	Percentage	9.1%	81.8%	9.1%	
	Chisq PValue	0.78576	0.87026	0.87812	
Genetic selection	*n*	6	11	2	19
	Percentage	31.6%	57.9%	10.5%	
	Chisq PValue	0.01307	0.33204	0.99255	
Preventative chemical treatment	*n*	4	20	6	30
	Percentage	13.3%	66.7%	20.0%	
	Chisq PValue	0.82266	0.50091	0.11357	
Timing of shearing	*n*	3	19	0	22
	Percentage	13.6%	86.4%	0.0%	
	Chisq PValue	0.81569	0.63608	0.12681	
Timing of crutching	*n*	2	19	2	23
	Percentage	8.7%	82.6%	8.7%	
	Chisq PValue	0.65419	0.78006	0.77949	
Trapping flies	*n*	1	9	1	11
	Percentage	9.1%	81.8%	9.1%	
	Chisq PValue	0.78576	0.87026	0.87812	
Destroy maggots	*n*	0	14	1	15
	Percentage	0.0%	93.3%	6.7%	
		0.18116	0.48557	0.64013	

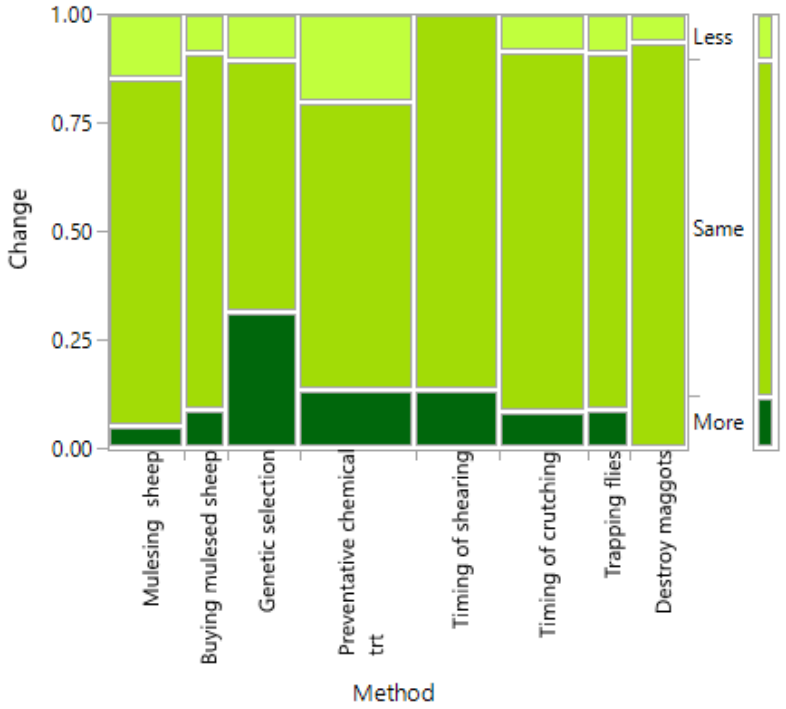


Figure 22-4: Proportions of the change in use of methods used to assist blowfly control over 5 years in Northern NSW/Queensland (2014-2018).

22.3.2.4 SA Peninsula

Table 22-12: Proportion of respondents reporting more, less or same usage of methods to assist with blowfly control in 2018 compared with 5 years earlier in SA Peninsula (total number of responses for this region n=59).

Methods to assist with blowfly control		More	Same	Less	Total Responses
Mulesing sheep	*n*	0	8	1	9
	Percentage	0.0%	88.9%	11.1%	
	Chisq PValue	0.58071	0.89294	0.20835	
Buying mulesed sheep	*n*	1	6	0	7
	Percentage	14.3%	85.7%	0.0%	
	Chisq PValue	0.11741	0.83704	0.62617	
Genetic selection	*n*	0	10	0	10
	Percentage	0.0%	100.0%	0.0%	
	Chisq PValue	0.56042	0.82427	0.56042	
Preventative chemical treatment	*n*	1	10	0	11
	Percentage	9.1%	90.9%	0.0%	
	Chisq PValue	0.30443	0.93672	0.54144	
Timing of shearing	*n*	0	8	0	8
	Percentage	0.0%	100.0%	0.0%	
	Chisq PValue	0.60254	0.84257	0.60254	
Timing of crutching	*n*	0	11	1	12
	Percentage	0.0%	91.7%	8.3%	
	Chisq PValue	0.52361	0.95555	0.35231	
Trapping flies	*n*	-	-	-	-
	Percentage				
	Chisq PValue				
Destroy maggots	*n*	0	2	0	2
	Percentage	0.0%	100.0%	0.0%	
		0.79457	0.9209	0.79457	

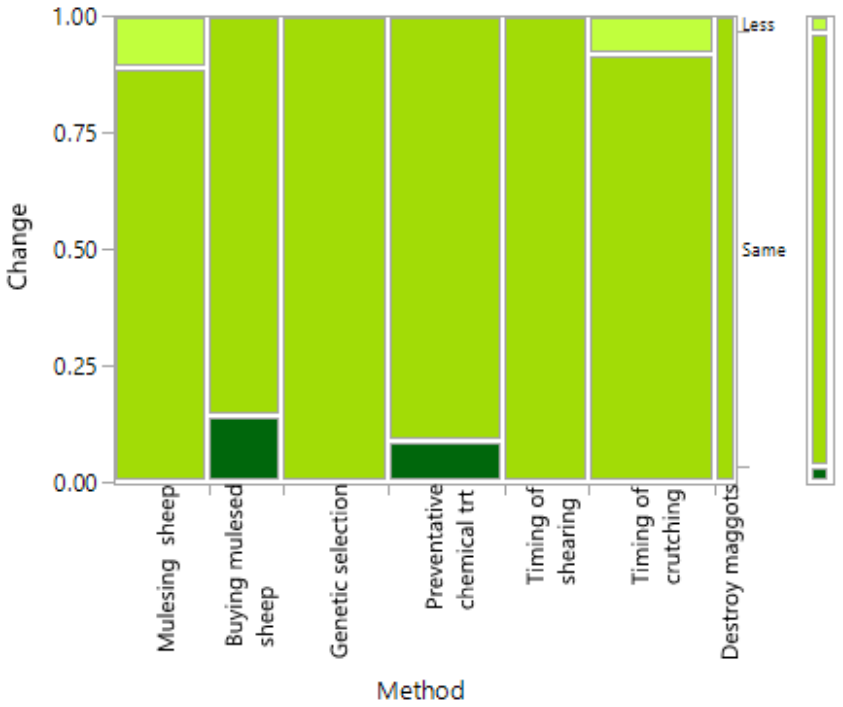


Figure 22-5: Proportions of the change in use of methods used to assist blowfly control over 5 years in SA Peninsula (2014-2018).

22.3.2.5 Tasmania

Table 22-13: Proportion of respondents reporting more, less or same usage of methods to assist with blowfly control in 2018 compared with 5 years earlier in Tasmania, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue), total number of responses for this question n=30.

Methods to assist with blowfly control		More	Same	Less	Total Responses
Mulesing sheep	*n*	0	3	1	4
	Percentage	0.0%	75.0%	25.0%	
	Chisq PValue	0.60558	0.91098	0.52282	
Buying mulesed sheep	*n*	0	2	1	3
	Percentage	0.0%	66.7%	33.3%	
	Chisq PValue	0.65472	0.79625	0.34278	
Genetic selection	*n*	1	2	0	3
	Percentage	33.3%	66.7%	0.0%	
	Chisq PValue	0.07364	0.79625	0.52709	
Preventative chemical treatment	*n*	1	4	0	5
	Percentage	20.0%	80.0%	0.0%	
	Chisq PValue	0.24821	1	0.41422	
Timing of shearing	*n*	0	4	0	4
	Percentage	0.0%	100.0%	0.0%	
	Chisq PValue	0.60558	0.65472	0.46521	
Timing of crutching	*n*	0	5	0	5
	Percentage	0.0%	100.0%	0.0%	
	Chisq PValue	0.5637	0.61708	0.41422	
Trapping flies	*n*	0	1	2	3
	Percentage	0.0%	33.3%	66.7%	
	Chisq PValue	0.65472	0.36616	0.01141	
Destroy maggots	*n*	0	3	0	3
	Percentage	0.0%	100.0%	0.0%	
	Chisq PValue	0.65472	0.69854	0.52709	

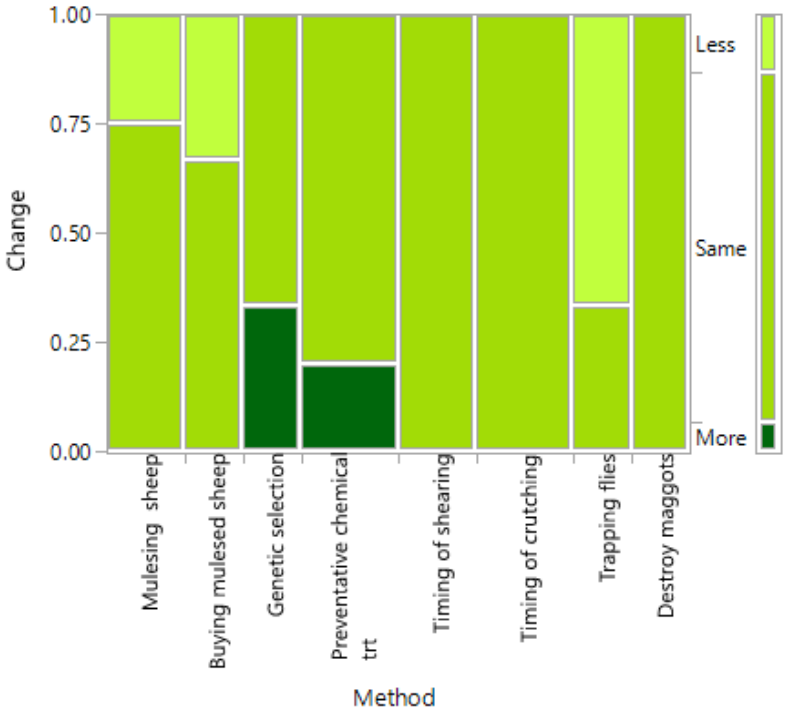


Figure 22-6: Proportions of the change in use of methods used to assist blowfly control over 5 years in Tasmania (2014-2018).

22.3.2.6 Western Australia

Table 22-14: Proportion of respondents reporting more, less or same usage of methods to assist with blowfly control in 2018 compared with 5 years earlier in Western Australia , p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue), total number of responses for this region n=152.

Methods to assist with blowfly control		More	Same	Less	Total Responses
Mulesing sheep	*n*	0	20	4	24
	Percentage	0.0%	83.3%	16.7%	
	Chisq PValue	0.11196	0.86667	0.22875	
Buying mulesed sheep	*n*	0	11	2	13
	Percentage	0.0%	84.6%	15.4%	
	Chisq PValue	0.24208	0.86096	0.46325	
Genetic selection	*n*	6	12	2	20
	Percentage	30.0%	60.0%	10.0%	
	Chisq PValue	0.00727	0.31178	0.90739	
Preventative chemical treatment	*n*	5	20	2	27
	Percentage	18.5%	74.1%	7.4%	
	Chisq PValue	0.20054	0.71962	0.75753	
Timing of shearing	*n*	1	17	1	19
	Percentage	5.3%	89.5%	5.3%	
	Chisq PValue	0.4795	0.65406	0.57075	
Timing of crutching	*n*	3	20	1	24
	Percentage	12.5%	83.3%	4.2%	
	Chisq PValue	0.76569	0.86667	0.41554	
Trapping flies	*n*	0	9	1	10
	Percentage	0.0%	90.0%	10.0%	
	Chisq PValue	0.3049	0.73108	0.93444	
Destroy maggots	*n*	1	13	1	15
	Percentage	6.7%	86.7%	6.7%	
		0.64499	0.78191	0.74546	

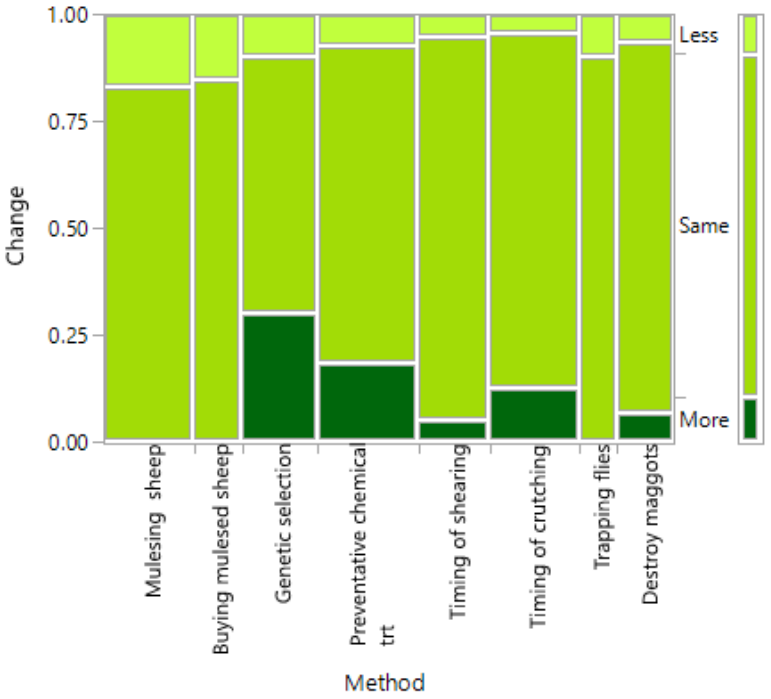


Figure 22-7: Proportions of the change in use of methods used to assist blowfly control over 5 years in Western Australia (2014-2018).

22.3.2.7 Wimmera Mallee Murray

Table 22-15: Proportion of respondents reporting more, less or same usage of methods to assist with blowfly control in 2018 compared with 5 years earlier in Wimmera Mallee Murray, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue), total number of responses for this region n=211.

Methods to assist with blowfly control		More	Same	Less	Total Responses
Mulesing sheep	*n*	0	27	4	31
	Percentage	0.0%	87.1%	12.9%	
	Chisq PValue	0.11402	0.89121	0.22629	
Buying mulesed sheep	*n*	0	19	4	23
	Percentage	0.0%	82.6%	17.4%	
	Chisq PValue	0.17343	0.90775	0.06439	
Genetic selection	*n*	6	18	1	25
	Percentage	24.0%	72.0%	4.0%	
	Chisq PValue	0.00498	0.48599	0.55988	
Preventative chemical treatment	*n*	8	24	1	33
	Percentage	24.2%	72.7%	3.0%	
	Chisq PValue	0.00105	0.45019	0.37953	
Timing of shearing	*n*	1	29	1	31
	Percentage	3.2%	93.5%	3.2%	
	Chisq PValue	0.34332	0.59835	0.41742	
Timing of crutching	*n*	1	35	0	36
	Percentage	2.8%	97.2%	0.0%	
	Chisq PValue	0.26446	0.41967	0.10965	
Trapping flies	*n*	0	11	3	14
	Percentage	0.0%	78.6%	21.4%	
	Chisq PValue	0.28821	0.79918	0.04448	
Destroy maggots	*n*	1	16	1	18
	Percentage	5.6%	88.9%	5.6%	
		0.7085	0.85184	0.80476	

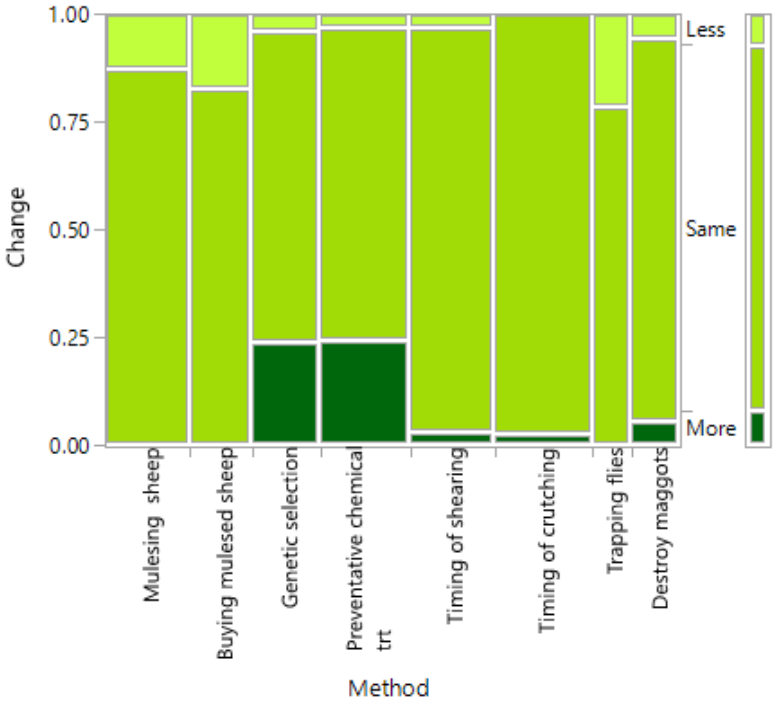


Figure 22-8: Proportions of the change in use of methods used to assist blowfly control over 5 years in Wimmera Mallee Murray (2014-2018).

22.3.3 Change over five years in the use of methods to assist with blowfly control (2014-2018) by Chosen enterprise

22.3.3.1 Merino x Merino

Table 22-16: Proportion of respondents reporting more, less or same usage of methods to assist with blowfly control in 2018 compared with 5 years earlier in Merino x Merino enterprises, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue), total number of responses for this chosen enterprise n=642.

Methods to assist with blowfly control		More	Same	Less	Total Responses
Mulesing sheep	*n*	4	97	8	109
	Percentage	3.7%	89.0%	7.3%	
	Chisq PValue	0.01319	0.36367	0.89643	
Buying mulesed sheep	*n*	1	45	6	52
	Percentage	1.9%	86.5%	11.5%	
	Chisq PValue	0.03771	0.66638	0.21735	
Genetic selection	*n*	30	52	4	86
	Percentage	34.9%	60.5%	4.7%	
	Chisq PValue	P<0.0001	0.0332	0.4088	
Preventative chemical treatment	*n*	20	79	12	111
	Percentage	18.0%	71.2%	10.8%	
	Chisq PValue	0.05844	0.24306	0.13034	
Timing of shearing	*n*	7	76	4	87
	Percentage	8.0%	87.4%	4.6%	
	Chisq PValue	0.30395	0.52066	0.39553	
Timing of crutching	*n*	9	95	4	108
	Percentage	8.3%	88.0%	3.7%	
	Chisq PValue	0.2898	0.43207	0.19444	
Trapping flies	*n*	2	28	5	35
	Percentage	5.7%	80.0%	14.3%	
	Chisq PValue	0.29236	0.93966	0.10396	
Destroy maggots	*n*	3	49	2	54
	Percentage	5.6%	90.7%	3.7%	
		0.17966	0.43414	0.35887	

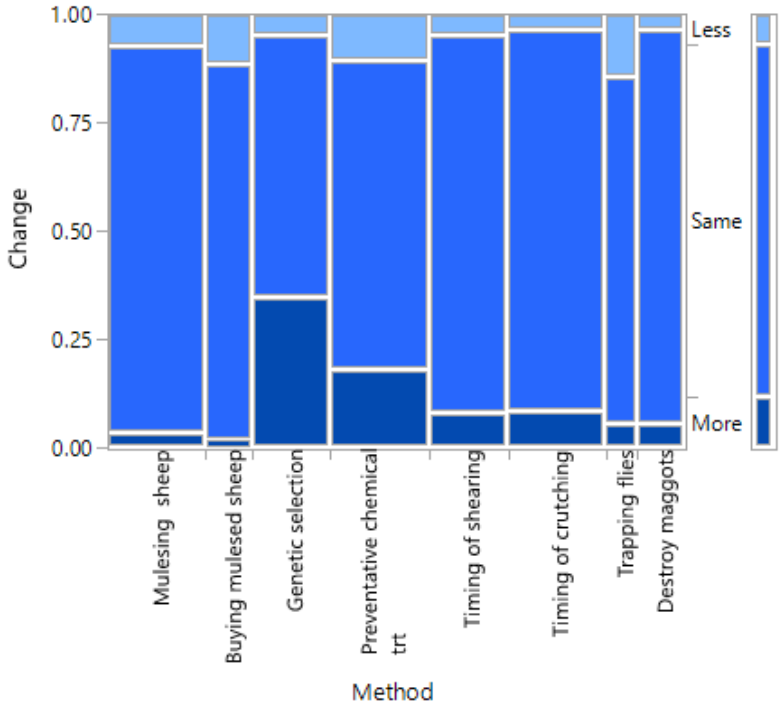


Figure 22-9: Proportions of the change in use of methods used to assist blowfly control over 5 years in Merino x Merino enterprises (2014-2018).

22.3.3.2 Merino wethers

Table 22-17: Proportion of respondents reporting more, less or same usage of methods to assist with blowfly control in 2018 compared with 5 years earlier in Merino wether enterprises (total number of responses for this chosen enterprise n=43).

Methods to assist with blowfly control		More	Same	Less	Total Responses
Mulesing sheep	*n*	1	3	1	5
	Percentage	20.0%	60.0%	20.0%	
	Chisq PValue	0.94233	0.83942	0.71739	
Buying mulesed sheep	*n*	1	2	2	5
	Percentage	20.0%	40.0%	40.0%	
	Chisq PValue	0.94233	0.45495	0.11896	
Genetic selection	*n*	0	2	1	3
	Percentage	0.0%	66.7%	33.3%	
	Chisq PValue	0.45501	0.98696	0.36886	
Preventative chemical treatment	*n*	3	5	0	8
	Percentage	37.5%	62.5%	0.0%	
	Chisq PValue	0.21533	0.86485	0.29072	
Timing of shearing	*n*	1	5	1	7
	Percentage	14.3%	71.4%	14.3%	
	Chisq PValue	0.79107	0.8978	0.98123	
Timing of crutching	*n*	1	5	1	7
	Percentage	14.3%	71.4%	14.3%	
	Chisq PValue	0.79107	0.8978	0.98123	
Trapping flies	*n*	0	3	0	3
	Percentage	0.0%	100.0%	0.0%	
	Chisq PValue	0.45501	0.49228	0.51763	
Destroy maggots	*n*	1	4	0	5
	Percentage	20.0%	80.0%	0.0%	
		0.94233	0.7324	0.40357	

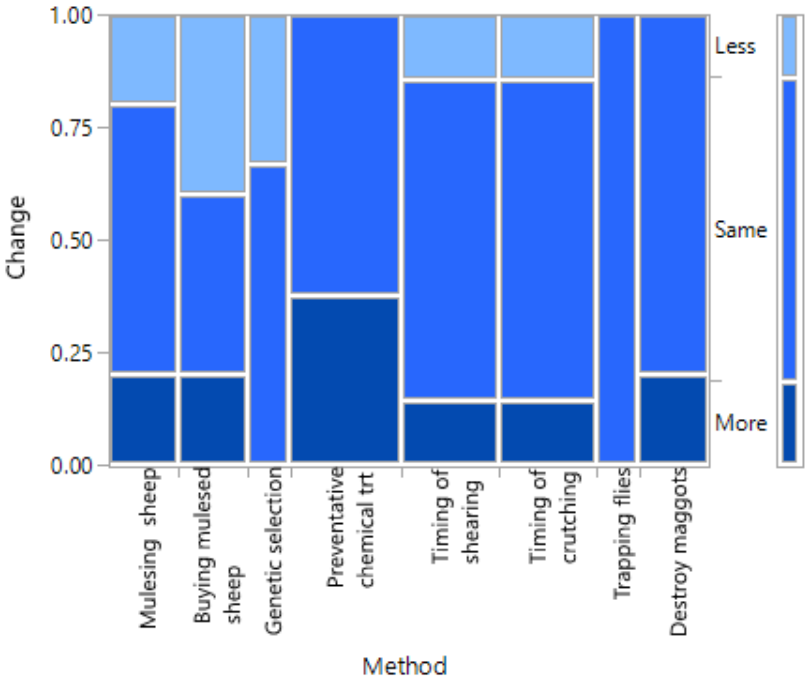


Figure 22-10: Proportions of the change in use of methods used to assist blowfly control over 5 years in Merino wethers enterprises (2014-2018).

22.3.3.3 Merino x Other

Table 22-18: Proportion of respondents reporting more, less or same usage of methods to assist with blowfly control in 2018 compared with 5 years earlier Merino x Other enterprises (total number of responses for this chosen enterprise n=98).

Methods to assist with blowfly control		More	Same	Less	Total Responses
Mulesing sheep	*n*	0	6	2	8
	Percentage	0.0%	75.0%	25.0%	
	Chisq PValue	0.34333	0.85967	0.09556	
Buying mulesed sheep	*n*	1	14	1	16
	Percentage	6.3%	87.5%	6.3%	
	Chisq PValue	0.55257	0.75895	0.78881	
Genetic selection	*n*	3	6	1	10
	Percentage	30.0%	60.0%	10.0%	
	Chisq PValue	0.07636	0.46785	0.83891	
Preventative chemical treatment	*n*	2	13	1	16
	Percentage	12.5%	81.3%	6.3%	
	Chisq PValue	0.87896	0.97733	0.78881	
Timing of shearing	*n*	2	13	0	15
	Percentage	13.3%	86.7%	0.0%	
	Chisq PValue	0.8074	0.79396	0.26848	
Timing of crutching	*n*	2	14	0	16
	Percentage	12.5%	87.5%	0.0%	
	Chisq PValue	0.87896	0.75895	0.2531	
Trapping flies	*n*	0	5	2	7
	Percentage	0.0%	71.4%	28.6%	
	Chisq PValue	0.3754	0.78668	0.05878	
Destroy maggots	*n*	1	8	1	10
	Percentage	10.0%	80.0%	10.0%	
		0.90799	0.9828	0.83891	

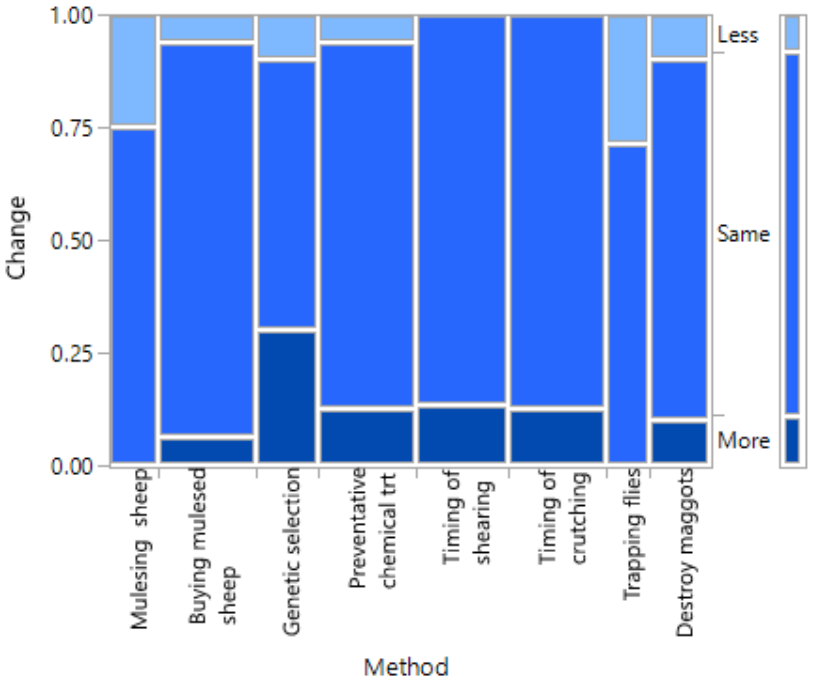


Figure 22-11: Proportions of the change in use of methods used to assist blowfly control over 5 years in Merino x Other enterprises (2014-2018).

22.3.3.4 Meat x Meat

Table 22-19: Proportion of respondents reporting more, less or same usage of methods to assist with blowfly control in 2018 compared with 5 years earlier in Meat x Meat enterprises, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue), total number of responses for this chosen enterprise n=141.

Methods to assist with blowfly control		More	Same	Less	Total Responses
Mulesing sheep	*n*	1	8	3	12
	Percentage	8.3%	66.7%	25.0%	
	Chisq PValue	0.75659	0.50377	0.00049	
Buying mulesed sheep	*n*	2	10	0	12
	Percentage	16.7%	83.3%	0.0%	
	Chisq PValue	0.58438	0.968	0.47486	
Genetic selection	*n*	2	13	0	15
	Percentage	13.3%	86.7%	0.0%	
	Chisq PValue	0.8194	0.92378	0.42433	
Preventative chemical treatment	*n*	5	22	2	29
	Percentage	17.2%	75.9%	6.9%	
	Chisq PValue	0.34608	0.61685	0.4905	
Timing of shearing	*n*	2	25	0	27
	Percentage	7.4%	92.6%	0.0%	
	Chisq PValue	0.54334	0.64298	0.28377	
Timing of crutching	*n*	3	26	0	29
	Percentage	10.3%	89.7%	0.0%	
	Chisq PValue	0.87265	0.75792	0.26662	
Trapping flies	*n*	0	8	1	9
	Percentage	0.0%	88.9%	11.1%	
	Chisq PValue	0.31222	0.88338	0.31874	
Destroy maggots	*n*	1	7	0	8
	Percentage	12.5%	87.5%	0.0%	
	Chisq PValue	0.92291	0.92389	0.55958	

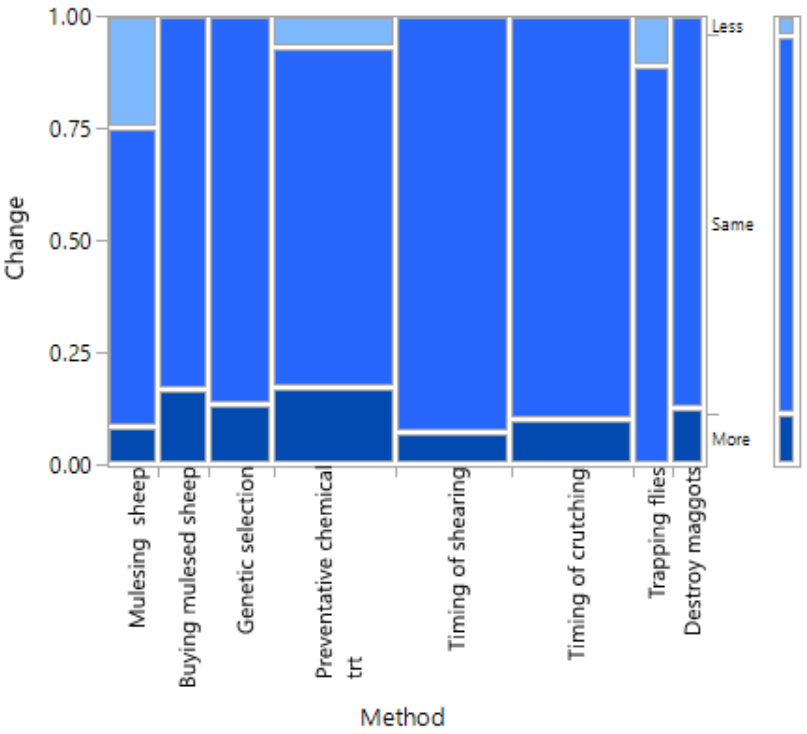


Figure 22-12: Proportions of the change in use of methods used to assist blowfly control over 5 years in Meat x Meat enterprises (2014-2018).

22.3.3.5 Other sheep enterprise

Table 22-20: Proportion of respondents reporting more, less or same usage of methods to assist with blowfly control in 2018 compared with 5 years earlier in Other enterprise (total number of responses for this chosen enterprise n=29).

Methods to assist with blowfly control		More	Same	Less	Total Responses
Mulesing sheep	*n*	0	2	1	3
	Percentage	0.0%	66.7%	33.3%	
	Chisq PValue	0.57747	0.90688	0.50206	
Buying mulesed sheep	*n*	0	2	1	3
	Percentage	0.0%	66.7%	33.3%	
	Chisq PValue	0.57747	0.90688	0.50206	
Genetic selection	*n*	0	4	0	4
	Percentage	0.0%	100.0%	0.0%	
	Chisq PValue	0.52005	0.51676	0.40628	
Preventative chemical treatment	*n*	1	4	0	5
	Percentage	20.0%	80.0%	0.0%	
	Chisq PValue	0.50206	0.842	0.35316	
Timing of shearing	*n*	1	3	0	4
	Percentage	25.0%	75.0%	0.0%	
	Chisq PValue	0.36214	0.95153	0.40628	
Timing of crutching	*n*	1	3	1	5
	Percentage	20.0%	60.0%	20.0%	
	Chisq PValue	0.50206	0.74428	0.8819	
Trapping flies	*n*	0	1	1	2
	Percentage	0.0%	50.0%	50.0%	
	Chisq PValue	0.64921	0.70952	0.26454	
Destroy maggots	*n*	0	2	1	3
	Percentage	0.0%	66.7%	33.3%	
		0.57747	0.90688	0.50206	

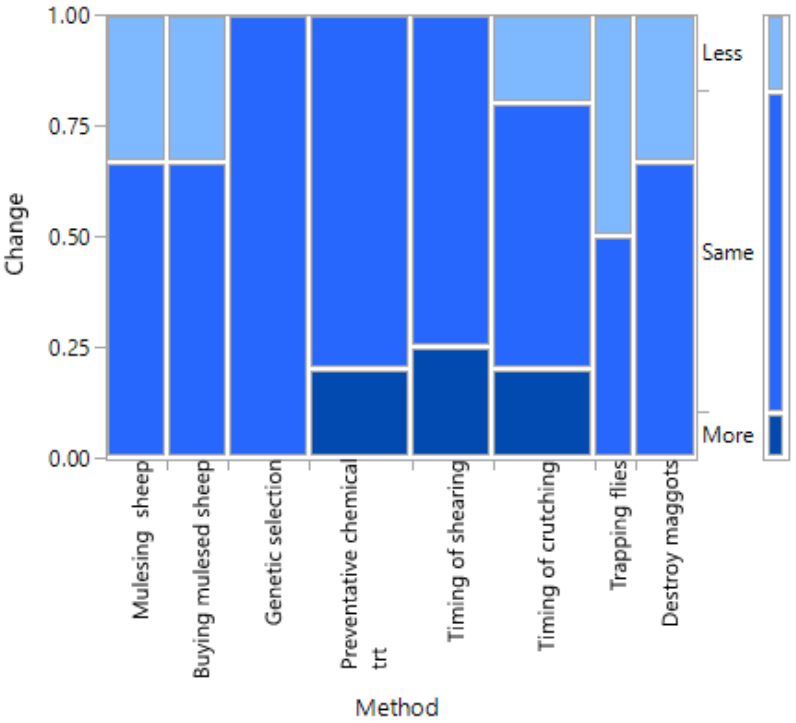


Figure 22-13: Proportions of the change in use of methods used to assist blowfly control over 5 years in Other sheep enterprises (2014-2018).

Q23 Please indicate the months you shear and crutch each class of sheep, you can select multiple months for each class

	Adult ewes		Maiden ewes		Unmated hoggets/ yearlings		Adult Wethers		Adult rams	
	Shearing	Crutching	Shearing	Crutching	Shearing	Crutching	Shearing	Crutching	Shearing	Crutching
Jan	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Feb	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Mar	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Apr	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
May	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Jun	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Jul	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Aug	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Sep	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Oct	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Nov	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dec	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

23.1 National proportions of month of shearing and crutching

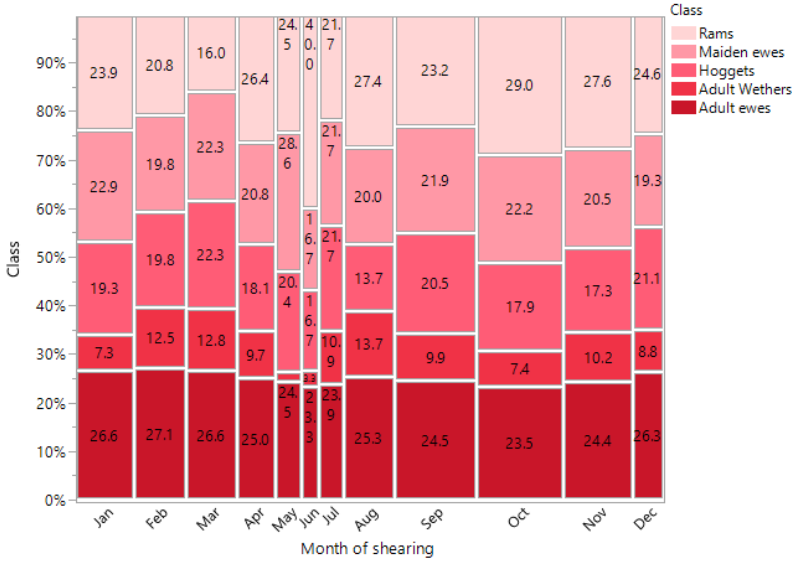


Figure 23-1: National proportions of month of shearing by class, chi square =23.52, P=0.9951, n=354.

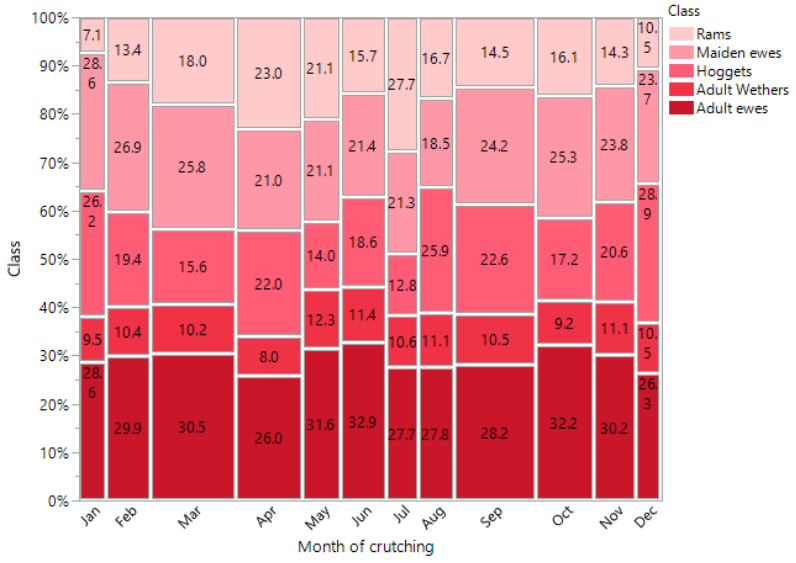


Figure 23-2: National proportions of months of crutching by class, chi-square=23.26, P=0.9957, n=354.

Q24 If you used mulesing in 2018 please provide details in the table below.

24. If you used mulesing in 2018 please provide details in the table below.

	Age at mulesing (months)	Percentage mulesed in 2018 (%)	Percentage mulesed 5 years ago (%)	Change in skin area removed compared to 5 years ago			Pain relief provided at mulesing				Some wool left on tail	
				No change	More now	Less now	No	Yes, TriSolfen®	Yes, Metacam®20	Yes, Buccalgesic®	Yes	No
Replacement ewe lambs				☐	☐	☐	☐	☐	☐	☐	☐	☐
Replacement wether lambs				☐	☐	☐	☐	☐	☐	☐	☐	☐
Other				☐	☐	☐	☐	☐	☐	☐	☐	☐

The 'Other' category was not included in the analysis as the numbers were too low (*n*=3).

24.1 Age at mulesing

24.1.1 Age at mulesing by Region

Table 24-1: Mean age at mulesing (in months) by class and Region (Number respondents for this question *n*=120).

	Mean Age at mulesing (months)					
	All Classes		Ewe lambs		Wether lambs	
Regions	*N*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Central NSW	59	**2.0 (0-10)[b]**	35	2.1 (0-10)	24	1.8 (0-3)
East Vic	17	**3.1 (1-8)[a]**	8	3.0 (1-8)	8	3.3 (2-8)
Northern NSW/Qld	25	**3.3 (1-9)[a]**	15	3.3 (1-9)	9	3.3 (1.5-7)
South Australia	22	**2.1 (1.5-3)[b]**	11	2.1 (1.5-3)	11	2.1 (1.5-3)
Tasmania	4	**2.0 (2-2)[ab]**	2	2.0 (2-2)	2	2.0 (2-2)
Western Australia	40	**1.6 (1-2.5)[b]**	22	1.6 (1-2.5)	18	1.6 (1-2.5)
Wimmera Mallee Murray	45	**2.1 (1-4)[b]**	27	2.1 (1-4)	17	2.0 (1-4)
All Regions	***212***	**2.2**	**120**	**2.2**	**89**	**2.1**

n = total responses, Two-way ANOVA, Region df=6, F ratio 6.5504, P<0.0001, Class df=1, F ratio=0.0182, P=0.8928.
Values within columns not sharing a letter in the superscript are significantly different

24.1.2 Age at mulesing by Chosen enterprise

Table 24-2: Mean age at mulesing (in months) by class and Chosen enterprise (Number respondents for this question *n*=120).

	Mean Age at mulesing (months)					
	All Classes		Ewe lambs		Wether lambs	
Chosen enterprise	*N*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Merino ewes joined to Merino rams	192	**2.2 (0-10)**	108	2.2 (0-10)	82	2.1(0-8)
Merino wethers	6	**3.2 (2-4)**	2	3.0 (2-4)	3	3.0 (2-4)
Merino ewes joined to Other rams	9	**2.0 (2-2)**	5	2.0 (2-2)	4	2.0 (2-2)
Meat ewes joined to Meat rams	4	**2.0 (2-2)**	4	2.0 (2-2)	0	-
Other enterprise	1	**2.0 (2-2)**	1	2.0 (2-2)	0	-
All Enterprises	***212***	**2.2**	**120**	**2.2**	**89**	**2.1**

n= total responses, Two-way ANOVA, Chosen enterprise df=4, F ratio=0.5953, P=0.6664, Class df=1, F ratio=0.5344, P=0.4656.

24.2 Percentage mulesed in 2018

24.2.1 Percentage mulesed in 2018 by Region

Table 24-3: Mean percentage (%) of replacement sheep mulesed in 2018 by class and Region (Number respondents for this question *n*=122).

	Mean % mulesed in 2018					
	All Classes		Ewe lambs		Wether lambs	
Regions	*N*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Central NSW	58	**89.9 (0-100)**	34	91.5 (1-100)	24	87.5 (0-100)
East Vic	17	**95.9 (50-100)**	8	100	8	97.5 (80-100)
Northern NSW/Qld	24	**78.8 (0-100)**	14	85.1 (0-100)	9	77.8 (0-100)
South Australia	23	**95.7 (0-100)**	12	91.7 (0-100)	11	100
Tasmania	4	**100**	2	100.0	2	100
Western Australia	40	**97.9 (60-100)**	22	96.9 (60-100)	18	99.0 (85-100)
Wimmera Mallee Murray	49	**94.3 (0-100)**	30	96.7 (0-100)	19	90.5 (0-100)
All Regions	***215***	**92.4**	**122**	**93.7**	**91**	**92.1**

n= total responses, Two way ANOVA, Region: F Ratio=1.5703, df=6, P=0.1576; Class: F Ratio=0.0804, df=1, P=0.7771; Region*Class: F Ratio=0.3449, df=6, P=0.9122.

24.2.2 Percentage mulesed in 2018 by Chosen enterprise

Table 24-4: Mean percentage (%) of replacement sheep mulesed in 2018 by class and Chosen enterprise (Number respondents for this question *n*=122).

	Mean % mulesed in 2018					
	All Classes		Ewe lambs		Wether lambs	
Chosen enterprise	*N*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Merino ewes joined to Merino rams	194	**92.7 (0-100)**	108	94.7 (0-100)	84	91.7 (0-100)
Merino wethers	6	**80.0 (0-100)**	3	66.7 (0-100)	3	93.3 (80-100)
Merino ewes joined to Other rams	10	**100**	6	100	4	100
Meat ewes joined to Meat rams	4	**77.5 (10-100)**	4	77.5 (10-100)	0	-
Other enterprise	1	**100**	1	100	0	-
All Enterprises	***215***	**92.4**	**122**	**93.7**	**91**	**92.1**

Some data for ewe lambs was entered by respondents who had selected 'Merino wethers' as their reporting enterprise.

n= total responses, Two way ANOVA, Chosen enterprise: F Ratio=1.4920, df=3, P=0.2178; Class: F Ratio=0.3419, df=1, P=0.5594; No interaction fitted.

24.3 Change in percentage Mulesed over 5 years

24.3.1 Change in percentage Mulesed over 5 years by Region

Table 24-5: Mean change in proportion (%) of sheep mulesed from 2014 to 2018 by Region, negative value means fewer sheep were mulesed in 2018 (Number respondents *n*=122).

	Mean change in % mulesed from 2014 to 2018					
	All Classes		Ewe lambs		Wether lambs	
Regions	*N*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Central NSW	57	**1.1 (-100-100)[a]**	34	1.8 (-50-100)	23	0.0
East Vic	17	**-1.2 (-20-0)[a]**	8	0.0	8	-2.5 (-20-0)
Northern NSW/Qld	24	**-21.1 (-100-0)[b]**	13	-8.4 (-99-0)	10	-29.9 (-100-0)
South Australia	19	**0.0[a]**	10	0.0	9	0.0
Tasmania	4	**0.0[a]**	2	0.0	2	0.0
Western Australia	39	**-1.3 (-40-0)[a]**	22	-2.3 (-40-0)	17	-0.1 (-1-0)
Wimmera Mallee Murray	42	**0.5 (0-20)[a]**	26	0.0	16	1.3 (0-20)
All Regions	***202***	**-2.5**	**115**	**-0.9**	**85**	**-3.5**

n= total responses, Two way ANOVA, Region: F Ratio=3.5924, df=6, P=0.0022; Class: F Ratio=0.7447, df=1, P=0.3893; Region*Class: F Ratio=1.1717, df=6, P=0.3232.
Values within columns not sharing a letter in the superscript are significantly different

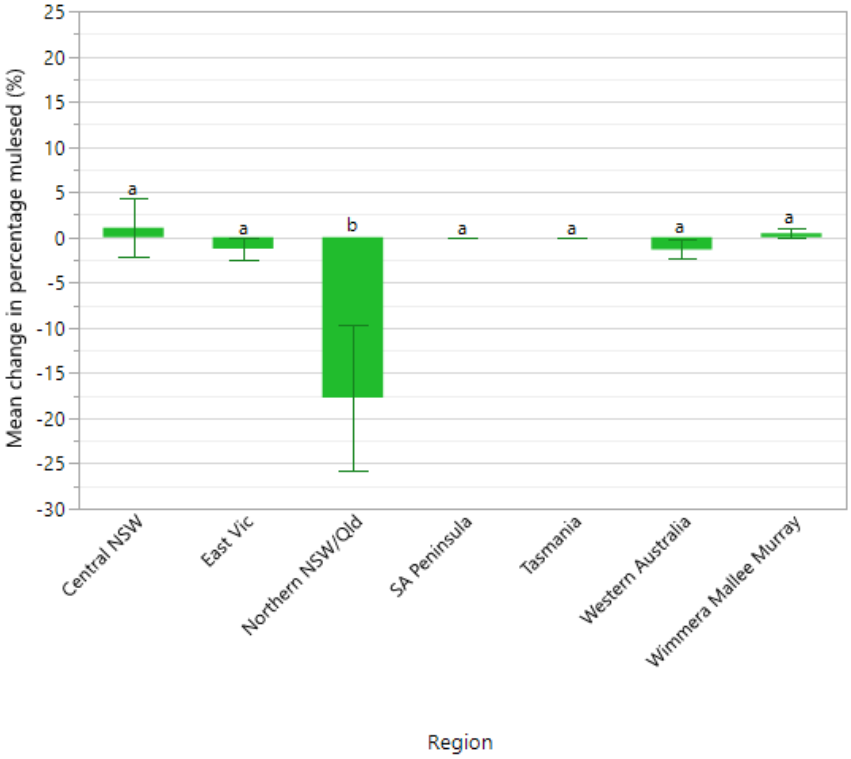


Figure 24-1: Mean change in percentage sheep mulesed from 2014 to 2018 by Region, P=0.0022.

24.3.1 Change in percentage Mulesed over 5 years by Chosen enterprise

Table 24-6: Mean change in proportion (%) of sheep mulesed from 2014 to 2018 by Chosen enterprise, negative value means fewer sheep were mulesed in 2018 (Number respondents *n*=122).

	Mean change in % mulesed from 2014 to 2018					
	All Classes		**Ewe lambs**		**Wether lambs**	
Chosen enterprise	*N*	Mean (Range)	*n*	Mean (Range)	*n*	Mean (Range)
Merino ewes joined to Merino rams	183	-2.7 (-100-100)	103	-1.1 (-99-100)	80	-4.8 (-100-20)
Merino wethers	3	-6.7 (-20-0)	1	0.0	2	-10.0 (-20-0)
Merino ewes joined to Other rams	9	11.1 (0-100)	6	0.0	3	33.3 (0-100)
Meat ewes joined to Meat rams	4	2.5 (0-10)	4	2.5 (0-10)	0	-
Other enterprise	1	0.0	1	0.0	0	-
All Enterprises	***202***	**-2.5**	**115**	**-0.9**	**85**	**-3.5**

n= total responses, Two way ANOVA, Chosen enterprise: F Ratio=1.1254, df=4, P=0.3458; Class: F Ratio=0.6324, df=1, P=0.4275; interaction not fitted.

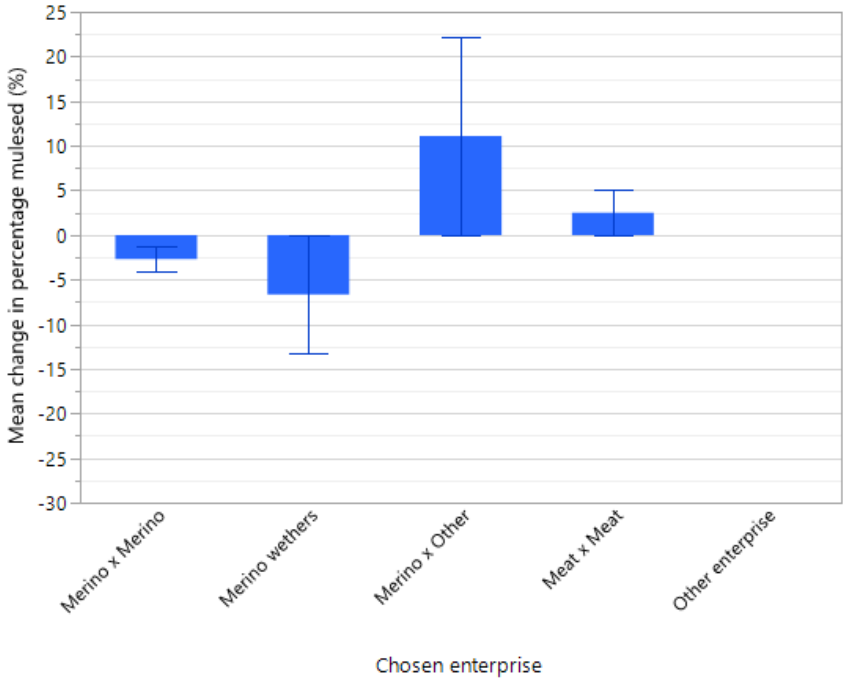


Figure 24-2: Mean change in percentage sheep mulesed from 2014 to 2018 by Chosen enterprise, P=0.3458.

24.4 Change in skin area removed compared to 5 years ago

24.4.1 Change in skin area removed compared to 5 years ago by Region – Ewe Lambs

Table 24-7: Proportion of respondents who reported a change or no change in skin area removed during mulesing for Ewe lambs in 2018 compared to five years ago (2014) by Region.

Region		No change	More now	Less now	Total Responses
Central NSW	*n*	19	1	15	35
	Percentage	54.3%	2.9%	42.9%	
	Chisq PValue	0.72632	0.19306	0.81434	
East Vic	*n*	5	0	3	8
	Percentage	62.5%	0.0%	37.5%	
	Chisq PValue	0.89215	0.79542	0.89949	
Northern NSW/Qld	*n*	10	0	6	16
	Percentage	62.5%	0.0%	37.5%	
	Chisq PValue	0.84794	0.71386	0.85823	
SA Peninsula	*n*	9	0	2	11
	Percentage	81.8%	0.0%	18.2%	
	Chisq PValue	0.32004	0.7611	0.2473	
Tasmania	*n*	1	0	1	2
	Percentage	50.0%	0.0%	50.0%	
	Chisq PValue	0.87076	0.89685	0.82962	
Western Australia	*n*	9	0	11	20
	Percentage	45.0%	0.0%	55.0%	
	Chisq PValue	0.42022	0.68184	0.30181	
Wimmera Mallee Murray	*n*	17	0	10	27
	Percentage	63.0%	0.0%	37.0%	
	Chisq PValue	0.77914	0.63384	0.78722	
National	*n*	70	1	48	119
	Percentage	58.8%	0.8%	40.3%	

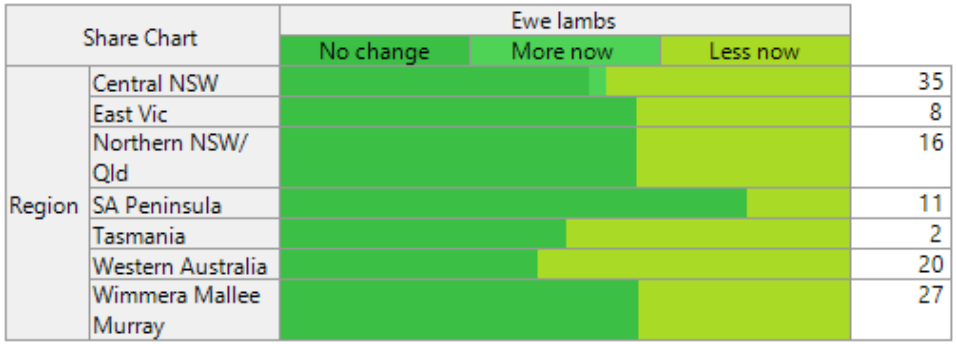


Figure 24-3: Share chart of the change or no change in skin area removed during mulesing for Ewe lambs in 2018 compared to five years ago (2014) by Region.

24.4.2 Change in skin area removed compared to 5 years ago by Region – Wether lambs

Table 24-8: Proportion of respondents who reported a change or no change in skin area removed during mulesing for Wether lambs in 2018 compared to five years ago (2014) by Region.

Region		No change	More now	Less now	Total Responses
Central NSW	*n* Percentage Chisq PValue	13 52.0% 0.65354	-	12 48.0% 0.59113	25
East Vic	*n* Percentage Chisq PValue	5 62.5% 0.89412	-	3 37.5% 0.87344	8
Northern NSW/Qld	*n* Percentage Chisq PValue	6 50.0% 0.68823	-	6 50.0% 0.63106	12
SA Peninsula	*n* Percentage Chisq PValue	8 72.7% 0.54978	-	3 27.3% 0.4741	11
Tasmania	*n* Percentage Chisq PValue	1 50.0% 0.86988	-	1 50.0% 0.84457	2
Western Australia	*n* Percentage Chisq PValue	8 50.0% 0.64313	-	8 50.0% 0.57921	16
Wimmera Mallee Murray	*n* Percentage Chisq PValue	12 75.0% 0.40103	-	4 25.0% 0.31485	16
National	*n* Percentage	53 58.9%	-	37 41.1%	90

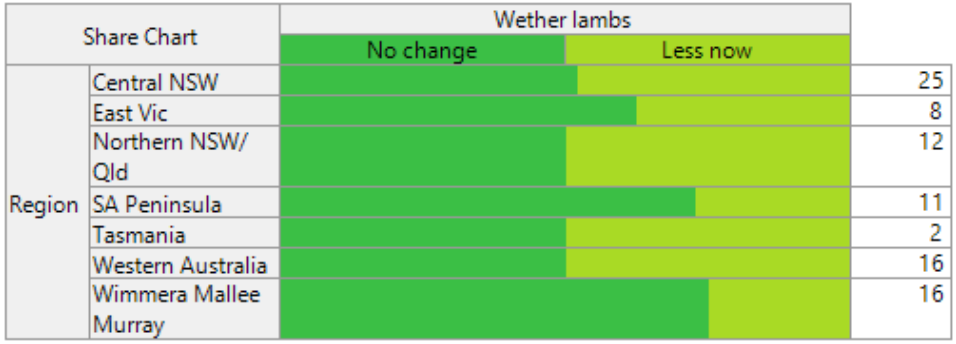


Figure 24-4: Share chart of the change or no change in skin area removed during mulesing for Wether lambs in 2018 compared to five years ago (2014) by Region.

24.4.3 Change in skin area removed compared to 5 years ago by Chosen enterprise – Ewe Lambs

Table 24-9: Proportion of respondents who reported a change or no change in skin area removed during mulesing for Ewe lambs in 2018 compared to five years ago (2014) by Chosen enterprise.

Chosen enterprise		**No change**	**More now**	**Less now**	**Total Responses**
Merino x Merino	*n*	63	1	44	108
	Percentage	58.3%	0.9%	40.7%	
	Chisq PValue	0.94704	0.9227	0.94721	
Merino wethers	*n*	0	0	1	1
	Percentage	0.0%	0.0%	100.0%	
	Chisq PValue	0.4431	0.92696	0.34751	
Merino x Other	*n*	4	0	1	5
	Percentage	80.0%	0.0%	20.0%	
	Chisq PValue	0.53697	0.83759	0.474	
Meat x Meat	*n*	2	0	2	4
	Percentage	50.0%	0.0%	50.0%	
	Chisq PValue	0.81802	0.85453	0.76088	
Other enterprise	*n*	1	0	0	1
	Percentage	100.0%	0.0%	0.0%	
	Chisq PValue	0.59135	0.92696	0.52536	
All enterprises	*n*	**70**	**1**	**48**	**119**
	Percentage	**58.8%**	**0.8%**	**40.3%**	

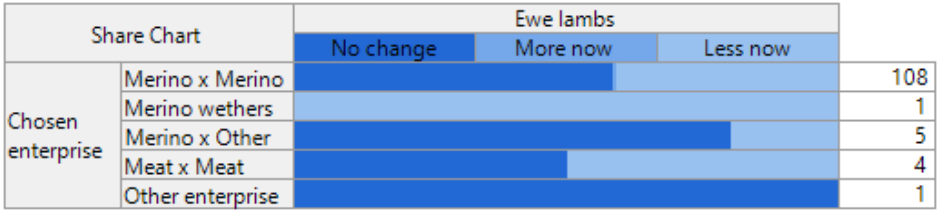


Figure 24-5: Share chart of the change or no change in skin area removed during mulesing for Ewe lambs in 2018 compared to five years ago (2014) by Chosen enterprise.

24.4.4 Change in skin area removed compared to 5 years ago by Chosen enterprise – Wether lambs

Table 24-10: Proportion of respondents who reported a change or no change in skin area removed during mulesing for Wether lambs in 2018 compared to five years ago (2014) by Chosen enterprise.

Chosen enterprise		**No change**	**More now**	**Less now**	**Total Responses**
Merino x Merino	*n* Percentage Chisq PValue	50 58.8% 0.99373	-	35 41.2% 0.9925	85
Merino wethers	*n* Percentage Chisq PValue	0 0.0% 0.27781	-	2 100.0% 0.19399	2
Merino x Other	*n* Percentage Chisq PValue	3 100.0% 0.35346	-	0 0.0% 0.26676	3
Meat x Meat	*n* Percentage Chisq PValue	-	-	-	-
Other enterprise	*n* Percentage Chisq PValue	-	-	-	-
All enterprises	*n* Percentage	**53** **58.9%**	**-**	**37** **41.1%**	**90**

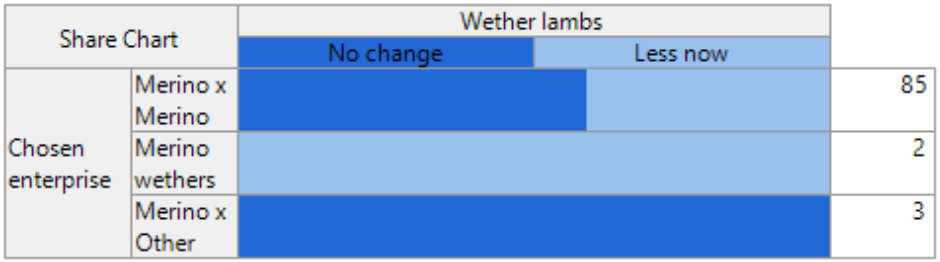


Figure 24-6: Share chart of the change or no change in skin area removed during mulesing for Wether lambs in 2018 compared to five years ago (2014) by Chosen enterprise.

24.5 Pain relief around mulesing

24.5.1 Pain relief around mulesing by Region – Ewe lambs

Table 24-11: Proportion of respondents who use pain relief around mulesing for Ewe lambs in 2018 by Region, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Region		No	Yes Tri-Solfen® only	Yes Metacam® only	Yes Buccalgesic® only	Yes both Buccalgesic and Tri-Solfen®	Total Responses
Central NSW	*n*	6	25	-	0	4	35
	Percentage	17.1%	71.4%		0.0%	11.4%	
	Chisq PValue	0.5508	0.47635		0.58759	0.00924	
East Vic	*n*	1	7	-	0	0	8
	Percentage	12.5%	87.5%		0.0%	0.0%	
	Chisq PValue	0.94187	0.87255		0.79542	0.60407	
Northern NSW/Qld	*n*	2	12	-	1	0	15
	Percentage	13.3%	80.0%		6.7%	0.0%	
	Chisq PValue	0.99056	0.92001		0.01383	0.47766	
SA Peninsula	*n*	1	10	-	0	0	11
	Percentage	9.1%	90.9%		0.0%	0.0%	
	Chisq PValue	0.69368	0.7545		0.7611	0.54314	
Tasmania	*n*	0	2	-	0	0	2
	Percentage	0.0%	100.0%		0.0%	0.0%	
	Chisq PValue	0.60407	0.78331		0.89685	0.79542	
Western Australia	*n*	2	19	-	0	0	21
	Percentage	9.5%	90.5%		0.0%	0.0%	
	Chisq PValue	0.62406	0.68166		0.67442	0.40081	
Wimmera Mallee Murray	*n*	4	23	-	0	0	27
	Percentage	14.8%	85.2%		0.0%	0.0%	
	Chisq PValue	0.84613	0.87117		0.63384	0.34076	
National	*n*	**16**	**98**	**-**	**1**	**4**	**119**
	Percentage	**13.4%**	**82.4%**		**0.8%**	**3.4%**	

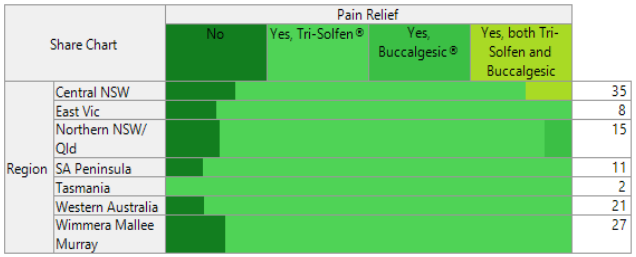


Figure 24-7: Share chart of Pain relief used around mulesing for Ewe lambs in 2018 by Region.

2011 Survey reported 59% used pain relief in ewe lambs
2014 Western Australian Sheep Producer survey found 68% of mulesed lambs were given pain relief.
2017 AWI Merino Husbandry Practices Survey reported 83% of producers used pain relief with mulesing in ewes.
The current study finds 86.6% used pain relief in ewe lambs and 90.9% in wether lambs, although the number of respondents to this question was small (ewes *n*=119, wethers n=88).

24.5.2 Pain relief around mulesing by Region – Wether lambs

Table 24-12: Proportion of respondents who use pain relief around mulesing for Wether lambs in 2018 by Region, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Region		No	Yes Trisolfen® only	Yes Metacam® only	Yes Buccalgesic® only	Yes both Buccalgesic and Tri-Solfen®	Total Responses
Central NSW	*n* Percentage Chisq PValue	4 16.7% 0.21835	16 66.7% 0.29911	-	-	4 16.7% 0.00535	24
East Vic	*n* Percentage Chisq PValue	0 0.0% 0.42503	7 100.0% 0.69785	-	-	0 0.0% 0.5727	7
Northern NSW/Qld	*n* Percentage Chisq PValue	1 9.1% 1	10 90.9% 0.87113	-	-	0 0.0% 0.4795	11
SA Peninsula	*n* Percentage Chisq PValue	1 9.1% 1	10 90.9% 0.87113	-	-	0 0.0% 0.4795	11
Tasmania	*n* Percentage Chisq PValue	0 0.0% 0.66982	2 100.0% 0.83561	-	-	0 0.0% 0.76302	2
Western Australia	*n* Percentage Chisq PValue	1 6.3% 0.70626	15 93.8% 0.75054	-	-	0 0.0% 0.39377	16
Wimmera Mallee Murray	*n* Percentage Chisq PValue	1 5.9% 0.66083	16 94.1% 0.73083	-	-	0 0.0% 0.37937	17
National	*n* Percentage	**8** **9.1%**	**76** **86.4%**	**-**	**-**	**4** **4.5%**	**88**

2011 Survey reported 64% used pain relief in wether lambs.

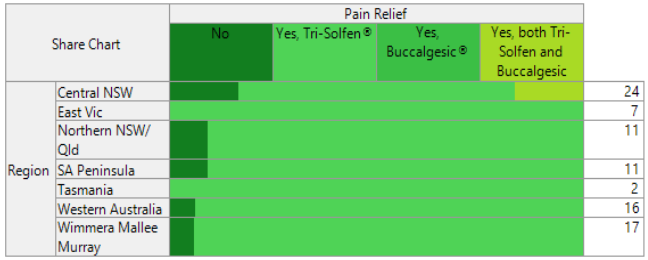


Figure 24-8: Share chart of Pain relief used around mulesing for Wether lambs in 2018 by Region.

24.5.3 Pain relief around mulesing by Chosen enterprise – Ewe Lambs

Table 24- 13: Proportion of respondents who use pain relief around mulesing for Ewe lambs in 2018 compared to five years ago (2014) by Chosen enterprise.

Chosen enterprise		No	Yes Trisolfen® only	Yes Metacam® only	Yes Buccalgesic® only	Yes both Trisolfen® and Buccalgesic®	Total Responses
Merino x Merino	*n* Percentage Chisq PValue	15 13.9% 0.89997	88 81.5% 0.92051	-	1 0.9% 0.9227	4 3.7% 0.84613	108
Merino wethers	*n* Percentage Chisq PValue	0 0.0% 0.71386	1 100.0% 0.84581	-	0 0.0% 0.92696	0 0.0% 0.85453	1
Merino x Other	*n* Percentage Chisq PValue	0 0.0% 0.41226	5 100.0% 0.66369	-	0 0.0% 0.83759	0 0.0% 0.68184	5
Meat x Meat	*n* Percentage Chisq PValue	1 25.0% 0.52854	3 75.0% 0.87127	-	0 0.0% 0.85453	0 0.0% 0.71386	4
Other enterprise	*n* Percentage Chisq PValue	0 0.0% 0.71386	1 100.0% 0.84581	-	0 0.0% 0.92696	0 0.0% 0.85453	1
All enterprises	*n* Percentage	**16** **13.4%**	**98** **82.4%**	**-**	**1** **0.8%**	**4** **3.4%**	**119**

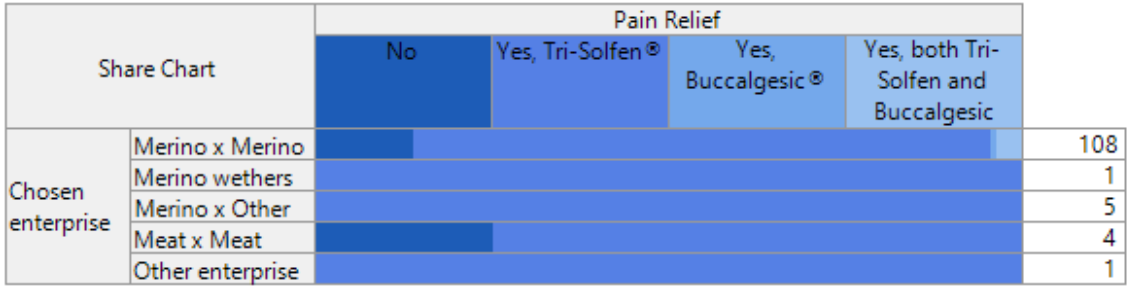


Figure 24-9: Share chart of Pain relief used around mulesing for Ewe lambs in 2018 by Chosen enterprise.

24.5.4 Pain relief around mulesing by Chosen enterprise – Wether Lambs

Table 24-14: Proportion of respondents who use pain relief around mulesing for Wether lambs in 2018 compared to five years ago (2014) by Chosen enterprise.

Chosen enterprise		No	Yes Metacam® only	Yes Buccalgesic® only	Yes Trisolfen® only	Yes both Trisolfen® and Buccalgesic®	Total Responses
Merino x Merino	*n* Percentage Chisq PValue	8 9.8% 0.84165	-	-	70 85.4% 0.92255	4 4.9% 0.88766	82
Merino wethers	*n* Percentage Chisq PValue	0 0.0% 0.66982	-	-	2 100.0% 0.83561	0 0.0% 0.76302	2
Merino x Other	*n* Percentage Chisq PValue	0 0.0% 0.54649	-	-	4 100.0% 0.76916	0 0.0% 0.66982	4
Meat x Meat	*n* Percentage Chisq PValue	-	-	-	-	-	-
Other enterprise	*n* Percentage Chisq PValue	-	-	-	-	-	-
All enterprises	*n* Percentage	**8** **9.1%**	**-**	**-**	**76** **86.4%**	**4** **4.5%**	**88**

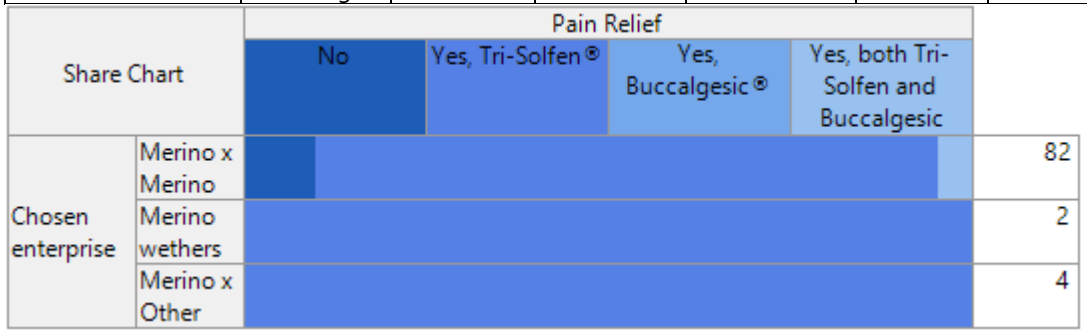


Figure 24-10: Share chart of Pain relief used around mulesing for Wether lambs in 2018 by Chosen enterprise.

24.6 Some wool left on tail

24.6.1 Some wool left on tail - Ewe Lambs

Table 24-15: Proportion of respondents who left some wool on the tail for ewe lambs, Nationally (*n*=107).

Some wool left on tail- ewe lambs	*n*	% of Total
Yes	58	54.2
No	49	45.8

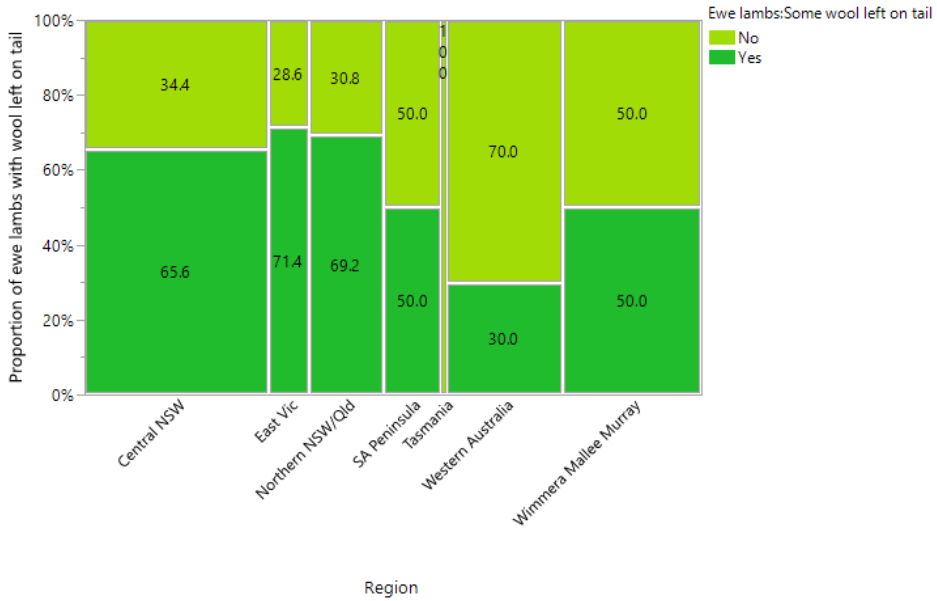


Figure 24-11: Proportion of Respondents who left wool on the tail at mulesing for Ewe lambs in 2018 by Region. Width of the columns is proportions to the total number of respondents for that region, numbers in the columns represent the percentage of a given response, chi-square=9.846, df=6, P=0.1313.

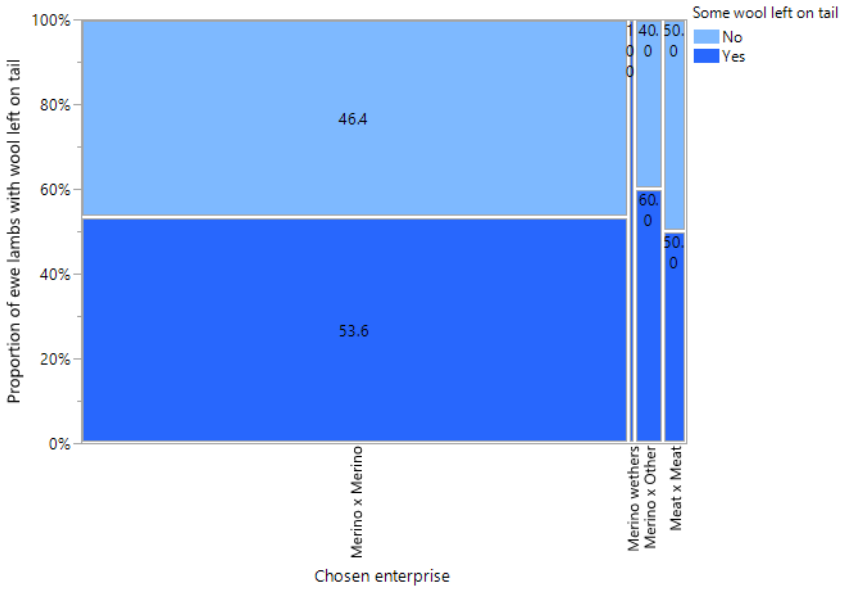


Figure 24-12: Proportion of Respondents who left wool on the tail at mulesing for Ewe lambs in 2018 by Chosen enterprise. Width of the columns is proportion of the total number of respondents for that region, numbers in the columns represent the percentage of a given response, chi-square=0.955, df=6, P=0.8122.

24.6.2 Some wool left on tail - Wether lambs

24.6.2.1 Some wool left on tail – Whether lambs by Region

Table 24-16: Proportion of respondents who left some wool on the tail for wether lambs, Nationally (*n*=76).

Some wool left on tail- wether lambs	*n*	% of Total
Yes	43	56.6
No	33	43.4

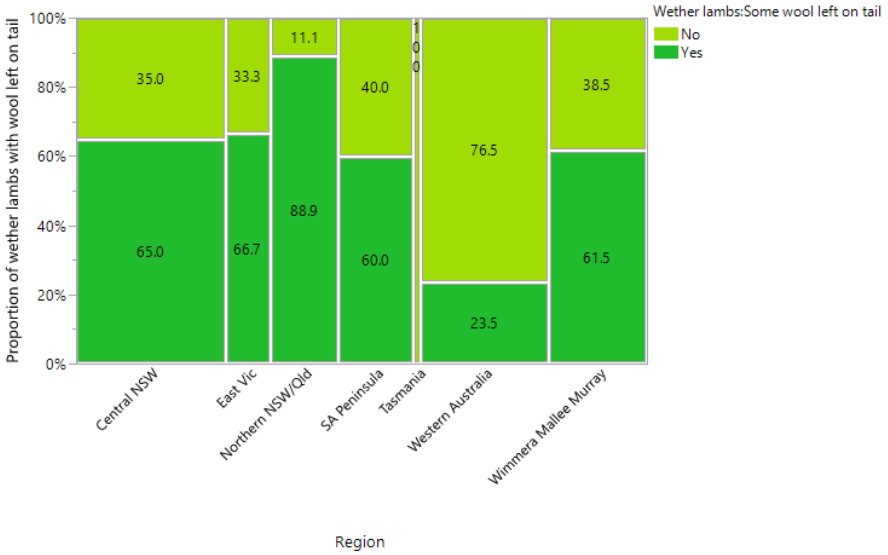


Figure 24-13: Proportion of Respondents who left wool on the tail at mulesing for Wether lambs in 2018 by Region. Width of the columns is proportions to the total number of respondents for that region, numbers in the columns represent the percentage of a given response, chi-square=13.689, df=6, P=0.0333.

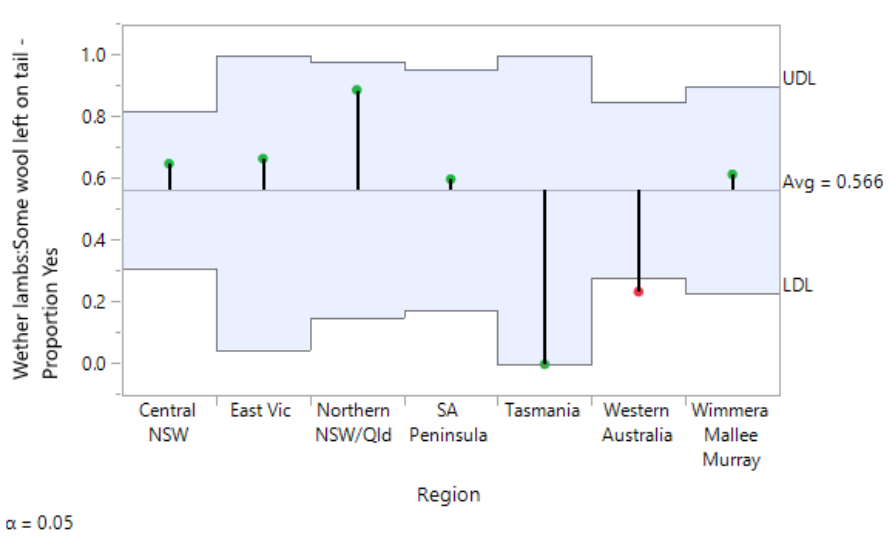


Figure 24-14: Analysis of means for proportions of who left wool on the tail of Wether lambs at mulesing in 2018. Black line indicates the Region mean distance from the overall mean, red dot indicates the mean is significantly different from the overall mean, green dot indicates the mean does not differ significantly from the overall mean.

24.6.2.2 Some wool left on tail – Wether lambs by Chosen enterprise

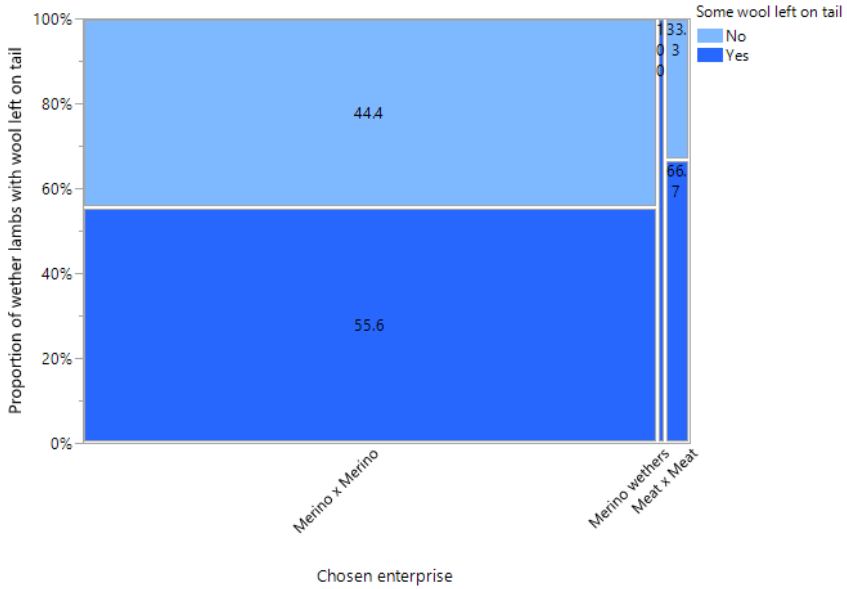


Figure 24-15: Proportion of Respondents who left wool on the tail at mulesing for Wether lambs in 2018 by Chosen enterprise. Width of the columns is proportion of the total number of respondents for that region, numbers in the columns represent the percentage of a given response, chi-square=0.922, df=2, P=0.6305.

Q25 In 2018, if you used chemical treatments to prevent or treat flystrike please provide details in the table below.

	I usually do this		If used, month used 2018	If used, product used in 2018	If used, method used in 2018							
	Yes	No			Backliner/ spray on	Hand jet	Jetting race	Plunge dip	Shower dip	Cage dip	Electro-dip	Wound dressing
Treat your sheep with preventative chemicals for fly strike at approximately the same time every year	☐	☐			☐	☐	☐	☐	☐	☐	☐	☐
Treat your sheep with preventative chemicals only when the risk of flystrike is high	☐	☐			☐	☐	☐	☐	☐	☐	☐	☐
Treat your sheep with preventative chemicals when you are unable to check sheep e.g. during harvest, before going on holidays.	☐	☐			☐	☐	☐	☐	☐	☐	☐	☐
Treat the whole mob of sheep once flystrike is detected	☐	☐			☐	☐	☐	☐	☐	☐	☐	☐
Only treat individually struck sheep	☐	☐			☐	☐	☐	☐	☐	☐	☐	☐

25.1 Proportion of respondent using a treatment for flystrike

25.1.1 Proportion of respondent using a treatment for flystrike by Region

Table 25-1: Percentage of respondents using treatments for Flystrike in 2018 by Region. P values are for a chi-square test, for each treatment.

Treatments for flystrike	Percentage (%) respondents using treatment by Region								
	Central NSW	East Vic	Northern NSW/Qld	SA Peninsula	Tasmania	Western Australia	Wimmera Mallee Murray	National	P-value
Only treat individually struck sheep	69.0	76.9	60.0	66.7	100	68.2	64.7	**67.9**	0.5121
Treat your sheep with preventative chemicals for flystrike at approximately the same time every year	70.0	65.0	61.3	54.5	66.7	71.0	66.7	**66.3**	0.9566
Treat your sheep with preventative chemicals only when the risk of flystrike is high	47.0	57.1	45.5	40.0	40.0	50.0	35.1	**44.6**	0.837
Treat the whole mob of sheep once flystrike is detected	11.0	40.0	21.7	14.3	60.0	15.8	26.5	**22.2**	0.2019
Treat your sheep with preventative chemicals when you are unable to check sheep e.g. during harvest	19.0	18.2	18.2	25.0	25.0	22.7	11.4	**18.0**	0.932
N	**173**	**68**	**123**	**45**	**28**	**118**	**188**	**743**	

25.1.2 Proportion of respondent using a treatment for flystrike by Chosen enterprise

Table 25-2: Percentage of respondents using treatments for Flystrike in 2018 by Chosen enterprise. P values are for a chi-square test, for each treatment.

Treatments for flystrike	Percentage (%) respondents using treatment by Chosen enterprise						
	Merino x Merino	Merino wethers	Merino x Other	Meat x Meat	Other enterprise	All enterprises	P-value
Only treat individually struck sheep	71.1	66.7	53.3	69.2	40.0	**67.9**	0.4834
Treat your sheep with preventative chemicals for flystrike at approximately the same time every year	63.9	75.0	70.0	65.0	87.5	**66.3**	0.6178
Treat your sheep with preventative chemicals only when the risk of flystrike is high	44.0	50.0	61.1	39.3	33.3	**44.6**	0.6142
Treat the whole mob of sheep once flystrike is detected	21.5	0.0	23.1	26.9	20.0	**22.2**	0.8506
Treat your sheep with preventative chemicals when you are unable to check sheep e.g. during harvest	17.6	0.0	28.6	11.5	40.0	**18.0**	0.4232
N	**464**	**19**	**80**	**146**	**29**	**743**	

The proportion of respondents treating sheep with preventative chemicals at the same time each year has increased from 2011 (43%).
Respondents who selected 'Only treat individually struck sheep' may have misunderstood the question, option is disproportionately high when viewed in context of proportions of other treatment options.

25.2 Month of flystrike treatment

25.2.1 Month of flystrike treatment – National

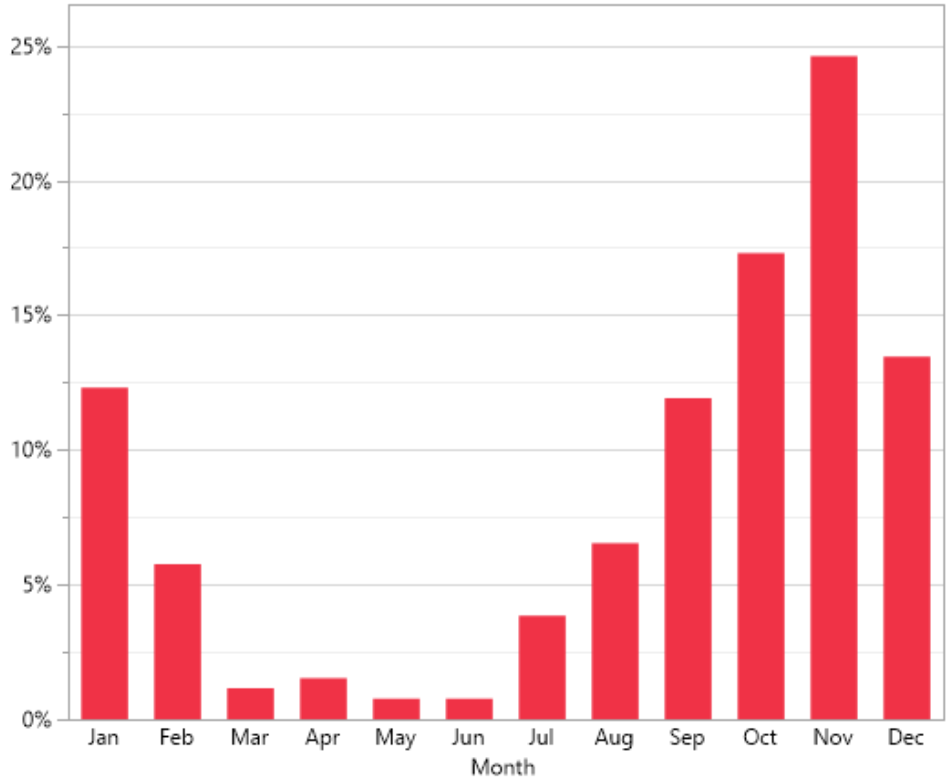


Figure 25-1: Proportion of respondents treating for flystrike per month in 2018 over all Regions and Enterprises.

Table 17-3: Proportion of respondents treating for flystrike per month in 2018 over all Regions and Enterprises

Month	*n*	% of Total
Jan	32	12.3%
Feb	15	5.8%
Mar	3	1.2%
Apr	4	1.5%
May	2	0.8%
Jun	2	0.8%
Jul	10	3.8%
Aug	17	6.5%
Sep	31	11.9%
Oct	45	17.3%
Nov	64	24.6%
Dec	35	13.5%

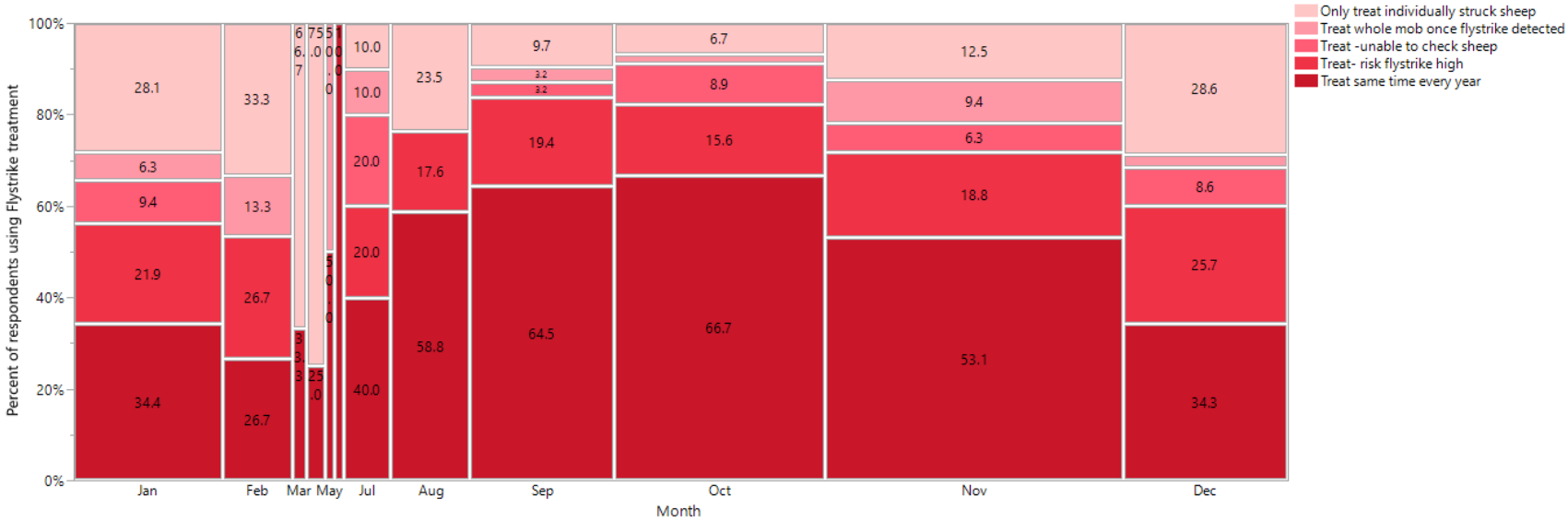


Figure 25-2: Proportion of respondents Nationally using Flystrike treatment by month, width of column indicates number of respondents, number in column indicates percentage of respondents who used a treatment in a given month.

Table 25-4: National proportion of respondents using Flystrike treatment by month, *n=260*.

Flystrike treatment	***n***	**Month (%)**											
		Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Treat your sheep with preventative chemicals for flystrike at approximately the same time every year	130	34	27	33	25	50	100	40	59	65	67	53	34
Treat your sheep with preventative chemicals only when the risk of flystrike is high	50	22	27	0	0	0	0	20	18	19	16	19	26
Treat your sheep with preventative chemicals when you are unable to check sheep e.g. during harvest	17	9	0	0	0	0	0	20	0	3	9	6	9
Treat the whole mob of sheep once flystrike is detected	15	6	13	0	0	50	0	10	0	3	2	9	3
Only treat individually struck sheep	48	28	33	67	75	0	0	10	24	10	7	13	29

25.3 Product used to treat or prevent Flystrike

25.3.1 Product used for all treatment methods

Table 25-5: Proportion of respondents using flystrike product (active ingredient or class) Nationally.

Treatment	Product used (%)								
	n	**Abamectin**	**Cyromazine**	**Diazinon**	**Dicyclanil**	**Ivermectin**	**Neonicotinoid**	**Spinosad**	**Unspecified product**
Treat at same time every year	130	0	12	0	28	4	3	2	1
Treat when risk flystrike high	39	0	4	0	7	2	0	1	1
Treat when unable to check sheep	19	0	3	0	2	1	0	1	0
Treat whole mob once flystrike is detected	13	0	3	0	2	0	0	0	0
Only treat individually struck sheep	52	0	2*	3	1	4	0	8	2
All Treatments	**254**	**0**	**24**	**3**	**40**	**12**	**4**	**12**	**5**

*Cyromazine is not effective against maggots.

25.3.2 Treat with preventative chemicals at same time every year

25.3.2.1 Treat with preventative chemicals at same time every year by Region

Table 25-6: Proportion of respondents using flystrike product (active ingredient or class) by Region.

Region	Proportion of respondents (%)								
	n	**Abamectin**	**Cyromazine**	**Diazinon**	**Dicyclanil**	**Ivermectin**	**Neonicotinoid**	**Spinosad**	**Unspecified product**
Central NSW	30	0	13	0	32	0	25	20	0
East Vic	14	0	13	0	8	0	25	40	0
Northern NSW/Qld	20	0	19	0	18	0	13	0	0
SA Peninsula	6	0	10	0	4	0	0	0	0
Tasmania	7	0	10	0	3	18	0	0	0
Western Australia	23	0	10	0	17	45	0	0	100
Wimmera Mallee Murray	30	0	26	0	18	36	38	40	0
National	**130**	**0**	**24**	**0**	**55**	**9**	**6**	**4**	**2**

Note: percentages may sum to more than 100 as respondents could name more than one chemical.

Chi-square=52.330, df=30, P=0.0070.

2011 survey found 54% used Dicyclanil and 36% used Cyromazine for planned preventative treatments.

25.3.2.2 Treat with preventative chemicals at same time every year by Chosen enterprise

Table 25-7: Proportion of respondents using flystrike product (active ingredient or class) by Chosen enterprise.

Region	Proportion of respondents (%)									
	n	**Abamectin**	**Cyromazine**	**Diazinon**	**Dicyclanil**	**Ivermectin**	**Neonicotinoid**	**Propetamphos**	**Spinosad**	**Unspecified product**
Merino x Merino	79	0	65	0	65	55	38	0	60	33
Merino wethers	7	0	3	0	6	0	25	0	0	0
Merino x Other	13	0	3	0	13	0	13	0	20	33
Meat x Meat	24	0	23	0	13	46	25	0	20	0
Other enterprise	6	0	7	0		0	0	0	0	33
All enterprises	**130**	**0**	**24**	**0**	**55**	**9**	**6**	**0**	**4**	**2**

Note: percentages may sum to more than 100 as respondents could name more than one chemical.

Chi-square=23.747, df=20, P=0.2536.

25.3.3 Treat with preventative chemicals only when the risk is high

25.3.3.1 Treat with preventative chemicals only when the risk is high by Region

Table 25-8: Proportion of respondents using flystrike product (active ingredient or class) by Region.

Region	Proportion of respondents (%)									
	n	**Abamectin**	**Cyromazine**	**Diazinon**	**Dicyclanil**	**Ivermectin**	**Neonicotinoid**	**Propetamphos**	**Spinosad**	**Unspecified product**
Central NSW	13	0	27	0	53	20	0	0	0	0
East Vic	4	0	9	0	6	20	0	0	0	33
Northern NSW/Qld	2	0	0	0	6	0	0	0	0	33
SA Peninsula	4	0	27	0	6	0	0	0	0	0
Tasmania	0	0	0	0	0	0	0	0	0	0
Western Australia	8	0	9	0	12	60	0	0	50	33
Wimmera Mallee Murray	8	0	27	0	18	0	100	0	50	0
National	**39**	**0**	**28**	**0**	**44**	**13**	**3**	**0**	**5**	**8**

Note: percentages may sum to more than 100 as respondents could name more than one chemical.

Chi-square=28.313, df=25, P=0.2546.

2011 survey found 42% used Dicyclanil and 36% used Cyromazine and 14% used Ivermectin for treat with preventative chemicals when risk is high.

25.3.3.2 Treat with preventative chemicals only when the risk is high by Chosen enterprise

Table 25-9: Proportion of respondents using flystrike product (active ingredient or class) by Chosen enterprise.

Region	Proportion of respondents (%)									
	n	**Abamectin**	**Cyromazine**	**Diazinon**	**Dicyclanil**	**Ivermectin**	**Neonicotinoid**	**Propetamphos**	**Spinosad**	**Unspecified product**
Merino x Merino	25	0	55	0	65	100	0	0	50	67
Merino wethers	0	0	0	0	0	0	0	0	0	0
Merino x Other	8	0	27	0	24	0	0	0	50	0
Meat x Meat	4	0	9	0	6	0	100	0	0	33
Other enterprise	2	0	9	0	6	0	0	0	0	0
All enterprises		**0**	**28**	**0**	**44**	**13**	**3**	**0**	**5**	**8**

Note: percentages may sum to more than 100 as respondents could name more than one chemical.

Chi-square=13.942, df=15, P=0.5299.

25.3.4 Treat with preventative chemicals when you are unable to check sheep

25.3.4.1 Treat with preventative chemicals when you are unable to check sheep by Region

Table 25-10: Proportion of respondents using flystrike product (active ingredient or class) by Region.

Region	Proportion of respondents (%)									
	n	**Abamectin**	**Cyromazine**	**Diazinon**	**Dicyclanil**	**Ivermectin**	**Neonicotinoid**	**Propetamphos**	**Spinosad**	**Unspecified product**
Central NSW	4	0	29	0	17	0	0	0	33	0
East Vic	1	0	0	0	17	0	0	0	0	0
Northern NSW/Qld	3	0	14	0	33	0	0	0	0	0
SA Peninsula	2	0	14	0	17	0	0	0	0	0
Tasmania	1	0	14	0	0	0	0	0	0	0
Western Australia	6	0	29	0	0	100	0	0	33	100
Wimmera Mallee Murray	2	0	0	0	17	0	0	0	33	0
National	**19**	**0**	**37**	**0**	**32**	**11**	**0**	**0**	**16**	**5**

Note: percentages may sum to more than 100 as respondents could name more than one chemical.

Chi-square=20.143, df=24, P=0.6886.

25.3.4.2 Treat with preventative chemicals when you are unable to check sheep by Chosen enterprise

Table 25-11: Proportion of respondents using flystrike product (active ingredient or class) by Chosen enterprise.

Region	Proportion of respondents (%)									
	n	**Abamectin**	**Cyromazine**	**Diazinon**	**Dicyclanil**	**Ivermectin**	**Neonicotinoid**	**Propetamphos**	**Spinosad**	**Unspecified product**
Merino x Merino	13	0	86	0	67	100	0	0	33	0
Merino wethers	0	0	0	0	0	0	0	0	0	0
Merino x Other	4	0	14	0	0	0	0	0	67	100
Meat x Meat	1	0	0	0	17	0	0	0	0	0
Other enterprise	1	0	0	0	17	0	0	0	0	0
All enterprises	**19**	**0**	**37**	**0**	**32**	**11**	**0**	**0**	**16**	**5**

Note: percentages may sum to more than 100 as respondents could name more than one chemical.

Chi-square=14.138, df=12, P=0.2920.

25.3.5 Treat whole mob once flystrike is detected

25.3.5.1 Treat whole mob once flystrike is detected by Region

Table 25-12: Proportion of respondents using flystrike product (active ingredient or class) by Region.

Region	Proportion of respondents (%)									
	n	**Abamectin**	**Cyromazine**	**Diazinon**	**Dicyclanil**	**Ivermectin**	**Neonicotinoid**	**Propetamphos**	**Spinosad**	**Unspecified product**
Central NSW	1	0	0	0	25	0	0	0	0	0
East Vic	1	0	0	0	25	0	0	0	0	0
Northern NSW/Qld	2	0	0	0	25	0	0	0	100	0
SA Peninsula	1	0	14	0	0	0	0	0	0	0
Tasmania	2	0	29	0	0	0	0	0	0	0
Western Australia	2	0	14	0	0	100	0	0	0	0
Wimmera Mallee Murray	4	0	43	0	0	0	0	0	0	0
National	**13**	**0**	**54**	**0**	**31**	**8**	**0**	**0**	**8**	**0**

Note: percentages may sum to more than 100 as respondents could name more than one chemical.

Chi-square=18.312, df=18, P=0.4353.

25.3.5.2 Treat whole mob once flystrike is detected by Chosen enterprise

Table 25-13: Proportion of respondents using flystrike product (active ingredient or class) by Chosen enterprise.

Region	Proportion of respondents (%)									
	n	**Abamectin**	**Cyromazine**	**Diazinon**	**Dicyclanil**	**Ivermectin**	**Neonicotinoid**	**Propetamphos**	**Spinosad**	**Unspecified product**
Merino x Merino	8	0	71	0	50	100	0	0	0	0
Merino wethers	0	0	0	0	0	0	0	0	0	0
Merino x Other	3	0	0	0	50	0	0	0	100	0
Meat x Meat	1	0	14	0	0	0	0	0	0	0
Other enterprise	1	0	14	0	0	0	0	0	0	0
All enterprises	**13**	**0**	**54**	**0**	**31**	**8**	**0**	**0**	**8**	**0**

Note: percentages may sum to more than 100 as respondents could name more than one chemical.

Chi-square=10.132, df=9, P=0.3573.

25.3.6 Only treat individually struck sheep

25.3.6.1 Only treat individually struck sheep by Region

Table 25-14: Proportion of respondents using flystrike product (active ingredient or class) by Region.

Region	Proportion of respondents (%)									
	n	**Abamectin**	**Cyromazine**	**Diazinon**	**Dicyclanil**	**Ivermectin**	**Neonicotinoid**	**Propetamphos**	**Spinosad**	**Unspecified product**
Central NSW	13	0	0	13	0	55	0	0	25	20
East Vic	5	0	0	0	0	9	0	100	10	20
Northern NSW/Qld	5	0	0	25	50	0	0	0	5	20
SA Peninsula	4	0	25	13	0	0	0	0	10	0
Tasmania	2	0	0	13	0	0	0	0	5	0
Western Australia	11	0	50	13	0	18	0	0	20	40
Wimmera Mallee Murray	13	100	25	25	50	18	100	0	25	0
National	**53**	**2**	**8***	**15**	**4**	**21**	**2**	**2**	**38**	**9**

Note: percentages may sum to more than 100 as respondents could name more than one chemical.

**Cyromazine is not effective against maggots.*

Chi-square=39.818, df=48, P=0.7935.

2011 survey reported Spinosad as most popular active for treating individually struck sheep (38%), followed by Diazinon (23%) and Ivermectin (14%). Cyromazine was reported to have been used in both 2018 (8%) and 2011 (17%) despite it not being effective against maggots.

25.3.6.2 Only treat individually struck sheep by Chosen enterprise

Table 25-15: Proportion of respondents using flystrike product (active ingredient or class) by Chosen enterprise.

Region	Proportion of respondents (%)									
	n	**Abamectin**	**Cyromazine**	**Diazinon**	**Dicyclanil**	**Ivermectin**	**Neonicotinoid**	**Propetamphos**	**Spinosad**	**Unspecified product**
Merino x Merino	37	0	100	100	50	80	0	0	65	60
Merino wethers	1	0	0	0	0	0	100	0	0	0
Merino x Other	1	0	0	0	0	0	0	0	0	20
Meat x Meat	13	100	0	0	50	20	0	100	35	20
Other enterprise	0	0	0	0	0	0	0	0	0	0
All enterprises	**53**	**2**	**8**	**15**	**4**	**21**	**2**	**2**	**38**	**9**

Note: percentages may sum to more than 100 as respondents could name more than one chemical.

Chi-square=73.568, df=24, P<0.0001.

25.4 Method of application of chemical flystrike treatments

25.4.1 Method of application of chemical flystrike treatments – Treat at same time every year

Table 25-16: Methods used by respondents who treat at the same time every year with preventative chemicals, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Region		Method							
		Backliner/ spray on	**Cage dip**	**Electrodip**	**Hand jet**	**Jetting race**	**Shower/dip**	**Wound dressing**	**Total Responses**
Central NSW	*n*	25	0	1	3	0	0	0	29
	Percentage	86.2%	0.0%	3.4%	10.3%	0.0%	0.0%	0.0%	
	Chi-sq P-value	0.19037	0.49051	0.436	0.42111	0.19707	0.49051	0.62587	
East Victoria	*n*	11	2	1	0	1	0	0	15
	Percentage	73.3%	13.3%	6.7%	0.0%	6.7%	0.0%	0.0%	
	Chi-sq P-value	0.7415	0.0004	0.91931	0.11685	0.88061	0.61998	0.72586	
Norhtern NSW/Qld	*n*	13	0	0	2	1	0	0	16
	Percentage	81.3%	0.0%	0.0%	12.5%	6.3%	0.0%	0.0%	
	Chi-sq P-value	0.46581	0.60855	0.27729	0.7005	0.93183	0.60855	0.71725	
SA Peninsula	*n*	2	0	0	1	0	1	0	4
	Percentage	50.0%	0.0%	0.0%	25.0%	0.0%	25.0%	0.0%	
	Chi-sq P-value	0.6874	0.79789	0.58698	0.67074	0.63189	0.00026	0.85631	
Tasmania	*n*	1	0	0	3	1	0	0	5
	Percentage	20.0%	0.0%	0.0%	60.0%	20.0%	0.0%	0.0%	
	Chi-sq P-value	0.20297	0.77465	0.54363	0.01603	0.18306	0.77465	0.83957	
Western Australia	*n*	11	0	2	5	3	0	0	21
	Percentage	52.4%	0.0%	9.5%	23.8%	14.3%	0.0%	0.0%	
	Chi-sq P-value	0.43066	0.55738	0.7172	0.40127	0.10198	0.55738	0.67822	
Wimmera Mallee Murray	*n*	18	0	5	6	1	1	1	32
	Percentage	56.3%	0.0%	15.6%	18.8%	3.1%	3.1%	3.1%	
	Chi-sq P-value	0.48131	0.46889	0.08583	0.74197	0.53722	0.51158	0.14975	
All Regions	*n*	**81**	**2**	**9**	**20**	**7**	**2**	**1**	**122**
	Percentage	**66.4%**	**1.6%**	**7.4%**	**16.4%**	**5.7%**	**1.6%**	**0.8%**	

25.4.2 Method of application of chemical flystrike treatments – Treat when risk of flystrike is high

Table 25-17: Methods used by respondents who treat when the risk of flystrike is high, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

		Method							
Region		**Backliner/ spray on**	**Cage dip**	**Electrodip**	**Hand jet**	**Jetting race**	**Shower/dip**	**Wound dressing**	**Total Responses**
Central NSW	*n*	8	0	0	3	0	0	-	11
	Percentage	72.7%	0.0%	0.0%	27.3%	0.0%	0.0%		
	Chi-sq P-value	0.45274	0.61301	0.61301	0.96824	0.38101	0.47443		
East Victoria	*n*	2	1	0	1	1	0	-	5
	Percentage	40.0%	20.0%	0.0%	20.0%	20.0%	0.0%		
	Chi-sq P-value	0.63599	0.00955	0.73311	0.73786	0.27024	0.62963		
Norhtern NSW/Qld	*n*	3	0	0	1	0	0	-	4
	Percentage	75.0%	0.0%	0.0%	25.0%	0.0%	0.0%		
	Chi-sq P-value	0.60752	0.76037	0.76037	0.91236	0.59731	0.66623		
SA Peninsula	*n*	1	0	0	3	1	0	-	5
	Percentage	20.0%	0.0%	0.0%	60.0%	20.0%	0.0%		
	Chi-sq P-value	0.28375	0.73311	0.73311	0.17433	0.27024	0.62963		
Tasmania	*n*	1	0	0	0	0	0	-	1
	Percentage	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
	Chi-sq P-value	0.55422	0.87879	0.87879	0.59731	0.79168	0.82925		
Western Australia	*n*	4	0	1	2	1	0	-	8
	Percentage	50.0%	0.0%	12.5%	25.0%	12.5%	0.0%		
	Chi-sq P-value	0.82578	0.66623	0.05915	0.87631	0.55422	0.54187		
Wimmera Mallee Murray	*n*	5	0	0	2	0	2	-	9
	Percentage	55.6%	0.0%	0.0%	22.2%	0.0%	22.2%		
	Chi-sq P-value	0.99172	0.64731	0.64731	0.74682	0.42812	0.01452		
All Regions	*n*	**24**	**1**	**1**	**12**	**3**	**2**		**43**
	Percentage	**55.8%**	**2.3%**	**2.3%**	**27.9%**	**7.0%**	**4.7%**		

25.4.3 Method of application of chemical flystrike treatments – Treat when unable to check sheep

Table 25-18: Methods used by respondents who treat when unable to check sheep, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Region		Method							
		Backliner/ spray on	**Cage dip**	**Electrodip**	**Hand jet**	**Jetting race**	**Shower/dip**	**Wound dressing**	**Total Responses**
Central NSW	*n* Percentage Chi-sq P-value	3 60.0% 0.75183	-	-	2 40.0% 0.72634	0 0.0% 0.4292	0 0.0% 0.57615	-	5
East Victoria	*n* Percentage Chi-sq P-value	1 100.0% 0.4795	-	-	0 0.0% 0.57615	0 0.0% 0.72367	0 0.0% 0.80259	-	1
Norhtern NSW/Qld	*n* Percentage Chi-sq P-value	2 66.7% 0.68309	-	-	0 0.0% 0.33292	1 33.3% 0.30743	0 0.0% 0.66501	-	3
SA Peninsula	*n* Percentage Chi-sq P-value	1 50.0% 1	-	-	1 50.0% 0.63526	0 0.0% 0.61708	0 0.0% 0.72367	-	2
Tasmania	*n* Percentage Chi-sq P-value	0 0.0% 0.4795	-	-	1 100.0% 0.21876	0 0.0% 0.72367	0 0.0% 0.80259	-	1
Western Australia	*n* Percentage Chi-sq P-value	1 33.3% 0.68309	-	-	1 33.3% 0.94853	1 33.3% 0.30743	0 0.0% 0.66501	-	3
Wimmera Mallee Murray	*n* Percentage Chi-sq P-value	0 0.0% 0.4795	-	-	0 0.0% 0.57615	0 0.0% 0.72367	1 100.0% 0.00018	-	1
All Regions	*n* Percentage	**8** **50.0%**	**-**	**-**	**5** **31.3%**	**2** **12.5%**	**1** **6.3%**	**-**	**16**

25.4.4 Method of application of chemical flystrike treatments – Treat whole mob once flystrike detected

Table 25-19: Methods used by respondents who treat whole mob of sheep once flystrike is detected.

Region		Method							
		Backliner/ spray on	**Cage dip**	**Electrodip**	**Hand jet**	**Jetting race**	**Shower/dip**	**Wound dressing**	**Total Responses**
Central NSW	*n* Percentage Chi-sq P-value	1 50.0% 0.79246	-	0 0.0% 0.49691	1 50.0% 0.42801	0 0.0% 0.5791	-	-	2
East Victoria	*n* Percentage Chi-sq P-value	1 100.0% 0.32106	-	0 0.0% 0.63095	0 0.0% 0.63095	0 0.0% 0.69489	-	-	1
Norhtern NSW/Qld	*n* Percentage Chi-sq P-value	1 100.0% 0.32106	-	0 0.0% 0.63095	0 0.0% 0.63095	0 0.0% 0.69489	-	-	1
SA Peninsula	*n* Percentage Chi-sq P-value	0 0.0% 0.53514	-	0 0.0% 0.63095	1 100.0% 0.10931	0 0.0% 0.69489	-	-	1
Tasmania	*n* Percentage Chi-sq P-value	0 0.0% 0.53514	-	0 0.0% 0.63095	1 100.0% 0.10931	0 0.0% 0.69489	-	-	1
Western Australia	*n* Percentage Chi-sq P-value	1 50.0% 0.79246	-	1 50.0% 0.42801	0 0.0% 0.49691	0 0.0% 0.5791	-	-	2
Wimmera Mallee Murray	*n* Percentage Chi-sq P-value	1 20.0% 0.50564	-	2 40.0% 0.43086	0 0.0% 0.28275	2 40.0% 0.16053	-	-	5
All Regions	*n* Percentage	**5** **38.5%**	**-**	**3** **23.1%**	**3** **23.1%**	**2** **15.4%**	**-**	**-**	**13**

25.4.5 Method of application of chemical flystrike treatments – Treat only individually struck sheep

Table 25-20: Methods used by respondents who treat only individually struck sheep.

Region		Method							
		Backliner/ spray on	**Cage dip**	**Electrodip**	**Hand jet**	**Jetting race**	**Shower/dip**	**Wound dressing**	**Total Responses**
Central NSW	*n* Percentage Chi-sq P-value	1 5.9% 0.78788	-	-	2 11.8% 0.8176	1 5.9% 0.14875	-	13 76.5% 0.98303	17
East Victoria	*n* Percentage Chi-sq P-value	1 12.5% 0.62393	-	-	2 25.0% 0.39654	0 0.0% 0.72572	-	5 62.5% 0.64184	8
Norhtern NSW/Qld	*n* Percentage Chi-sq P-value	1 16.7% 0.42801	-	-	0 0.0% 0.36205	0 0.0% 0.76126	-	5 83.3% 0.85792	6
SA Peninsula	*n* Percentage Chi-sq P-value	0 0.0% 0.53514	-	-	2 40.0% 0.11603	0 0.0% 0.78151	-	3 60.0% 0.66614	5
Tasmania	*n* Percentage Chi-sq P-value	0 0.0% 0.63095	-	-	0 0.0% 0.51925	0 0.0% 0.8299	-	3 100.0% 0.64858	3
Western Australia	*n* Percentage Chi-sq P-value	1 8.3% 0.93619	-	-	3 25.0% 0.2991	0 0.0% 0.66744	-	8 66.7% 0.68541	12
Wimmera Mallee Murray	*n* Percentage Chi-sq P-value	1 7.1% 0.94091	-	-	0 0.0% 0.16384	0 0.0% 0.64258	-	13 92.9% 0.49665	14
All Regions	*n* Percentage	**5** **7.7%**	**-**	**-**	**9** **13.8%**	**1** **1.5%**	**-**	**50** **76.9%**	**65**

Q26 Do you suspect resistance to a flystrike treatment product on your reporting property?

26.1 Proportion of respondents who suspect resistance to Flystrike treatments by Region

Table 26-1: Proportion of respondents who suspect resistance to a flystrike treatment product by Region.

Region	*n*	Proportion of respondents suspect resistance to flystrike treatment (%)
Central NSW	83	11.3
East Vic	44	0.0
Northern NSW/Qld	62	8.1
SA Peninsula	20	0.0
Tasmania	13	11.1
Western Australia	53	2.9
Wimmera Mallee Murray	79	0.0
All Regions	**354**	**4.9**

Chi-square=14.233, df=6, P-value=0.271.

26.2 Proportion of respondents who suspect resistance to Flystrike treatments by Chosen enterprise

Table 26-2: Proportion of respondents who suspect resistance to a flystrike treatment product by Chosen enterprise.

Region	*n*	Proportion of respondents suspect resistance to flystrike treatment (%)
Merino x Merino	220	7.2
Merino wethers	16	0.0
Merino x Other	36	0.0
Meat x Meat	69	2.4
Other enterprise	13	0.0
All Enterprises	**354**	**4.9**

Chi-square=6.401, df=4, P-value=0.1711.

Q27 Which product do you suspect flies are resistant to and when did you first suspect resistance to this product?

Q27 Which product do you suspect flies are resistant to and when did you first suspect resistance to this product?

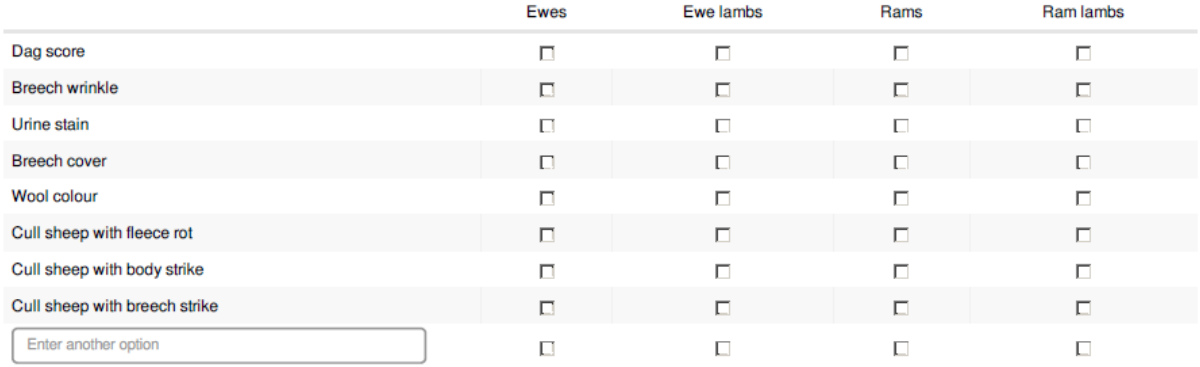
	Product flies resistant to	Year(s) resistance suspected
1		
2		
3		
4		

National

Table 27-1: National proportion of respondents who suspected resistance to specific flystrike treatment products and the mean number of years since resistance was suspected, number of respondents for this question *n*=12.

Product suspect resistance to	***n***	**Proportion of respondents who suspected resistance to this product**	**Mean number of years since suspected resistance**
Diazinon	6	50.0	13.0 (0-20)
Dicyclanil	3	25.0	0.3 (0-1)
Cyromazine	1	8.3	3.0
Ivermectin	1	8.3	3.0
Propetamphos	1	8.3	0.0
All products	**12**		**7.1 (0-20)**

Q28 In 2018, if you used visual assessment to breed sheep that are less likely to get flystrike, please indicate which visual traits you used.



28.1 Proportion of respondents who used visual traits to breed sheep less susceptible to flystrike by Region

Of respondents who answered questions on Blowfly Control 55.5% and 43.7% used visual traits to breed for ewes and rams that are less susceptible to flystrike, respectively.

28.1.1 Visual traits used for ewes and ewe lambs by Region

Table 28-1: Proportion of respondents using visual traits in ewes and ewe lambs to breed sheep that are less likely to get flystrike by Region, *n*= number of responses per visual trait, total number of responses *n*=584, total number of respondents *n*=136.

Visual trait		Proportion (%) respondents using visual traits for ewes and ewe lambs by Region							
	n	**Central NSW**	**East Vic**	**Northern NSW/Qld**	**SA Peninsula**	**Tasmania**	**Western Australia**	**Wimmera Mallee Murray**	**National**
Cull sheep with body strike *	108	35.6	11.1	31.7	35.0	15.4	40.7	22.6	**29.1**
Cull sheep with fleece rot *	102	31.0	13.3	33.3	35.0	15.4	40.7	17.9	**27.5**
Breech wrinkle *	82	23.0	6.7	30.2	35.0	7.7	30.5	16.7	**22.1**
Wool colour	74	21.8	11.1	23.8	30.0	15.4	28.8	11.9	**20.0**
Cull sheep with breech strike *	74	16.1	6.7	25.4	30.0	7.7	32.2	17.9	**20.0**
Dag score *	54	12.6	8.9	9.5	15.0	15.4	32.2	10.7	**14.6**
Urine stain *	45	13.8	8.9	11.1	20.0	0.0	23.7	4.8	**12.1**
Breech cover	45	10.3	2.2	19.0	20.0	15.4	15.3	9.5	**12.1**

*Indicates a significant difference between regions for that trait P<0.05, using a binomial homogeneity test for each trait.

28.1.2 Visual traits used for ewes and ewe lambs by Chosen enterprise

Table 28-2: Proportion of respondents using visual traits in ewes and ewe lambs to breed sheep that are less likely to get flystrike by Chosen enterprise, *n*= number of responses per visual trait, total number of responses *n*=584, total number of respondents *n*=136.

Visual trait		Proportion (%) respondents using visual traits for ewes and ewe lambs by Chosen enterprise					
	n	**Merino x Merino**	**Merino wethers**	**Merino x Other**	**Meat x Meat**	**Other enterprise**	**All enterprises**
Cull sheep with body strike *	108	40.5	6.3	19.4	8.7	30.8	**29.1**
Cull sheep with fleece rot *	102	38.2	6.3	22.2	5.8	30.8	**27.5**
Breech wrinkle *	82	29.6	0.0	27.8	5.8	23.1	**22.1**
Wool colour*	74	28.6	0.0	8.3	4.4	30.8	**20.0**
Cull sheep with breech strike *	74	27.3	0.0	19.4	5.8	23.1	**20.0**
Dag score	54	17.3	0.0	16.7	10.1	23.1	**14.6**
Urine stain	45	14.6	6.3	16.7	4.4	23.1	**12.1**
Breech cover	45	14.1	0.0	16.7	7.3	23.1	**12.1**

*Indicates a significant difference between enterprises for that trait P<0.05, using a binomial homogeneity test for each trait.

28.1.3 Visual traits used for rams and ram lambs by Region

Table 28-3: Proportion of respondents using visual traits in rams and ram lambs to breed sheep that are less likely to get flystrike by Region, *n*= number of responses per visual trait, total number of responses *n*=402 total number of respondents *n*=107.

Visual trait		Proportion (%) respondents using visual traits for rams and ram lambs by Region							
	n	**Central NSW**	**East Vic**	**Northern NSW/Qld**	**SA Peninsula**	**Tasmania**	**Western Australia**	**Wimmera Mallee Murray**	**National**
Breech wrinkle *	72	20.7	4.4	23.8	35.0	7.7	25.4	16.7	**19.4**
Cull sheep with fleece rot	69	17.2	8.9	22.2	25.0	15.4	27.1	15.5	**18.6**
Cull sheep with body strike	65	16.1	6.7	20.6	25.0	15.4	27.1	14.3	**17.5**
Wool colour	59	17.2	8.9	20.6	30.0	15.4	17.0	10.7	**15.9**
Cull sheep with breech strike *	46	9.2	4.4	15.9	25.0	7.7	22.0	8.3	**12.4**
Dag score *	42	6.9	8.9	6.4	5.0	15.4	23.7	13.1	**11.3**
Breech cover	34	5.8	2.2	14.3	15.0	15.4	8.5	10.7	**9.2**
Urine stain	15	2.3	4.4	1.6	15.0	0.0	8.5	2.4	**4.0**

*Indicates a significant difference between regions for that trait P<0.05, using a binomial homogeneity test for each trait.

28.1.4 Visual traits used for rams and ram lambs by Chosen enterprise.

Table 28-4: Proportion of respondents using visual traits in rams and ram lambs to breed sheep that are less likely to get flystrike by Chosen enterprise, *n*= number of responses per visual trait, total number of responses *n*=402, total number of respondents *n*=107.

Visual trait		Proportion (%) respondents using visual traits for rams and ram lambs by Chosen enterprise					
	n	**Merino x Merino**	**Merino wethers**	**Merino x Other**	**Meat x Meat**	**Other enterprise**	**All enterprises**
Breech wrinkle *	72	27.3	0.0	13.9	4.4	23.1	**19.4**
Cull sheep with fleece rot *	69	26.8	6.3	8.3	4.4	23.1	**18.6**
Cull sheep with body strike *	65	24.6	0.0	11.1	5.8	23.1	**17.5**
Wool colour*	59	23.2	0.0	5.6	2.9	23.1	**15.9**
Cull sheep with breech strike *	46	17.7	0.0	8.3	1.5	23.1	**12.4**
Dag score	42	14.1	0.0	8.3	7.3	23.1	**11.3**
Breech cover	34	10.9	0.0	5.6	5.8	23.1	**9.2**
Urine stain *	15	4.6	0.0	8.3	0.0	15.4	**4.0**

*Indicates a significant difference between enterprises for that trait P<0.05, using a binomial homogeneity test for each trait.

Q29 In 2018, if you used Australian Sheep Breeding Values (ASBVs) to breed for sheep that are less likely to get flystrike, please indicate which traits you used.

	Ewes	Rams
Breech Wrinkle (BWR)	☐	☐
Breech Cover (BCOV)	☐	☐
Scouring and dags (DAG)	☐	☐
Worm Egg Count (WEC)	☐	☐
Co-efficient of variation of fibre diameter (FDCV)	☐	☐
Enter another option	☐	☐

29.1 Proportion of respondents using Australian Sheep Breeding Values (ASBVs) to breed sheep less susceptible to flystrike

Of respondents who answered questions on Blowfly Control (*n*=245) 17.3% used ASBV traits for ram selection to breed for sheep that are less susceptible to flystrike, respectively.

Table 29-1: Proportion of respondents who answered Q29 by Region.

Region	N	%
Central NSW	7	15.9%
East Vic	0	-
Northern NSW/Qld	10	22.7%
SA Peninsula	3	6.8%
Tasmania	1	2.3%
Western Australia	8	18.2%
Wimmera Mallee Murray	15	34.1%
All Regions	**44**	**100%**

Table 29-2: Proportion of respondents who answered Q29 by Chosen enterprise.

Chosen enterprise	N	%
Merino x Merino	32	74.4%
Merino wethers	1	2.3%
Merino x Other	3	7.0%
Meat x Meat	6	14.0%
Other enterprise	1	2.3%
All enterprises	**44**	**100%**

29.1.2 ASBVs used for Ram selection by Region

Table 29-3: Proportion of respondents using Australian Sheep Breeding Values (ASBVs) for Ram selection by Region, *n*= number of responses per ASBV, total number of responses *n*=99, total number of respondents *n*=44.

Australian Sheep Breeding Values (ASBVs)	*n*	Percentage (%) respondents using ASBVs for Rams by Region							
		Central NSW	East Vic	Northern NSW/Qld	SA Peninsula	Tasmania	Western Australia	Wimmera Mallee Murray	National
Breech Wrinkle (BWR) *	28	71.4	-	80.0	100	100	75.0	33.3	**63.6**
Worm Egg Count (WEC)	23	57.1	-	50.0	0.0	100	37.5	66.7	**52.3**
Scouring and dags (DAG)	16	28.6	-	10.0	33.3	100	50.0	46.7	**36.4**
CoV fibre diameter (FDCV)	16	28.6	-	70.0	66.7	0.0	12.5	26.7	**36.4**
Breech Cover (BCOV)	16	42.9	-	40.0	33.3	100	50.0	20.0	**36.4**

*Indicates a significant difference between regions for that trait P<0.05, using a binomial homogeneity test for each trait.

2014 Sheep CRC survey report found 18% of sheep producers used ASBVs to select rams, 80% considered ASBVs for breech wrinkle (BWR) when buying rams, 56% of those started using BWR in the previous 5 years.

29.1.2 ASBVs used for Ram selection by Chosen enterprise

Table 29-4: Proportion of respondents using Australian Sheep Breeding Values (ASBVs) for Ram selection by Region.

Australian Sheep Breeding Values (ASBVs)	*n*	Percentage (%) respondents using ASBVs for Rams by Chosen enterprise					
		Merino x Merino	Merino wethers	Merino x Other	Meat x Meat	Other enterprise	All enterprises
Breech Wrinkle (BWR) *	28	75.8	0.0	66.7	16.7	0	**63.6**
Worm Egg Count (WEC)	23	51.5	0.0	33.3	83.3	0	**52.3**
Breech Cover (BCOV)	16	39.4	0.0	66.7	16.7	0	**36.4**
Scouring and dags (DAG)	16	30.3	0.0	66.7	50.0	100	**36.4**
CoV fibre diameter (FDCV)	16	42.4	100	0	16.7	0	**36.4**

*Indicates a significant difference between enterprises for that trait P<0.05, using a binomial homogeneity test for each trait.

Q30 For your chosen enterprise on your reporting property, please summarise your lice detection and treatment methods between 2014 and 2018. (Please tick all that apply)

	2014	2015	2016	2017	2018
No evidence of lice seen	☐	☐	☐	☐	☐
Sheep seen rubbing	☐	☐	☐	☐	☐
Live lice seen	☐	☐	☐	☐	☐
Lice detected by ELISA (Lab test)	☐	☐	☐	☐	☐
No lice treatment	☐	☐	☐	☐	☐
Lice treated off shears	☐	☐	☐	☐	☐
Lice treated short wool (1 day to 6 weeks)	☐	☐	☐	☐	☐
Lice treated long wool (over 6 weeks)	☐	☐	☐	☐	☐

30.1 Detection of lice

30.1.1 Evidence of lice in sheep in each year and average in any given year (2014-2018) Nationally.

Table 30-1: National proportion of respondents who detected Lice in each year and average in any given year (2014 to 2018; total respondents *n*=238).

Year	Sheep lice detection					
		No lice seen	**Sheep rubbing**	**Live lice seen**	**ELISA detection**	**Total Responses**
2014	*n* Percentage	153 71.8%	30 14.1%	29 13.6%	1 0.5%	213
2015	*n* Percentage	163 75.8%	27 12.6%	25 11.6%	0 0.0%	215
2016	*n* Percentage	164 71.3%	37 16.1%	29 12.6%	0 0.0%	230
2017	*n* Percentage	155 66.8%	44 19.0%	33 14.2%	0 0.0%	232
2018	*n* Percentage	153 62.7%	49 20.1%	42 17.2%	0 0.0%	244
Mean percentage 2014-2018	*n* Percentage	**788** **69.5%**	**187** **16.5%**	**158** **13.9%**	**1** **0.1%**	

Nationally, in any given year, 30.5% respondents reported evidence of lice in this survey.
2011 survey 19% saw live lice at last shearing.

30.1.2 Evidence of lice over 5 years

Table 30-2: Proportion of respondents who reported any evidence of lice over five years (2014-2018) by Region.

Region		Evidence lice over 5 yrs		
		No lice seen	**Evidence of lice**	**Total Responses**
Central NSW	*n*	20	33	53
	Percentage	37.7%	62.3%	
East Vic	*n*	6	18	24
	Percentage	25.0%	75.0%	
Northern NSW/Qld	*n*	20	20	40
	Percentage	50.0%	50.0%	
SA Peninsula	*n*	9	5	14
	Percentage	64.3%	35.7%	
Tasmania	*n*	3	5	8
	Percentage	37.5%	62.5%	
Western Australia	*n*	13	22	35
	Percentage	37.1%	62.9%	
Wimmera Mallee Murray	*n*	28	22	50
	Percentage	56.0%	44.0%	
National	*n*	**99**	**125**	**224**
	Percentage	**44.2%**	**55.8%**	

Chi-square=11.202, df=6, P=0.0823.

Table 30-3: Proportion of respondents who reported any evidence of lice over five years (2014-2018) by Chosen enterprise.

Region		Evidence lice over 5 yrs		
		No lice seen	**Evidence of lice**	**Total Responses**
Merino x Merino	*n*	66	70	136
	Percentage	48.5%	51.5%	
Merino wether	*n*	5	8	13
	Percentage	38.5%	61.5%	
Merino x Other	*n*	8	16	24
	Percentage	33.3%	66.7%	
Meat x Meat	*n*	15	27	42
	Percentage	35.7%	64.3%	
Other enterprise	*n*	5	4	9
	Percentage	55.6%	44.4%	
All enterprises	*n*	**99**	**125**	**224**
	Percentage	**44.2%**	**55.8%**	

Chi-square=4.098, df=4, P=0.3929.

30.1.3 Mean number of years respondents reported evidence of lice over 5 years

Table 30-4: Mean number of years respondents reported evidence of lice over 5 years (2014-2018) by Region.

Region	Mean number of years evidence of lice	
	n	**Mean (range)**
Central NSW	53	1.1 (0-5)[ab]
East Vic	24	1.3 (0-4)[a]
Northern NSW/Qld	40	1.0 (0-5)[ab]
SA Peninsula	14	0.4 (0-2)[b]
Tasmania	8	0.8 (0-2)[ab]
Western Australia	35	1.4 (0-5)[a]
Wimmera Mallee Murray	50	0.7 (0-4)[b]
National	**224**	**1.0 (0-5)**

H=13.5563, df=6, P=0.0350.

Table 30-5: Mean number of years respondents reported evidence of lice over 5 years by Chosen enterprise.

Chosen enterprise	Mean number of years evidence of lice	
	n	**Mean (range)**
Merino x Merino	136	1.0 (0-5)
Merino wethers	13	1.2 (0-4)
Merino x Other	24	1.3 (0-5)
Meat x Meat	42	1.0 (0-4)
Other enterprise	9	0.8 (0-3)
All enterprises	**224**	**1.0 (0-5)**

H=2.8790, df=4, P=0.5783.

2003 IPM-s survey mean number of years respondents reported evidence of lice over 5 years was 0.7 (0-5).

30.2 Treatment for lice

30.2.1 Proportion of lice treatments given in each year and average in any given year

Table 30-6: Average proportion of lice treatments given per year and average in any given year (2014-2018).

		Treatments (%)				
Year		**No lice treatment**	**Treat off shears**	**Treat short wool**	**Treat long wool**	**Total Responses**
2014	*n*	48	95	29	12	184
	Percentage	26.1%	51.6%	15.8%	6.5%	
2015	*n*	51	93	29	7	180
	Percentage	28.3%	51.7%	16.1%	3.9%	
2016	*n*	49	97	33	8	187
	Percentage	26.2%	51.9%	17.6%	4.3%	
2017	*n*	55	91	31	14	191
	Percentage	28.8%	47.6%	16.2%	7.3%	
2018	*n*	50	98	35	21	204
	Percentage	24.5%	48.0%	17.2%	10.3%	
Average year	*n*	**253**	**474**	**157**	**62**	**946**
	Percentage	**26.7%**	**50.1%**	**16.6%**	**6.6%**	

30.1.2 Treatment for lice over 5 years

Table 30-7: Proportion of respondents who treated for lice over five years (2014-2018) by Region.

Region		Lice treatment over 5 yrs		
		Treated for lice	**No lice treatment**	
Central NSW	*n*	42	8	50
	Percentage	84.0%	16.0%	
East Vic	*n*	21	0	21
	Percentage	100.0%	0.0%	
Northern NSW/Qld	*n*	29	3	32
	Percentage	90.6%	9.4%	
SA Peninsula	*n*	12	1	13
	Percentage	92.3%	7.7%	
Tasmania	*n*	3	2	5
	Percentage	60.0%	40.0%	
Western Australia	*n*	31	4	35
	Percentage	88.6%	11.4%	
Wimmera Mallee Murray	*n*	37	7	44
	Percentage	84.1%	15.9%	
National	*n*	**175**	**25**	**200**
	Percentage	**87.5%**	**12.5%**	

Chi-square=9.613, df=6, P=0.1419.

Table 30-8: Proportion of respondents who treated for lice over five years (2014-2018) by Chosen enterprise.

Region		Lice treatment over 5 yrs		
		Treated for lice	**No lice treatment**	**Total Responses**
Merino x Merino	*n*	33	2	35
	Percentage	94.3%	5.7%	
Merino wether	*n*	9	2	11
	Percentage	81.8%	18.2%	
Merino x Other	*n*	106	20	126
	Percentage	84.1%	15.9%	
Meat x Meat	*n*	21	1	22
	Percentage	95.5%	4.5%	
Other enterprise	*n*	6	0	6
	Percentage	100.0%	0.0%	
All enterprises	*n*	**175**	**25**	**200**
	Percentage	**87.5%**	**12.5%**	

Chi-square=6.544 df=4, P=0.1620.

30.1.3 Mean number of years respondents treating for lice over 5 years

Table 30-9: Mean number of years respondents treated for lice over 5 years (2014-2018) by Region.

Region	Number of years treatment for lice	
	n	**Mean (range)**
Central NSW	50	2.7 (0-5)
East Vic	21	2.6 (1-5)
Northern NSW/Qld	32	3.6 (0-5)
SA Peninsula	13	3.5 (0-5)
Tasmania	5	1.6 (0-5)
Western Australia	35	3.0 (0-5)
Wimmera Mallee Murray	44	2.8 (0-5)
National	**200**	**2.9 (0-5)**

H=13.5563, df=6, P=0.0350.

Table 30-10: Mean number of years respondents treated for lice over 5 years by Chosen enterprise.

Chosen enterprise	Number of years treatment for lice	
	n	**Mean (range)**
Merino x Merino	126	3.0 (0-5)
Merino wethers	11	2.5 (0-5)
Merino x Other	22	3.4 (0-5)
Meat x Meat	35	2.6 (0-5)
Other enterprise	6	3.3 (1-5)
All enterprises	**200**	**2.9 (0-5)**

H=9.5013, df=4, P=0.1473.

Q31 If you treated for lice in 2018, which of the following lice control methods and products did you use?

	Application of chemical							Contractor used		Product(s) used
	Backliner/ Spray on	Hand jet	Jetting race	Plunge dip	Shower dip	Cage dip	Electrodip	Yes	No	
Off-shears or short wool (1 day to 6 weeks)	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Long wool (over 6 weeks)	☐	☐	☐	☐	☐	☐	☐	☐	☐	

31.1 Wool length at lice treatment application

Table 31-1: Length of wool when lice treatment applied by Region.

Region	Off-shears or short wool	Long wool
Central NSW	78.9%	21.1%
East Vic	80.0%	20.0%
Northern NSW/Qld	88.9%	11.1%
SA Peninsula	75.0%	25.0%
Tasmania	80.0%	20.0%
Western Australia	76.5%	23.5%
Wimmera Mallee Murray	79.5%	20.5%
All Regions	**80.0%**	**20.0%**

Chi-sq=1.99, df=6, P=0.9.

Table 31-2: Length of wool when lice treatment applied by Chosen enterprise..

Chosen enterprise	Off-shears or short wool	Long wool
Merino x Merino	82.4%	17.6%
Merino wethers	100.0%	0.0%
Merino x Other	78.3%	21.7%
Meat x Meat	71.9%	28.1%
Other enterprise	70.0%	30.0%
All enterprises	**80.0%**	**20.0%**

Chi-sq=5.75, df=4, P=0.22.

31.2 Method of application of lice chemical and use of contractors

31.2.1 Method of application of lice chemical and use of contractors by Region

31.2.1.1 Off shears or short wool

Table 31-3: Proportion of respondents using methods of application of lice chemical Off-shears or short wool (1 day to 6 weeks after shearing) in 2018 by Region, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue), *n*= number of responses per Region.

Region		Percentage (%) respondents using application method								% used Contractor*	
		Backliner/ Spray on	Hand jet	Jetting race	Plunge dip	Shower dip	Cage dip	Electrodip	Total responses	*n*	Yes
Central NSW	*n*	18	0	0	5	2	5	0	30	24	41.7
	Percentage	60.0%	0.0%	0.0%	16.7%	6.7%	16.7%	0.0%			
	Chisq PValue	0.36396	0.51269	0.64343	0.18462	0.68309	0.08518	0.51269			
East Victoria	*n*	12	0	1	1	0	2	0	16	11	18.2
	Percentage	75.0%	0.0%	6.3%	6.3%	0.0%	12.5%	0.0%			
	Chisq PValue	0.97356	0.63259	0.00879	0.69027	0.37109	0.50762	0.63259			
Northern NSW/Qld	*n*	19	2	0	3	0	0	0	24	16	6.3
	Percentage	79.2%	8.3%	0.0%	12.5%	0.0%	0.0%	0.0%			
	Chisq PValue	0.78145	0.00465	0.67885	0.60533	0.27332	0.16969	0.55818			
SA Peninsula	*n*	9	0	0	0	0	0	0	9	7	0
	Percentage	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
	Chisq PValue	0.37077	0.71992	0.79985	0.36063	0.50233	0.40039	0.71992			
Tasmania	*n*	3	0	0	1	0	0	0	4	2	0
	Percentage	75.0%	0.0%	0.0%	25.0%	0.0%	0.0%	0.0%			
	Chisq PValue	0.98678	0.81107	0.86577	0.30236	0.65472	0.57506	0.81107			
Western Australia	*n*	19	0	0	1	4	1	1	26	22	18.2
	Percentage	73.1%	0.0%	0.0%	3.8%	15.4%	3.8%	3.8%			
	Chisq PValue	0.94299	0.54223	0.66651	0.36271	0.01788	0.46561	0.30236			
Wimmera Mallee Murray	*n*	24	0	0	2	1	3	1	31	26	15.4
	Percentage	77.4%	0.0%	0.0%	6.5%	3.2%	9.7%	3.2%			
	Chisq PValue	0.83958	0.50575	0.63795	0.60458	0.65866	0.71768	0.40247			
All Regions	*n*	**104**	**2**	**1**	**13**	**11**	**2**	**7**	**140**	**108**	**19.4**
	Percentage	**74.3%**	**1.4%**	**0.7%**	**9.3%**	**7.9%**	**1.4%**	**5.0%**			

*Chi-square test Contractor used: Chi-sq=12.702, df=6, P=0.0480.

2014 report showed 73% using backliner Off-shears or short wool and 32% used Plunge dip, 16% used shower dip.

31.2.1.2 Long wool

Table 31-4: Proportion of respondents using methods of application of lice chemical Long wool (over 6 weeks after shearing) in 2018 by Region, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue), *n*= number of responses per Region.

Region		Percentage (%) respondents using application method								% used Contractor *	
		Backliner/ Spray on	Hand jet	Jetting race	Plunge dip	Shower dip	Cage dip	Electrodip	Total responses	*n*	Yes
Central NSW	*n*	4	0	1	1	0	2	0	8		
	Percentage	50.0%	0.0%	12.5%	12.5%	0.0%	25.0%	0.0%		4	50
	Chisq PValue	0.715	0.40763	0.10662	0.70429	0.63259	0.11248	0.40763			
East Victoria	*n*	1	0	0	2	0	0	1	4		
	Percentage	25.0%	0.0%	0.0%	50.0%	0.0%	0.0%	25.0%		6	33.3
	Chisq PValue	0.36616	0.55818	0.73532	0.00465	0.73532	0.55818	0.26174			
Northern NSW/Qld	*n*	3	0	0	0	0	0	0	3		
	Percentage	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		2	0
	Chisq PValue	0.37109	0.61209	0.7697	0.61209	0.7697	0.61209	0.61209			
SA Peninsula	*n*	2	1	0	0	0	0	0	3		
	Percentage	66.7%	33.3%	0.0%	0.0%	0.0%	0.0%	0.0%		1	0
	Chisq PValue	0.8815	0.14294	0.7697	0.61209	0.7697	0.61209	0.61209			
Tasmania	*n*	1	0	0	0	0	0	0	1		
	Percentage	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		1	0
	Chisq PValue	0.60558	0.7697	0.86577	0.7697	0.86577	0.7697	0.7697			
Western Australia	*n*	4	2	0	0	0	1	1	8		
	Percentage	50.0%	25.0%	0.0%	0.0%	0.0%	12.5%	12.5%		8	12.5
	Chisq PValue	0.715	0.11248	0.63259	0.40763	0.63259	0.70429	0.70429			
Wimmera Mallee Murray	*n*	6	0	0	0	1	0	1	8		
	Percentage	75.0%	0.0%	0.0%	0.0%	12.5%	0.0%	12.5%		6	0
	Chisq PValue	0.58388	0.40763	0.63259	0.40763	0.10662	0.40763	0.70429			
All Regions	*n*	**21**	**3**	**1**	**3**	**1**	**3**	**3**	**35**	**28**	**17.9**
	Percentage	**60.0%**	**8.6%**	**2.9%**	**8.6%**	**2.9%**	**8.6%**	**8.6%**			

*Chi-square test Contractor used: Chi-sq=7.065, df=6, P=0.3149.

2011 survey report showed 54% using jetting on long wool and 51% used backliner.

31.2.2 Method of application of lice chemical and use of contractors by Chosen enterprise

31.2.2.1 Off shears or short wool

Table 31-5: Proportion of respondents using methods of application of lice chemical Off-shears or short wool (1 day to 6 weeks after shearing) in 2018 by Chosen enterprise, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue), *n*= number of responses per Region.

Chosen enterprise		Percentage (%) respondents using application method								% used Contractor*	
		Backliner/ Spray on	Hand jet	Jetting race	Plunge dip	Shower dip	Cage dip	Electrodip	Total responses	*n*	% used Contractor
Merino x Merino	*n*	60	2	1	9	4	7	1	84	69	20.3
	Percentage	71.4%	2.4%	1.2%	10.7%	4.8%	8.3%	1.2%			
	Chisq PValue	0.76126	0.46521	0.60558	0.66744	0.92226	0.87627	0.85513			
Merino wethers	*n*	8	0	0	0	0	0	0	8	4	0
	Percentage	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
	Chisq PValue	0.39875	0.73532	0.81107	0.38875	0.52709	0.42788	0.73532			
Merino x Other	*n*	14	0	0	2	1	1	0	18	16	18.8
	Percentage	77.8%	0.0%	0.0%	11.1%	5.6%	5.6%	0.0%			
	Chisq PValue	0.86352	0.61209	0.71992	0.79938	0.91605	0.72757	0.61209			
Meat x Meat	*n*	17	0	0	2	1	3	0	23	14	28.6
	Percentage	73.9%	0.0%	0.0%	8.7%	4.3%	13.0%	0.0%			
	Chisq PValue	0.98346	0.5665	0.68524	0.92601	0.88876	0.37489	0.5665			
Other enterprise	*n*	5	0	0	0	1	0	1	7	5	0
	Percentage	71.4%	0.0%	0.0%	0.0%	14.3%	0.0%	14.3%			
	Chisq PValue	0.93011	0.75183	0.82306	0.42011	0.2719	0.45832	0.00443			
All enterprises	*n*	**104**	**2**	**1**	**13**	**11**	**2**	**7**	**140**	**108**	**19.4**
	Percentage	**74.3%**	**1.4%**	**0.7%**	**9.3%**	**7.9%**	**1.4%**	**5.0%**			

* Chi-square test Contractor used: Chi-sq=4.602, df=4, P=0.3306.

31.2.2.2 Long wool

Table 31-6: Proportion of respondents using methods of application of lice chemical Long wool (over 6 weeks after shearing) in 2018 by Chosen enterprise, p-values for cell chi-square are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue**)**, *n*= number of responses per Region.

Chosen enterprise		**Percentage (%) respondents using application method**								**% used Contractor***	
		Backliner/ Spray on	**Hand jet**	**Jetting race**	**Plunge dip**	**Shower dip**	**Cage dip**	**Electrodip**	**Total responses**	***n***	**% Yes**
Merino x Merino	*n* Percentage Chisq PValue	10 55.6% 0.80767	2 11.1% 0.71285	1 5.6% 0.49822	2 11.1% 0.71285	0 0.0% 0.47329	2 11.1% 0.71285	1 5.6% 0.66208	18	17	17.7
Merino wethers	*n* Percentage Chisq PValue	-	-	-	-	-	-	-	0	0	-
Merino x Other	*n* Percentage Chisq PValue	3 60.0% 1	0 0.0% 0.51269	0 0.0% 0.70546	0 0.0% 0.51269	1 20.0% 0.02334	1 20.0% 0.38273	0 0.0% 0.51269	5	4	25
Meat x Meat	*n* Percentage Chisq PValue	6 66.7% 0.79625	1 11.1% 0.79468	0 0.0% 0.61209	0 0.0% 0.37978	0 0.0% 0.61209	0 0.0% 0.37978	2 22.2% 0.16188	9	7	14.3
Other enterprise	*n* Percentage Chisq PValue	2 66.7% 0.8815	0 0.0% 0.61209	0 0.0% 0.7697	1 33.3% 0.14294	0 0.0% 0.7697	0 0.0% 0.61209	0 0.0% 0.61209	3	0	-
All enterprises	*n* Percentage	**21** **60.0%**	**3** **8.6%**	**1** **2.9%**	**3** **8.6%**	**1** **2.9%**	**3** **8.6%**	**3** **8.6%**	**35**	**28**	**17.9**

* Chi-square test Contractor used: Chi-sq=0.192, df=2, P=0.9084.

31.3 Product used for lice treatment

31.3.1 Product used for lice treatment by Region

31.3.1.1 Off shears or short wool

Table 31-7: Proportion of respondents using lice product (active ingredient) by Region..

Region	Proportion of respondents using products below (%)											
	n	**Abamectin**	**Ivermectin**	**Diazinon**	**Temephos**	**Dicyclanil**	**Diflubenzuron**	**Triflumuron**	**Imidacloprid**	**Thiacloprid**	**Spinosad**	**Rotenone +minerals**
Central NSW	25	0.0	0.0	4.0	24.0	0.0	4.0	0.0	32.0	20.0	16.0	0.0
East Vic	14	0.0	7.1	0.0	0.0	0.0	0.0	0.0	57.1	14.3	21.4	0.0
Northern NSW/Qld	21	9.5	9.5	14.3	9.5	0.0	0.0	0.0	38.1	4.8	14.3	0.0
SA Peninsula	10	20.0	0.0	0.0	0.0	0.0	0.0	0.0	70.0	0.0	10.0	0.0
Tasmania	3	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	33.3	0.0
Western Australia	30	10.0	0.0	16.7	6.7	0.0	6.7	0.0	30.0	13.3	16.7	0.0
Wimmera Mallee Murray	21	0.0	4.8	9.5	4.8	4.8	0.0	9.5	38.1	0.0	23.8	4.8
National	**124**	**6.5**	**3.2**	**8.9**	**8.9**	**0.8**	**2.4**	**1.6**	**38.7**	**10.5**	**17.7**	**0.8**

Note: percentages may sum to more than 100 as respondents could name more than one chemical.

Chi-square=73.831, df=60, P=0.1081.

31.3.1.2 Long wool

Table 31-8: Proportion of respondents using lice product (active ingredient) by Region.

Region	Proportion of respondents using products below (%)											
	n	**Abamectin**	**Ivermectin**	**Diazinon**	**Temephos**	**Dicyclanil**	**Diflubenzuron**	**Triflumuron**	**Imidacloprid**	**Thiacloprid**	**Spinosad**	**Rotenone +minerals**
Central NSW	5	-	0.0	0.0	20.0	-	-	-	0.0	0.0	80.0	-
East Vic	4	-	25.0	0.0	0.0	-	-	-	0.0	25.0	50.0	-
Northern NSW/Qld	1	-	0.0	0.0	0.0	-	-	-	100	0.0	0.0	-
SA Peninsula	3	-	33.3	0.0	0.0	-	-	-	0.0	0.0	66.7	-
Tasmania	0	-	0.0	0.0	0.0	-	-	-	0.0	0.0	0.0	-
Western Australia	7	-	42.9	14.3	0.0	-	-	-	0.0	0.0	42.9	-
Wimmera Mallee Murray	4	-	25.0	0.0	0.0	-	-	-	0.0	0.0	75.0	-
National	**24**	**-**	**25.0**	**4.2**	**4.2**	**-**	**-**	**-**	**4.2**	**4.2**	**58.3**	**-**

Note: percentages may sum to more than 100 as respondents could name more than one chemical. Chi-square=21.453, df=25, P=0.6671.

31.3.2 Product used for lice treatment by Chosen enterprise

31.3.2.1 Off shears or short wool

Table 31-9: Proportion of respondents using lice product (active ingredient) by Region.

Chosen enterprise	Proportion of respondents using products below (%)											
	n	**Abamectin**	**Ivermectin**	**Diazinon**	**Temephos**	**Dicyclanil**	**Diflubenzuron**	**Triflumuron**	**Imidacloprid**	**Thiacloprid**	**Spinosad**	**Rotenone +minerals**
Merino x Merino	86	7.0	3.5	11.6	9.3	0.0	2.3	1.2	34.9	12.8	17.4	0.0
Merino wethers	9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0
Merino x Other	11	0.0	0.0	9.1	9.1	9.1	9.1	0.0	36.4	9.1	18.2	0.0
Meat x Meat	17	11.8	0.0	0.0	11.8	0.0	0.0	0.0	41.2	5.9	23.5	5.9
Other enterprise	4	0.0	25.0	0.0	0.0	0.0	0.0	25	25.0	0.0	25.0	0.0
National	**124**	**6.5**	**3.2**	**8.9**	**8.9**	**0.8**	**2.4**	**1.6**	**38.7**	**10.5**	**17.7**	**0.8**

Chi-square=41.542, df=40, P=0.4034.

31.3.2.2 Long wool

Table 31-10: Proportion of respondents using lice product (active ingredient) by Region..

Chosen enterprise	Proportion of respondents using products below (%)											
	n	**Abamectin**	**Ivermectin**	**Diazinon**	**Temephos**	**Dicyclanil**	**Diflubenzuron**	**Triflumuron**	**Imidacloprid**	**Thiacloprid**	**Spinosad**	**Rotenone +minerals**
Merino x Merino	15	-	20.0	0.0	6.7	-	-	-	6.7	6.7	60.0	-
Merino wethers	0	-	0.0	0.0	0.0	-	-	-	0.0	0.0	0.0	-
Merino x Other	2	-	0.0	50.0	0.0	-	-	-	0.0	0.0	50.0	-
Meat x Meat	7	-	42.9	0.0	0.0	-	-	-	0.0	0.0	57.1	-
Other enterprise	0	-	0.0	0.0	0.0	-	-	-	0.0	0.0	0.0	-
National	**24**	**-**	**25.0**	**4.2**	**4.2**	**-**	**-**	**-**	**4.2**	**4.2**	**58.3**	**-**

Chi-square=73.831, df=60, P=0.1081

Q32 Do you suspect resistance to a lice product on your reporting property?

Of respondents who answered this question 8.4% suspect resistance to a lice product (*n*=214), which is lower than reported in the 2011 survey (26%).

32.1 Proportion of respondents who suspect resistance to a lice product by Region

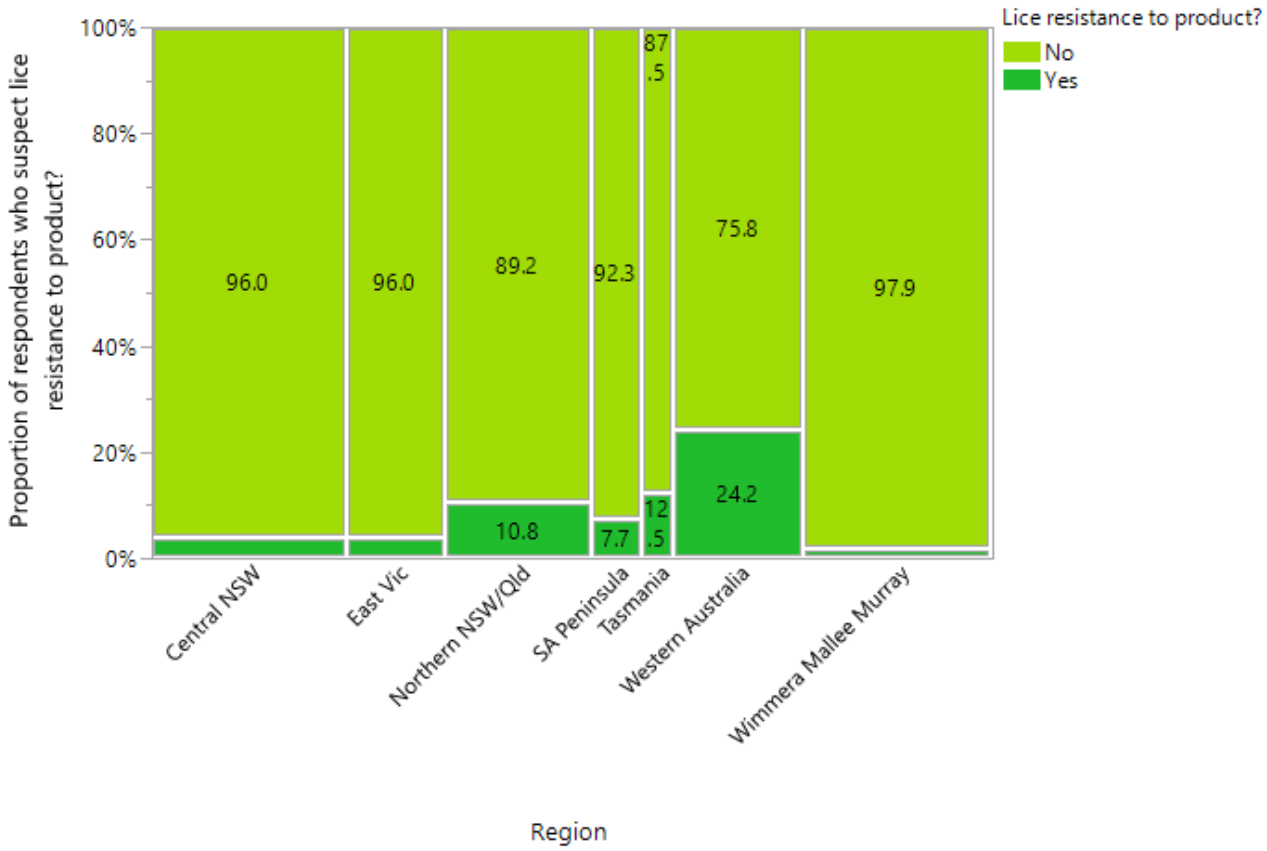


Figure 32-1: Proportion of respondents who suspect resistance to a lice product by Region, Chi-square test- chi-square=13.668, df=6, P-value=0.0336, number of respondents for this question *n*=214.

32.2 Proportion of respondents who suspect resistance to a lice product by Chosen enterprise

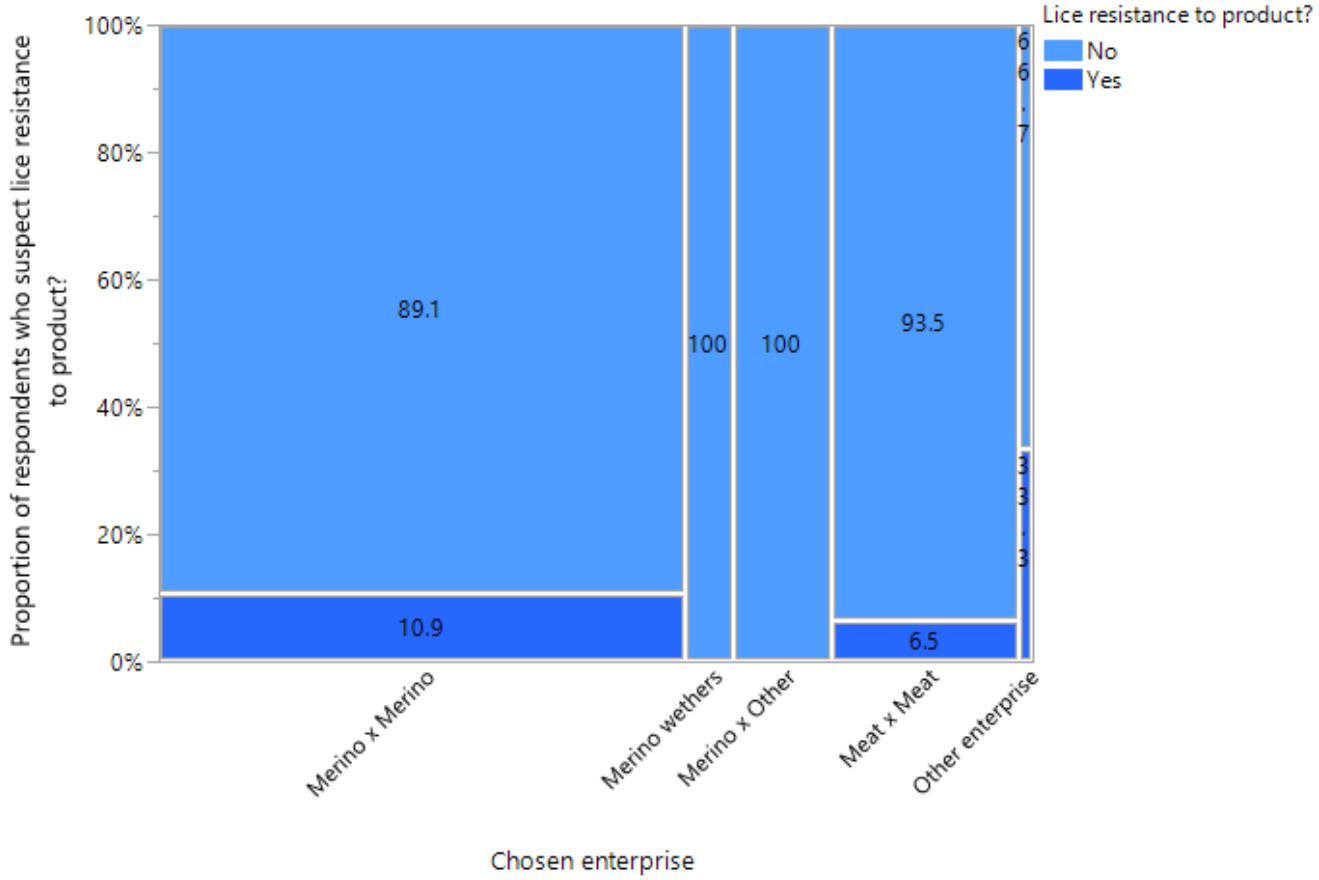


Figure 32-2: Proportion of respondents who suspect resistance to a lice product by Region, Chi-square test- chi-square=8.961, df=4, P-value=0.0621, number of respondents for this question *n*=214.

Q33 Which product do you suspect lice are resistant to and when did you first suspect resistance to this product?

	Product lice resistant to	Year(s) resistance suspected
1		
2		
3		

33.1 Products suspect lice resistance - National

Table 33-1: National proportion of respondents who suspected resistance to specific lice treatment products (given as active or group) and the mean number of years since resistance was suspected, number of respondents for this question *n*=14.

Product suspect resistance to	***n***	**Proportion of respondents who suspected resistance to this product (%)**	**Mean number of years since suspected resistance**	**Active ingredient Group**	**Proportion suspect resistance to active group (%)**
Diazinon	3	9.5	2.7 (2-4)	Organophosphates	15.5
Temephos	1	6.0	5.0		
Insect growth regulators*	1	15.5	13.0	Insect Growth Regulators	50.0
Diflubenzuron	2	13.1	5.5 (5-6)		
Triflumuron	2	21.4	9.0 (9-9)		
Synthetic Pyrethroids*	1	16.7	14.0	Synthetic Pyrethroids	28.6
Cypermethrin	2	11.9	5.0 (3-7)		
Imidacloprid	1	3.6	3.0	Neonicotinoids	6.0
Thiacloprid	1	2.4	2.0		
All products	**14**	**100**	**6 (2-14)**		**100**

*Actives unspecified

Q34 If you have a recurring lice problem, how important do you believe the following factors are in causing the problem?

	Very important	Important	Somewhat important	Not important
Resistance to lice control products	☐	☐	☐	☐
Problems with application	☐	☐	☐	☐
Incomplete mustering	☐	☐	☐	☐
Introduction through fences, or from purchased sheep	☐	☐	☐	☐
Whole flock not treated at the same time/multiple flock treatments	☐	☐	☐	☐
Partial flock treatment only	☐	☐	☐	☐

34.1 Importance ranking for factors causing lice control problems by Region

Table 34-1: Importance of possible causes of recurring lice infestations by Region. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, Important as 3 and Very important as 4. N = number of responses, number of respondents *n*=122.

Causes of recurring lice infestations	**Mean importance of causes by Region**								
	Central NSW	**East Vic**	**Northern NSW/Qld**	**SA Peninsula**	**Tasmania**	**Western Australia**	**Wimmera Mallee Murray**	**National**	**P-value**
Introduction through fences or from purchased sheep	3.8	3.7	4.0	4.0	3.8	3.8	3.8	**3.8**	0.8438
Whole flock not treated at the same time/multiple flock treatments	3.2	3.6	3.4	2.7	4.0	3.2	3.7	**3.4**	0.5385
Incomplete mustering	3.2	3.0	3.5	4.0	4.0	3.2	3.7	**3.4**	0.2666
Partial flock treatment only	2.7	2.6	3.3	3.0	4.0	2.9	3.3	**3.0**	0.7682
Problems with application	2.9	2.7	2.8	2.7	4.0	2.8	3.3	**2.9**	0.608
Resistance to lice control products	2.7	2.8	2.5	2.7	4.0	2.9	3.1	**2.8**	0.6792
N	146	65	92	18	17	126	86	**550**	

34.2 Importance ranking for factors causing lice control problems by Chosen enterprise

Table 34-2: Importance of possible causes of recurring lice infestations by Chosen enterprise. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, Important as 3 and Very important as 4. N = number of responses, number of respondents *n*=122.

Causes of recurring lice infestations	Mean importance of causes by Chosen enterprise						
	Merino x Merino	Merino wethers	Merino x Other	Meat x Meat	Other Enterprise	All enterprises	P-value
Introduction through fences or from purchased sheep	3.9	4.0	3.9	3.7	3.7	**3.8**	0.1719
Incomplete mustering	3.3	4.0	3.7	3.2	3	**3.4**	0.2876
Whole flock not treated at the same time/multiple flock treatments	3.2	3.9	3.8	3.5	3	**3.4**	0.2482
Partial flock treatment only	2.7	4.0	3.2	3.1	2.7	**3.0**	0.2191
Problems with application	2.8	3.6	3.0	2.9	3.0	**2.9**	0.3808
Resistance to lice control products	2.6	3.2	3.0	3.3	2.7	**2.8**	0.2013
N	**339**	**41**	**73**	**79**	**18**	**550**	

Q35 Did you introduce sheep to the flock in 2018?

35.1 Proportion of respondents who introduced sheep into their flocks in 2018 by Region.

Table 35-1: Proportion of respondents who introduced sheep to their flock in 2018 by Region.

Region	*n*	Introduced sheep 2018 (%)
Central NSW	83	57.1
East Vic	44	58.3
Northern NSW/Qld	62	50.0
SA Peninsula	20	69.2
Tasmania	13	60.0
Western Australia	53	58.3
Wimmera Mallee Murray	79	57.4
All Regions	**354**	**57.0**

Chi-square test: Chi square = 1.738, df=6, P=0.9422.

35.2 Proportion of respondents who introduced sheep to their flock in 2018 by Chosen enterprise.

Table 35-2: Proportion of respondents who introduced sheep to their flock in 2018 by Chosen enterprise.

Region	*n*	Introduced sheep 2018 (%)
Merino x Merino	220	50.4
Merino wethers	16	46.2
Merino x Other	36	79.2
Meat x Meat	69	70.2
Other enterprise	13	50.0
All Regions	**354**	**57.0**

Chi square=12.047, df=4, P=0.0170, Low sample size for some enterprises were too small for significant difference to be seen in the analysis of means.

Q36 How did you manage the introduction of new sheep onto your reporting property in 2018?

	Number of sheep introduced	Management action					Chemical(s) used
		Did nothing	Requested an animal health history	Applied quarantine drench for worms	Applied quarantine lice treatment	Isolated sheep for at least 2 weeks	
1		☐	☐	☐	☐	☐	
2		☐	☐	☐	☐	☐	
3		☐	☐	☐	☐	☐	
4		☐	☐	☐	☐	☐	
5		☐	☐	☐	☐	☐	

36.1 Number of sheep introduced as a proportion of the flock

Region

Table 36-1: Number of sheep introduced as a proportion of the flock by Region.

Region	*n*	Mean (%)	Min	Max
Central NSW	83	7.0^{bc}	0	40.0
East Vic	36	13.7^{ab}	0.2	100
Northern NSW/Qld	33	13.1^{a}	0.1	58.7
SA Peninsula	16	13.8^{a}	0.1	61.9
Tasmania	22	10.9^{ab}	0.1	27.0
Western Australia	34	8.6^{abc}	0.1	50.2
Wimmera Mallee Murray	85	5.6^{c}	0	47.5
National	**309**	**8.8**	**0**	**100**

Values within columns not sharing a letter in the superscript are significantly different,
Anova: F=3.1098, df=6, p=0.0057.

Chosen enterprise

Table 36-2: Number of sheep introduced as a proportion of the flock by Chosen enterprise.

Chosen enterprise	*n*	Mean (%)	Min	Max
Merino x Merino	147	5.7^{bc}	0.0	61.9
Merino wethers	12	29.5^{a}	0.0	100.0
Merino x Other	39	17.3^{a}	0.3	58.7
Meat x Meat	101	8.3^{b}	0.1	47.5
Other enterprise	10	0.1^{c}	0.0	0.2
All enterprises	**309**	**8.76**	**0**	**100**

Values within columns not sharing a letter in the superscript are significantly different
Anova: F=14.5312, df=4, p<0.0001

36.2 Management procedures for introducing sheep into flock

36.2.1 Management procedures for introducing sheep into flock by Region

Table 36-3: Management procedures used by respondents when introducing sheep into their flock in 2018 by Region, share is the proportion of all responses to the question and rate is the proportion of respondents who selected the particular option within the question.

Region		Management action (%)						
		Did nothing	**Requested animal health history***	**Applied quarantine drench for worms**	**Applied quarantine lice treatment**	**Isolated sheep – at least 2 weeks**	**Total responses**	**Total respondents**
Central NSW	*n*	1	22	23	8	29	83	32
	Share	1.2%	26.5%	27.7%	9.6%	34.9%		
	Rate	3.1%	68.8%	71.9%	25.0%	90.6%		
East Vic	*n*	3	6	11	3	12	35	11
	Share	8.6%	17.1%	31.4%	8.6%	34.3%		
	Rate	27.3%	54.5%	100.0%	27.3%	109.1%		
Northern NSW/Qld	*n*	4	9	8	1	11	33	20
	Share	12.1%	27.3%	24.2%	3.0%	33.3%		
	Rate	20.0%	45.0%	40.0%	5.0%	55.0%		
SA Peninsula	*n*	1	6	2	2	5	16	9
	Share	6.3%	37.5%	12.5%	12.5%	31.3%		
	Rate	11.1%	66.7%	22.2%	22.2%	55.6%		
Tasmania	*n*	2	8	6	0	6	22	6
	Share	9.1%	36.4%	27.3%	0.0%	27.3%		
	Rate	33.3%	133.3%	100.0%	0.0%	100.0%		
Western Australia	*n*	5	3	9	4	13	34	19
	Share	14.7%	8.8%	26.5%	11.8%	38.2%		
	Rate	26.3%	15.8%	47.4%	21.1%	68.4%		
Wimmera Mallee Murray	*n*	6	28	18	8	28	88	30
	Share	6.8%	31.8%	20.5%	9.1%	31.8%		
	Rate	20.0%	93.3%	60.0%	26.7%	93.3%		
National	*n*	**22**	**82**	**77**	**26**	**104**	**311**	**127**
	Share	**7.1%**	**26.4%**	**24.8%**	**8.4%**	**33.4%**		
	Rate	**17.3%**	**64.6%**	**60.6%**	**20.5%**	**81.9%**		

* indicates significant difference between Regions P<0.01.

36.2.1 Management procedures for introducing sheep into flock by Chosen enterprise

Table 36-4: Management procedures used by respondents when introducing sheep into their flock in 2018 by Chosen enterprise, share is the proportion of all responses to the question and rate is the proportion of respondents who selected the particular option within the question.

		Management action (%)						
Chosen enterprise		**Did nothing**	**Requested animal health history**	**Applied quarantine drench for worms**	**Applied quarantine lice treatment**	**Isolated sheep – at least 2 weeks**	**Total responses**	**Total respondents**
Merino x Merino	*n*	13	35	37	13	49	147	67
	Share	8.8%	23.8%	25.2%	8.8%	33.3%		
	Rate	19.4%	52.2%	55.2%	19.4%	73.1%		
Merino wethers	*n*	0	4	3	1	3	11	5
	Share	0.0%	36.4%	27.3%	9.1%	27.3%		
	Rate	0.0%	80.0%	60.0%	20.0%	60.0%		
Merino x Other	*n*	3	10	10	4	12	39	19
	Share	7.7%	25.6%	25.6%	10.3%	30.8%		
	Rate	15.8%	52.6%	52.6%	21.1%	63.2%		
Meat x Meat	*n*	6	31	24	7	36	104	32
	Share	5.8%	29.8%	23.1%	6.7%	34.6%		
	Rate	18.8%	96.9%	75.0%	21.9%	112.5%		
Other enterprise	*n*	0	2	3	1	4	10	4
	Share	0.0%	20.0%	30.0%	10.0%	40.0%		
	Rate	0.0%	50.0%	75.0%	25.0%	100.0%		
National	*n*	**22**	**82**	**77**	**26**	**104**	**311**	**127**
	Share	7.1%	26.4%	24.8%	8.4%	33.4%		
	Rate	**17.3%**	**64.6%**	**60.6%**	**20.5%**	**81.9%**		

Q37 How important are the following sources of information for parasite control on your reporting property?

	Very important	Important	Somewhat important	Not Important
Other farmer or member of my staff	○	○	○	○
Local Vet	○	○	○	○
Private veterinary consultant	○	○	○	○
Ag consultant	○	○	○	○
State Government Department (DPI)/Local Land Services (LLS) officer	○	○	○	○
Rural merchandise representative	○	○	○	○
Rural newspapers/magazines	○	○	○	○
WormBoss	○	○	○	○
FlyBoss	○	○	○	○
LiceBoss	○	○	○	○

37.1 Importance of sources of information by Region

Table 37-1: Importance of sources of information for parasite control by Region. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, Important as 3 and Very important as 4. Bolded values with superscripted letters are post hoc comparisons that identify pairs of values that were significantly different on Dunn's test. N = number of responses, number of respondents *n*=226.

Sources of information for parasite control	**Mean importance of sources by Region**								
	Central NSW	**East Vic**	**Northern NSW/Qld**	**SA Peninsula**	**Tasmania**	**Western Australia**	**Wimmera Mallee Murray**	**National**	**P-value**
Other farmer or member of my staff	2.8	3.4	2.5	3	2.9	2.4	2.8	**2.7**	0.0775
WormBoss	**2.4^{b}**	**3.1^{a}**	2.8^{ab}	2.4^{ab}	**3.2^{a}**	2.7^{ab}	2.3^{ab}	**2.6**	0.042
Local vet	2.6	2.5	2.3	2.3	2	2.4	2.3	**2.4**	0.7881
Rural merchandise representative	2.5	3	2.5	2.6	2.6	2.1	2.3	**2.4**	0.1572
FlyBoss	2.2	2.9	2.6	2.3	3.1	2.5	2.2	**2.4**	0.1466
LiceBoss	2.2	2.9	2.5	2.1	3	2.6	2.1	**2.4**	0.1301
State Government department (DPI)/Local Land Services (LLS) officer	**2.8^{a}**	2.5^{ab}	2.4^{ab}	2.3^{ab}	2.2^{ab}	2.0^{ab}	**2.0^{b}**	**2.3**	0.0217
Private veterinary consultant	2.2	2.6	2.3	1.6	2.5	2.2	2.1	**2.2**	0.483
Rural newspapers	2.1	2.6	2.1	2.2	2.2	2.1	2	**2.1**	0.4865
Ag consultant	2.3	2.8	2	2.2	1.6	1.9	2.2	**2.1**	0.1985
N	**395**	**151**	**301**	**118**	**86**	**315**	**424**	**1790**	

37.2 Importance of sources of information by Chosen enterprise

Table 37-2: Importance of sources of information for parasite control by Chosen enterprise. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, Important as 3 and Very important as 4. Bolded values with superscripted are post hoc comparisons that identify pairs of values that were significantly different on Dunn's test. N = number of responses, number of respondents *n*=226.

Sources of information for parasite control	Mean importance of sources by Chosen enterprise						
	Merino x Merino	Merino wethers	Merino x Other	Meat x Meat	Other Enterprise	All enterprises	P-value
Other farmer or member of my staff	**2.6^{b}**	**2.3^{b}**	3.0^{ab}	**3.1^{a}**	2.3^{ab}	**2.7**	0.0209
WormBoss	2.5	2.7	2.7	2.8	2.8	**2.6**	0.6505
Local vet	2.2	2.3	2.5	2.8	2.9	**2.4**	0.0316
Rural merchandise representative	2.3	2.5	2.6	2.9	2.4	**2.4**	0.063
FlyBoss	2.4	2.7	2.6	2.5	2.5	**2.4**	0.82
LiceBoss	2.3	2.7	2.6	2.4	2.7	**2.4**	0.6879
State Government department (DPI)/Local Land Services (LLS) officer	2.2	2.2	2.6	2.4	2.5	**2.3**	0.6002
Private veterinary consultant	2.2	2.3	1.8	2.3	2.3	**2.2**	0.4845
Ag consultant	2	2.1	1.9	2.6	2.2	**2.1**	0.2075
Rural newspapers	2	2.2	2.1	2.5	2	**2.1**	0.1069
N	**1118**	**104**	**176**	**331**	**61**	**1790**	

Q38 When making specific parasite control decisions (e.g. when to drench/jet) how important are the following people and resources on your reporting property?

	Worms and Liver fluke			Flies			Lice		
	Very important/ important	Somewhat important	Not important	Very important/ important	Somewhat important	Not important	Very important/ important	Somewhat important	Not important
Self	○	○	○	○	○	○	○	○	○
Manager	○	○	○	○	○	○	○	○	○
Other staff on-farm	○	○	○	○	○	○	○	○	○
Private veterinary consultant	○	○	○	○	○	○	○	○	○
Ag consultant	○	○	○	○	○	○	○	○	○
Rural merchandise representative	○	○	○	○	○	○	○	○	○
WormBoss drench decision guide	○	○	○	○	○	○	○	○	○
FlyBoss decision tools (e.g. Compare two management systems)	○	○	○	○	○	○	○	○	○
LiceBoss decision tools (e.g. Long wool tool, Treatment tool)	○	○	○	○	○	○	○	○	○

38.1 Worms/Liver fluke - Importance ranking for sources of information for specific parasite control decisions by Region

Table 38-1: Importance of sources of information for specific Worm/Liver fluke control decisions by Region. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, and Very important/Important as 3. Bolded values with superscripted letters are post hoc comparisons identifying enterprises that were significantly different. N = number of responses.

Sources of information for parasite control	Mean importance of sources by Region								
	Central NSW	East Vic	Northern NSW/Qld	SA Peninsula	Tasmania	Western Australia	Wimmera Mallee Murray	National	P-value
Self	2.9	2.9	3.0	2.9	3.0	3.0	2.9	**3.0**	0.6954
Other staff on-farm	1.8	2.5	2.1	2.0	2.4	1.8	2.3	**2.1**	0.1103
WormBoss drench decision guide	1.8	2.3	2.3	2.1	2.1	2.0	2.0	**2.1**	0.3929
Manager	1.9	2.7	2.0	1.9	2.0	1.9	2.2	**2.0**	0.4518
Rural merchandise representative	1.9	2.2	2.0	2.3	1.7	1.8	1.7	**1.9**	0.0776
Private veterinary consultant	1.5	2.1	1.8	1.6	2.2	1.9	1.9	**1.8**	0.3676
Ag consultant	1.6	2.1	1.6	1.7	1.2	1.5	1.7	**1.6**	0.4094
FlyBoss decision tools (e.g. compare two management systems)	**1.3[a]**	**1.9[b]**	**1.9[b]**	1.2ab	1.6[ab]	1.3[ab]	1.7[ab]	**1.6**	0.0351
LiceBoss decision tools (e.g. Long wool tool)	1.4	1.9	1.9	1.2	1.6	1.4	1.8	**1.6**	0.0719
N	**287**	**110**	**213**	**94**	**55**	**234**	**261**	**1254**	

38.2 Worms/Liver fluke - Importance ranking for sources of information for specific parasite control decisions by Chosen enterprise

Table 38-2: Importance of sources of information for specific Worm/Liver fluke control decisions by Chosen enterprise. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, and Very important/Important as 3. N = number of responses.

Sources of information for parasite control	Mean importance of sources by Chosen enterprise						
	Merino x Merino	Merino wethers	Merino x Other	Meat x Meat	Other Enterprise	All enterprises	P-value
Self	3.0	2.9	2.9	3.0	3.0	**3.0**	0.731
Other staff on-farm	1.9	2.4	2.4	2.2	3.0	**2.1**	0.0495
WormBoss drench decision guide	2.0	2.1	2.1	2.2	2.2	**2.1**	0.7946
Manager	2.0	2.2	2.1	2.2	3.0	**2.0**	0.6603
Rural merchandise representative	1.9	1.7	2.0	2.1	2.0	**1.9**	0.5131
Private veterinary consultant	1.8	1.9	1.7	2.0	2.0	**1.8**	0.7596
Ag consultant	1.5	1.5	2.2	1.8	1.5	**1.6**	0.0781
FlyBoss decision tools (e.g. compare two management systems)	1.5	1.9	1.8	1.5	2.0	**1.6**	0.156
LiceBoss decision tools (e.g. Long wool tool)	1.6	1.9	1.8	1.5	2.0	**1.6**	0.3494
N	**832**	**71**	**112**	**201**	**38**	**1254**	

38.3 Flies - Importance ranking for sources of information for specific parasite control decisions by Region

Table 38-3: Importance of sources of information for specific Fly control decisions by Region. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, and Very important/Important as 3. Bolded values with superscripted letters are post hoc comparisons identifying enterprises that were significantly different. N = number of responses.

Sources of information for parasite control	Mean importance of sources by Region								
	Central NSW	East Vic	Northern NSW/Qld	SA Peninsula	Tasmania	Western Australia	Wimmera Mallee Murray	National	P-value
Self	2.9	3.0	3.0	3.0	2.8	3.0	2.9	**3.0**	0.4784
Other staff on-farm	**1.7^{a}**	**2.5^{bc}**	**2.3^{bc}**	2.0^{abc}	2.3^{abc}	**1.8^{c}**	**2.4^{b}**	**2.1**	0.0115
Manager	1.9	2.7	2.1	1.9	1.7	1.9	2.2	**2.0**	0.4455
Rural merchandise representative	**1.7^{b}**	**2.2^{a}**	2.0^{ab}	**2.2^{a}**	1.6^{ab}	**1.7^{b}**	**1.6^{b}**	**1.8**	0.0421
FlyBoss decision tools (e.g. compare two management systems)	1.6	2.1	1.9	1.9	2.0	1.8	1.9	**1.8**	0.5824
Private veterinary consultant	1.3	2.0	1.5	1.3	1.5	1.6	1.6	**1.5**	0.3843
Ag consultant	1.5	1.7	1.6	1.7	1.0	1.5	1.6	**1.5**	0.6467
WormBoss drench decision guide	1.3	1.8	1.7	1.2	1.3	1.5	1.7	**1.5**	0.326
LiceBoss decision tools (e.g. Long wool tool)	1.3	1.8	1.7	1.2	1.8	1.4	1.7	**1.5**	0.1967
N	**257**	**98**	**203**	**91**	**41**	**223**	**246**	**1159**	

38.4 Flies - Importance ranking for sources of information for specific parasite control decisions by Chosen enterprise

Table 38-4: Importance of sources of information for specific Fly control decisions by Chosen enterprise. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, and Very important/Important as 3. N = number of responses.

Sources of information for parasite control	Mean importance of sources by Chosen enterprise						
	Merino x Merino	Merino wethers	Merino x Other	Meat x Meat	Other Enterprise	All enterprises	P-value
Self	3.0	3.0	2.9	2.9	3.0	**3.0**	0.2913
Other staff on-farm	2.0	2.1	2.4	2.3	3.0	**2.1**	0.1258
Manager	2.0	2.2	2.1	2.1	-	**2.0**	0.9422
Rural merchandise representative	1.7	1.8	2.1	2.0	2.3	**1.8**	0.3154
FlyBoss decision tools (e.g. compare two management systems)	1.7	2.1	2.3	1.8	2.3	**1.8**	0.095
Private veterinary consultant	1.5	1.6	1.8	1.5	1.0	**1.5**	0.56
Ag consultant	1.4	1.5	2.0	1.7	1.5	**1.5**	0.1858
WormBoss drench decision guide	1.4	1.8	1.7	1.8	2.0	**1.5**	0.1499
LiceBoss decision tools (e.g. Long wool tool)	1.4	1.7	1.8	1.6	2.5	**1.5**	0.1104
N	**793**	**65**	**109**	**169**	**23**	**1159**	

38.5 Lice - Importance ranking for sources of information for specific parasite control decisions by Region

Table 38-5: Importance of sources of information for specific Lice control decisions by Region. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, and Very important/Important as 3. Bolded values with superscripted letters are post hoc comparisons identifying enterprises that were significantly different. N = number of responses.

Sources of information for parasite control	Mean importance of sources by Region								
	Central NSW	East Vic	Northern NSW/Qld	SA Peninsula	Tasmania	Western Australia	Wimmera Mallee Murray	National	P-value
Self	2.9	3.0	3.0	3.0	2.8	3.0	3.0	**3.0**	0.6318
Other staff on-farm	**1.9[a]**	**2.7[b]**	2.2[ab]	2.0[ab]	2.2[ab]	**1.8[a]**	**2.4[b]**	**2.1**	0.0222
Manager	1.8	2.7	1.9	1.8	1.5	1.9	2.2	**2.0**	0.3385
Rural merchandise representative	1.8	2.2	2.1	2.2	1.6	1.7	1.8	**1.9**	0.2024
LiceBoss decision tools (e.g. Long wool tool)	1.6	2.3	2.0	1.9	2.5	1.9	2.0	**1.9**	0.2541
Private veterinary consultant	1.5	1.9	1.5	1.4	1.5	1.8	1.7	**1.6**	0.7411
Ag consultant	1.5	1.8	1.6	1.7	1.0	1.5	1.6	**1.6**	0.598
WormBoss drench decision guide	1.3	1.8	1.8	1.2	1.3	1.5	1.6	**1.6**	0.4034
FlyBoss decision tools (e.g. compare two management systems)	1.3	1.7	1.7	1.2	1.3	1.3	1.7	**1.5**	0.2235
N	**262**	**100**	**209**	**93**	**41**	**219**	**244**	**1168**	

38.6 Lice - Importance ranking for sources of information for specific parasite control decisions by Chosen enterprise

Table 38-6: Importance of sources of information for specific Lice control decisions by Chosen enterprise. The figures in cells are the means with Not important scored as 1, Somewhat important as 2, and Very important/Important as 3. Bolded values with superscripted letters are post hoc comparisons identifying enterprises that were significantly different. N = number of responses.

Sources of information for parasite control	Mean importance of sources by Chosen enterprise						
	Merino x Merino	Merino wethers	Merino x Other	Meat x Meat	Other Enterprise	All enterprises	P-value
Other staff on-farm	**2.0[b]**	2.4[ab]	**2.5[a]**	2.4[ab]	3.0[ab]	**2.1**	0.0438
Self	3.0	3.0	3.0	2.9	3.0	**3.0**	0.5811
Manager	1.9	2.2	2.1	2.2	-	**2.0**	0.7018
Rural merchandise representative	1.8	2.0	2.1	2.0	2.3	**1.9**	0.4736
LiceBoss decision tools (e.g. Long wool tool)	1.8	2.3	2.3	2.0	2.3	**1.9**	0.1742
Private veterinary consultant	1.6	1.5	1.8	1.7	1.0	**1.6**	0.6782
Ag consultant	1.5	1.7	2.1	1.6	1.5	**1.6**	0.1851
WormBoss drench decision guide	1.5	1.8	1.7	1.7	2.0	**1.6**	0.389
FlyBoss decision tools (e.g. compare two management systems)	1.4	1.7	1.8	1.5	2.5	**1.5**	0.0511
N	**797**	**66**	**110**	**172**	**23**	**1168**	

Q39. If you have changed your parasite management in the last five years, please describe the change(s) you regard as the most important.

39.1 Most important changes in worm and liver fluke management over the last 5 years

Table 39-1: Types of changes over the last 5 years in worm and fluke management that individual respondents regarded as the most important.

Type of change	*n*	Proportion of respondents (%)
WEC	18	22.5
Rotate drenches	6	7.5
Breeding resistant sheep	5	6.3
Changed to Triple combination drench	4	5.0
Use capsule drench	4	5.0
Use of Derquantel	4	5.0
Pre-lambing drench	3	3.8
Preventative management	3	3.8
Barbervax	2	2.5
Drench resistance tests	2	2.5
Rotate drench groups	2	2.5
Use capsules in ewes	2	2.5
Use of Monepantel	2	2.5
Use worm identification	2	2.5
Ceased drenching adults	1	1.3
Change from oral drench to backliner	1	1.3
Did a worm workshop	1	1.3
Drench less	1	1.3
Drench only as needed	1	1.3
Drenching lambs at 14 weeks	1	1.3
Good nutrition	1	1.3
Grazing management	1	1.3
Less use of single mectin	1	1.3
More drenching	1	1.3
Moxidectin injection at shearing	1	1.3
No longer use WEC	1	1.3
Only use long acting drenches on clean, rested pastures.	1	1.3
Provide minerals	1	1.3
Spelling paddocks	1	1.3
Strategic drenching	1	1.3
Summer drench	1	1.3
Use of Closantel again after break	1	1.3
Use of Closantel for Fluke	1	1.3
Use of WormBoss	1	1.3
Use only effective drenches	1	1.3
N	**80**	**101.2%**

Note: percentages may sum to more than 100 as respondents could name more than one change.

39.2 Most important changes in flystrike management over the last 5 years

Table 39-2: Types of changes over the last 5 years in flystrike management that individual respondents regarded as the most important.

Type of change	***n***	**Proportion of respondents (%)**
Breeding for genetic resistance	12	21.1
Preventative chemical treatment	4	7.0
Ceased mulesing	3	5.3
Rotate actives	3	5.3
Timing of treatments	3	5.3
Use of Dicyclanil on young stock	3	5.3
Use of Imidacloprid	3	5.3
Jet with electrodip	2	3.5
Use of Dicyclanil	2	3.5
Use of jetting	2	3.5
Breeding SRS sheep	1	1.8
Continue mulesing	1	1.8
Cull dense wool	1	1.8
Cull scoured wool	1	1.8
Cull struck sheep	1	1.8
Increased crutching	1	1.8
Increased presence of European wasp (predator of fly)	1	1.8
Monitor	1	1.8
Moved to no treatment	1	1.8
Only tail strip	1	1.8
Purchase of jetter	1	1.8
Reduce chemical residuals	1	1.8
Shearing twice a year	1	1.8
Targeted preventative treatment	1	1.8
Timing of shearing	1	1.8
Use best practice application	1	1.8
Use FlyBoss	1	1.8
Use of Cyromazine	1	1.8
Use of management calendar	1	1.8
Use of WEC in hoggets to reduce dag	1	1.8
N	**57**	**101.1%**

Note: percentages may sum to more than 100 as respondents could name more than one change.

39.3 Most important changes in lice management over 5 years

Table 39-3: Types of changes over the last 5 years in lice management that individual respondents regarded as the most important.

Type of change	*n*	Proportion of respondents (%)
Rotate actives	14	20.6
Boundary fences	10	14.7
Biosecurity	3	4.4
Closed flock	3	4.4
Monitor	3	4.4
Shear twice year	3	4.4
Use of Imidacloprid	3	4.4
Ask shearers to rotate/wear clean moccasins at shearing	2	2.9
Cage dipping	2	2.9
Off shears treatment	2	2.9
Preventative chemical treatment	2	2.9
Treatment of all introduced sheep/lambs	2	2.9
Cage dip with Diazinon required to eradicate	1	1.5
Changed to backline from plunge dip	1	1.5
Checking shearers gear	1	1.5
Contract plunge dipping	1	1.5
Dip infected sheep if present	1	1.5
Jet with Ivermectin	1	1.5
Only periodically dip	1	1.5
Plunge dip	1	1.5
Plunge dip for 3 years to eradicate lice	1	1.5
Preventative long wool treatment	1	1.5
Preventative treatment in short wool	1	1.5
Skip a year of treatment	1	1.5
Skip year of treatment every third year if no sign of lice.	1	1.5
Use LiceBoss	1	1.5
Use of backline more effective than shower dip	1	1.5
Use of Cage dip	1	1.5
Use of Neonicotinoids	1	1.5
Use of Spinosads	1	1.5
Use treatments that treat both fly and lice	1	1.5
Total Responses	**68**	**100.3%**

Note: percentages may sum to more than 100 as respondents could name more than one change.

Q40 What year were you born?

40.1 Mean age of respondents

Table 40-1: Mean age of respondents in years by Region.

Region	*n*	Mean age (years)	Min (years)	Max (years)
Central NSW	53	57	27	92
East Victoria	26	54	35	71
Northern NSW/Qld	40	59	32	79
SA Peninsula	13	54	45	64
Tasmania	9	59	49	67
Western Australia	34	56	27	79
Wimmera Mallee Murray	50	57	30	78
National	**225**	**57**	**27**	**92**

One way ANOA: Chi-square=5.6083, df=6, P=0.4685.

Table 40-2: Mean age of respondents in years by Chosen enterprise.

Chosen enterprise	*n*	Mean age (years)	Min (years)	Max (years)
Merino x Merino	136	56	27	92
Merino wethers	13	58	32	71
Merino x Other	26	59	32	79
Meat x Meat	41	57	36	71
Other enterprise	9	53	38	64
All enterprises	**225**	**57**	**27**	**92**

One way ANOVA: Chi-square=2.1305, df=4, P=0.7118.

The average age of respondents in the 2011 survey was 56 years with a range of 22-86 years.

Q41 What is your role on the reporting property (e.g. Owner, manager, farm worker)?

41.1 Role of respondents on the reporting property

Table 41-1: Proportion of respondent's role on the reporting property by Region.

Region	Role on reporting property (%)			
	n	**Owner**	**Manager**	**Farmhand**
Central NSW	54	91	9	0
East Victoria	26	88	12	0
Northern NSW/Qld	41	100	0	0
SA Peninsula	13	100	0	0
Tasmania	10	90	10	0
Western Australia	35	94	3	3
Wimmera Mallee Murray	54	91	9	0
National	**233**	**93**	**6**	**0.4**

Chi-square=14.229, df=12, P=0.2863.

Table 41-2: Proportion of respondent's role on the reporting property by Chosen enterprise.

Chosen enterprise	Role on reporting property (%)			
	n	**Owner**	**Manager**	**Farmhand**
Merino x Merino	139	94	6	1
Merino wethers	13	100	0	0
Merino x Other	26	96	4	0
Meat x Meat	45	91	9	0
Other enterprise	10	80	20	0
All enterprises	**233**	**93**	**6**	**0.4**

Chi-square=5.632, df=8, P=0.6884.

Q42 How useful for parasite control are these websites to you?

42. How useful for parasite control are each of these websites to you?

	Never heard of it	Only heard of it	Actually visited site	Used site to make changes
WormBoss web site	○	○	○	○
FlyBoss web site	○	○	○	○
LiceBoss web site	○	○	○	○
AWI web site	○	○	○	○
MLA web site	○	○	○	○
Ag Department web site	○	○	○	○
Enter another option	○	○	○	○

42.1 Usefulness of websites by Region

42.1.1 WormBoss website

Table 42-1: Percentage of usefulness of the WormBoss website for parasite control by Region.

Region		Never heard of it	Only heard of it	Actually visited site	Used site to make changes	Total Responses
Central NSW	*n*	8	15	21	10	54
	Percentage	14.8%	27.8%	38.9%	18.5%	
	Chisq PValue	0.76559	0.52264	0.68123	0.20584	
East Vic	*n*	4	4	10	6	24
	Percentage	16.7%	16.7%	41.7%	25.0%	
	Chisq PValue	0.65472	0.48683	0.61561	0.81149	
Northern NSW/Qld	*n*	3	10	14	13	40
	Percentage	7.5%	25.0%	35.0%	32.5%	
	Chisq PValue	0.31232	0.8507	0.95301	0.55136	
SA Peninsula	*n*	2	5	2	3	12
	Percentage	16.7%	41.7%	16.7%	25.0%	
	Chisq PValue	0.75183	0.19612	0.27249	0.86608	
Tasmania	*n*	0	1	5	3	9
	Percentage	0.0%	11.1%	55.6%	33.3%	
	Chisq PValue	0.27332	0.44176	0.3143	0.74125	
Western Australia	*n*	2	7	11	14	34
	Percentage	5.9%	20.6%	32.4%	41.2%	
	Chisq PValue	0.23411	0.72147	0.75415	0.13028	
Wimmera Mallee Murray	*n*	11	11	17	13	52
	Percentage	21.2%	21.2%	32.7%	25.0%	
	Chisq PValue	0.12248	0.72121	0.72914	0.72554	
National	*n*	**30**	**53**	**80**	**62**	**225**
	Percentage	**13.3%**	**23.6%**	**35.6%**	**27.6%**	

63.2% of respondents in the current survey have visited WormBoss or used the site to make changes.
2011 survey found only 16.2% of respondents had actually visited the WormBoss website and 4.7% has used it to make changes (total of 20.9% using the website in 2011).

42.1.2 FlyBoss website

Table 42-2: Percentage of usefulness of the FlyBoss website for parasite control by Region.

Region		Never heard of it	Only heard of it	Actually visited site	Used site to make changes	Total Responses
Central NSW	*n*	10	16	21	6	53
	Percentage	18.9%	30.2%	39.6%	11.3%	
	Chisq PValue	0.52731	0.54048	0.88358	0.26797	
East Vic	*n*	5	3	10	4	22
	Percentage	22.7%	13.6%	45.5%	18.2%	
	Chisq PValue	0.38555	0.25809	0.73888	0.95961	
Northern NSW/Qld	*n*	3	12	15	9	39
	Percentage	7.7%	30.8%	38.5%	23.1%	
	Chisq PValue	0.21755	0.55098	0.81112	0.4275	
SA Peninsula	*n*	1	5	4	2	12
	Percentage	8.3%	41.7%	33.3%	16.7%	
	Chisq PValue	0.53033	0.28354	0.68158	0.93046	
Tasmania	*n*	0	2	7	0	9
	Percentage	0.0%	22.2%	77.8%	0.0%	
	Chisq PValue	0.23825	0.82798	0.08376	0.20655	
Western Australia	*n*	2	8	15	9	34
	Percentage	5.9%	23.5%	44.1%	26.5%	
	Chisq PValue	0.15567	0.78516	0.7699	0.22595	
Wimmera Mallee Murray	*n*	13	11	18	9	51
	Percentage	25.5%	21.6%	35.3%	17.6%	
	Chisq PValue	0.06829	0.54255	0.5307	0.98914	
National	*n*	**34**	**57**	**90**	**39**	**220**
	Percentage	**15.5%**	**25.9%**	**40.9%**	**17.7%**	

58.6% of respondents in the current survey have visited FlyBoss or used the site to make changes.
2011 survey found 11.4% of respondents had actually visited the FlyBoss website and 2.0% has used it to make changes (total of 13.4% using the website in 2011).

42.1.3 LiceBoss website

Table 42-3: Percentage of usefulness of the FlyBoss website for parasite control by Region, p-values are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Region		Never heard of it	Only heard of it	Actually visited site	Used site to make changes	Total Responses
Central NSW	*n*	9	15	20	8	52
	Percentage	17.3%	28.8%	38.5%	15.4%	
	Chisq PValue	0.88796	0.70344	0.92068	0.481	
East Vic	*n*	6	4	9	3	22
	Percentage	27.3%	18.2%	40.9%	13.6%	
	Chisq PValue	0.2143	0.46502	0.80108	0.52023	
Northern NSW/Qld	*n*	3	11	17	8	39
	Percentage	7.7%	28.2%	43.6%	20.5%	
	Chisq PValue	0.17521	0.80152	0.54292	0.91177	
SA Peninsula	*n*	2	4	3	3	12
	Percentage	16.7%	33.3%	25.0%	25.0%	
	Chisq PValue	0.9896	0.62636	0.47615	0.68074	
Tasmania	*n*	0	3	4	2	9
	Percentage	0.0%	33.3%	44.4%	22.2%	
	Chisq PValue	0.2228	0.67329	0.73832	0.86603	
Western Australia	*n*	2	7	15	10	34
	Percentage	5.9%	20.6%	44.1%	29.4%	
	Chisq PValue	0.12714	0.52617	0.5364	0.20344	
Wimmera Mallee Murray	*n*	14	13	14	9	50
	Percentage	28.0%	26.0%	28.0%	18.0%	
	Chisq PValue	0.04564	0.98381	0.26764	0.78362	
National	*n*	**36**	**57**	**82**	**43**	**218**
	Percentage	**16.5%**	**26.1%**	**37.6%**	**19.7%**	

57.3% of respondents in the current survey have visited LiceBoss or used the site to make changes.
2011 survey found 12.8% of respondents had actually visited the LiceBoss website and 2.6% has used it to make changes (total of 15.4% using the website in 2011).

42.1.4 Australian Wool Innovation (AWI) website

Table 42-4: Percentage of usefulness of the Australian Wool Innovation (AWI) website for parasite control by Region.

Region		Never heard of it	Only heard of it	Actually visited site	Used site to make changes	Total Responses
Central NSW	*n*	3	11	33	5	52
	Percentage	5.8%	21.2%	63.5%	9.6%	
	Chisq PValue	0.70251	0.62236	0.69384	0.67802	
East Vic	*n*	1	3	16	2	22
	Percentage	4.5%	13.6%	72.7%	9.1%	
	Chisq PValue	0.98536	0.30199	0.41187	0.73209	
Northern NSW/Qld	*n*	0	13	21	3	37
	Percentage	0.0%	35.1%	56.8%	8.1%	
	Chisq PValue	0.1906	0.19311	0.84325	0.53545	
SA Peninsula	*n*	1	1	10	1	13
	Percentage	7.7%	7.7%	76.9%	7.7%	
	Chisq PValue	0.6078	0.22016	0.40805	0.68078	
Tasmania	*n*	0	2	5	3	10
	Percentage	0.0%	20.0%	50.0%	30.0%	
	Chisq PValue	0.49624	0.77209	0.70368	0.08676	
Western Australia	*n*	0	8	17	7	32
	Percentage	0.0%	25.0%	53.1%	21.9%	
	Chisq PValue	0.22354	0.95784	0.65215	0.08675	
Wimmera Mallee Murray	*n*	5	15	26	4	50
	Percentage	10.0%	30.0%	52.0%	8.0%	
	Chisq PValue	0.07758	0.43549	0.5049	0.45757	
National	*n*	**10**	**53**	**128**	**25**	**216**
	Percentage	**4.6%**	**24.5%**	**59.3%**	**11.6%**	

42.1.5 Meat and Livestock Australia (MLA) website

Table 42-5: Percentage of usefulness of the Meat and Livestock Australia (MLA) website for parasite control by Region, p-values are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Region		Never heard of it	Only heard of it	Actually visited site	Used site to make changes	Total Responses
Central NSW	*n*	2	13	28	7	50
	Percentage	4.0%	26.0%	56.0%	14.0%	
	Chisq PValue	0.43752	0.79424	0.98595	0.53656	
East Vic	*n*	1	4	16	1	22
	Percentage	4.5%	18.2%	72.7%	4.5%	
	Chisq PValue	0.49475	0.56688	0.2883	0.14298	
Northern NSW/Qld	*n*	1	13	20	4	38
	Percentage	2.6%	34.2%	52.6%	10.5%	
	Chisq PValue	0.90156	0.20893	0.79287	0.29458	
SA Peninsula	*n*	0	3	8	2	13
	Percentage	0.0%	23.1%	61.5%	15.4%	
	Chisq PValue	0.58243	0.93519	0.78234	0.84431	
Tasmania	*n*	0	0	7	3	10
	Percentage	0.0%	0.0%	70.0%	30.0%	
	Chisq PValue	0.62963	0.1199	0.54819	0.35387	
Western Australia	*n*	0	4	17	11	32
	Percentage	0.0%	12.5%	53.1%	34.4%	
	Chisq PValue	0.38832	0.17889	0.83866	0.02463	
Wimmera Mallee Murray	*n*	1	15	24	10	50
	Percentage	2.0%	30.0%	48.0%	20.0%	
	Chisq PValue	0.88	0.40319	0.45956	0.69569	
National	*n*	**5**	**52**	**120**	**38**	**215**
	Percentage	**2.3%**	**24.2%**	**55.8%**	**17.7%**	

42.1.6 State Agriculture Department website

Table 42-6: Percentage of usefulness of an Agricultural Department website for parasite control by Region, p-values are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Region		Never heard of it	Only heard of it	Actually visited site	Used site to make changes	Total Responses
Central NSW	*n*	5	10	30	8	53
	Percentage	9.4%	18.9%	56.6%	15.1%	
	Chisq PValue	0.89849	0.26812	0.49657	0.88725	
East Vic	*n*	2	7	7	2	18
	Percentage	11.1%	38.9%	38.9%	11.1%	
	Chisq PValue	0.7545	0.31852	0.50499	0.71631	
Northern NSW/Qld	*n*	3	12	18	2	35
	Percentage	8.6%	34.3%	51.4%	5.7%	
	Chisq PValue	0.94636	0.38746	0.90486	0.17722	
SA Peninsula	*n*	0	4	7	1	12
	Percentage	0.0%	33.3%	58.3%	8.3%	
	Chisq PValue	0.3011	0.65832	0.68309	0.58186	
Tasmania	*n*	0	1	6	0	7
	Percentage	0.0%	14.3%	85.7%	0.0%	
	Chisq PValue	0.42965	0.52417	0.18145	0.31612	
Western Australia	*n*	0	5	18	10	33
	Percentage	0.0%	15.2%	54.5%	30.3%	
	Chisq PValue	0.08638	0.19819	0.71192	0.01562	
Wimmera Mallee Murray	*n*	8	15	15	6	44
	Percentage	18.2%	34.1%	34.1%	13.6%	
	Chisq PValue	0.03939	0.34516	0.13559	0.89968	
National	*n*	**18**	**54**	**101**	**29**	**202**
	Percentage	**8.9%**	**26.7%**	**50.0%**	**14.4%**	

42.2 Usefulness of websites by Chosen enterprise

42.2.1 WormBoss website

Table 42-7: Percentage of usefulness of the WormBoss website for parasite control by Region, p-values are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Chosen enterprise		**Never heard of it**	**Only heard of it**	**Actually visited site**	**Used site to make changes**	**Total Responses**
Merino x Merino	*n*	11	37	57	32	137
	Percentage	8.0%	27.0%	41.6%	23.4%	
	Chisq PValue	0.08909	0.40516	0.23498	0.34926	
Merino wethers	*n*	3	1	3	5	12
	Percentage	25.0%	8.3%	25.0%	41.7%	
	Chisq PValue	0.26838	0.27727	0.53973	0.35175	
Merino x Other	*n*	10	7	5	4	26
	Percentage	38.5%	26.9%	19.2%	15.4%	
	Chisq PValue	0.00045	0.72349	0.16272	0.23711	
Meat x Meat	*n*	6	7	11	18	42
	Percentage	14.3%	16.7%	26.2%	42.9%	
	Chisq PValue	0.86577	0.35764	0.30875	0.05888	
Other enterprise	*n*	0	1	4	3	8
	Percentage	0.0%	12.5%	50.0%	37.5%	
	Chisq PValue	0.3017	0.51939	0.49324	0.59208	
All Enterprises	*n*	**30**	**53**	**80**	**62**	**225**
	Percentage	**13.3%**	**23.6%**	**35.6%**	**27.6%**	

42.2.2 FlyBoss website

Table 42-8: Percentage of usefulness of the FlyBoss website for parasite control by Region, p-values are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Chosen enterprise		**Never heard of it**	**Only heard of it**	**Actually visited site**	**Used site to make changes**	**Total Responses**
Merino x Merino	*n*	13	39	57	25	134
	Percentage	9.7%	29.1%	42.5%	18.7%	
	Chisq PValue	0.09026	0.46742	0.76824	0.79831	
Merino wethers	*n*	3	1	3	5	12
	Percentage	25.0%	8.3%	25.0%	41.7%	
	Chisq PValue	0.40028	0.23165	0.38889	0.04888	
Merino x Other	*n*	10	7	6	3	26
	Percentage	38.5%	26.9%	23.1%	11.5%	
	Chisq PValue	0.00284	0.91909	0.15514	0.45355	
Meat x Meat	*n*	8	9	17	6	40
	Percentage	20.0%	22.5%	42.5%	15.0%	
	Chisq PValue	0.46461	0.67187	0.875	0.68205	
Other enterprise	*n*	0	1	7	0	8
	Percentage	0.0%	12.5%	87.5%	0.0%	
	Chisq PValue	0.26617	0.45621	0.03937	0.2337	
All Enterprises	*n*	**34**	**57**	**90**	**39**	**220**
	Percentage	**15.5%**	**25.9%**	**40.9%**	**17.7%**	

42.2.3 LiceBoss website

Table 42-9: Percentage of usefulness of the LiceBoss website for parasite control by Region, p-values are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Chosen enterprise		**Never heard of it**	**Only heard of it**	**Actually visited site**	**Used site to make changes**	**Total Responses**
Merino x Merino	*n*	16	36	56	24	132
	Percentage	12.1%	27.3%	42.4%	18.2%	
	Chisq PValue	0.21428	0.80028	0.3676	0.68978	
Merino wethers	*n*	3	1	4	4	12
	Percentage	25.0%	8.3%	33.3%	33.3%	
	Chisq PValue	0.46943	0.22752	0.80892	0.28849	
Merino x Other	*n*	10	6	4	6	26
	Percentage	38.5%	23.1%	15.4%	23.1%	
	Chisq PValue	0.00589	0.75951	0.06457	0.70034	
Meat x Meat	*n*	7	12	12	9	40
	Percentage	17.5%	30.0%	30.0%	22.5%	
	Chisq PValue	0.87801	0.63366	0.43231	0.69269	
Other enterprise	*n*	0	2	6	0	8
	Percentage	0.0%	25.0%	75.0%	0.0%	
	Chisq PValue	0.25039	0.94942	0.08469	0.20905	
All Enterprises	*n*	**36**	**57**	**82**	**43**	**218**
	Percentage	**16.5%**	**26.1%**	**37.6%**	**19.7%**	

42.2.4 Australian Wool Innovation (AWI) website

Table 42-10: Percentage of usefulness of the Australian Wool Innovation (AWI) website for parasite control by Region.

Chosen enterprise		**Never heard of it**	**Only heard of it**	**Actually visited site**	**Used site to make changes**	**Total Responses**
Merino x Merino	*n*	4	28	85	16	133
	Percentage	3.0%	21.1%	63.9%	12.0%	
	Chisq PValue	0.38461	0.41723	0.48599	0.87715	
Merino wethers	*n*	0	3	7	1	11
	Percentage	0.0%	27.3%	63.6%	9.1%	
	Chisq PValue	0.47546	0.85467	0.85042	0.80872	
Merino x Other	*n*	1	10	13	2	26
	Percentage	3.8%	38.5%	50.0%	7.7%	
	Chisq PValue	0.8527	0.15175	0.53967	0.5607	
Meat x Meat	*n*	4	8	21	6	39
	Percentage	10.3%	20.5%	53.8%	15.4%	
	Chisq PValue	0.10244	0.61191	0.66056	0.48425	
Other enterprise	*n*	1	4	2	0	7
	Percentage	14.3%	57.1%	28.6%	0.0%	
	Chisq PValue	0.23509	0.08159	0.29155	0.36807	
All Enterprises	*n*	**10**	**53**	**128**	**25**	**216**
	Percentage	**4.6%**	**24.5%**	**59.3**	**11.6%**	

42.2.5 Meat and Livestock Australia (MLA) website

Table 42-11: Percentage of usefulness of the Meat and Livestock Australia (MLA) website for parasite control by Region.

Chosen enterprise		Never heard of it	Only heard of it	Actually visited site	Used site to make changes	Total Responses
Merino x Merino	*n*	2	28	82	20	132
	Percentage	1.5%	21.2%	62.1%	15.2%	
	Chisq PValue	0.54148	0.48721	0.33206	0.49053	
Merino wethers	*n*	0	5	6	0	11
	Percentage	0.0%	45.5%	54.5%	0.0%	
	Chisq PValue	0.61301	0.15148	0.95509	0.16321	
Merino x Other	*n*	1	8	10	6	25
	Percentage	4.0%	32.0%	40.0%	24.0%	
	Chisq PValue	0.58301	0.42694	0.28989	0.45186	
Meat x Meat	*n*	2	8	19	11	40
	Percentage	5.0%	20.0%	47.5%	27.5%	
	Chisq PValue	0.26736	0.59035	0.48154	0.13937	
Other enterprise	*n*	0	3	3	1	7
	Percentage	0.0%	42.9%	42.9%	14.3%	
	Chisq PValue	0.6866	0.31515	0.64634	0.83112	
All Enterprises	*n*	**5**	**52**	**120**	**38**	**215**
	Percentage	**2.3%**	**24.2%**	**55.8%**	**17.7%**	

42.2.6 State Agriculture Department website

Table 42-12: Percentage of usefulness of a State Agriculture Department website for parasite control by Region.

Chosen enterprise		Never heard of it	Only heard of it	Actually visited site	Used site to make changes	Total Responses
Merino x Merino	*n*	9	27	70	18	124
	Percentage	7.3%	21.8%	56.5%	14.5%	
	Chisq PValue	0.53752	0.28556	0.30963	0.96257	
Merino wethers	*n*	0	4	6	1	11
	Percentage	0.0%	36.4%	54.5%	9.1%	
	Chisq PValue	0.32215	0.53671	0.83117	0.64486	
Merino x Other	*n*	3	11	8	3	25
	Percentage	12.0%	44.0%	32.0%	12.0%	
	Chisq PValue	0.60486	0.09495	0.20309	0.75583	
Meat x Meat	*n*	6	9	14	5	34
	Percentage	17.6%	26.5%	41.2%	14.7%	
	Chisq PValue	0.08792	0.97642	0.46685	0.95711	
Other enterprise	*n*	0	3	3	2	8
	Percentage	0.0%	37.5%	37.5%	25.0%	
	Chisq PValue	0.39849	0.55585	0.61708	0.42689	
All Enterprises	*n*	**18**	**54**	**101**	**29**	**202**
	Percentage	**8.9%**	**26.7%**	**50.0%**	**14.4%**	

Q43 If you have used WormBoss, FlyBoss or LiceBoss to information to make changes to your parasite management, please estimate the annual dollar ($) value of these changes across your property from changes in labour costs, chemical costs, other costs or differences in production.

- $0 - $1000
- $1000 - $5000
- $5000 - $10,000
- more than $10,000

43.1 Dollar value of ParaBoss by Region

Table 43-1: Proportion of the value of ParaBoss websites to respondents by Region, p-values are coloured for significance for higher counts than expected (red) and for lower counts than expected (blue).

Region		$0 - $1000	$1000 - $5000	$5000 - $10,000	more than $10,000	Total Responses
Central NSW	*n*	5	4	1	0	10
	Percentage	50.0%	40.0%	10.0%	0.0%	
	Chisq PValue	0.24352	0.87459	0.55447	0.34399	
East Vic	*n*	2	2	1	1	6
	Percentage	33.3%	33.3%	16.7%	16.7%	
	Chisq PValue	0.87593	0.71104	0.94261	0.5279	
Northern NSW/Qld	*n*	3	7	0	4	14
	Percentage	21.4%	50.0%	0.0%	28.6%	
	Chisq PValue	0.56409	0.70248	0.11331	0.01418	
SA Peninsula	*n*	0	2	2	0	4
	Percentage	0.0%	50.0%	50.0%	0.0%	
	Chisq PValue	0.27452	0.83822	0.12939	0.5495	
Tasmania	*n*	1	1	0	0	2
	Percentage	50.0%	50.0%	0.0%	0.0%	
	Chisq PValue	0.60198	0.8852	0.5495	0.67214	
Western Australia	*n*	6	6	3	1	16
	Percentage	37.5%	37.5%	18.8%	6.3%	
	Chisq PValue	0.57547	0.72511	0.93675	0.71765	
Wimmera Mallee Murray	*n*	3	7	5	0	15
	Percentage	20.0%	46.7%	33.3%	0.0%	
	Chisq PValue	0.48499	0.84214	0.15812	0.24646	
National	*n*	**20**	**29**	**12**	**6**	**67**
	Percentage	**29.9%**	**43.3%**	**17.9%**	**9.0%**	

43.2 Dollar value of ParaBoss by Chosen enterprise

Table 43-2: Proportion of the value of ParaBoss websites to respondents by Chosen enterprise.

Region		**$0 - $1000**	**$1000 - $5000**	**$5000 - $10,000**	**more than $10,000**	**Total Responses**
Merino x Merino	*n*	9	13	10	4	36
	Percentage	25.0%	36.1%	27.8%	11.1%	
	Chisq PValue	0.59424	0.51303	0.16183	0.66556	
Merino wethers	*n*	2	2	0	1	5
	Percentage	40.0%	40.0%	0.0%	20.0%	
	Chisq PValue	0.67787	0.91114	0.34399	0.40921	
Merino x Other	*n*	3	2	1	1	7
	Percentage	42.9%	28.6%	14.3%	14.3%	
	Chisq PValue	0.5288	0.55409	0.82073	0.63744	
Meat x Meat	*n*	4	11	1	0	16
	Percentage	25.0%	68.8%	6.3%	0.0%	
	Chisq PValue	0.72249	0.12154	0.27042	0.2313	
Other enterprise	*n*	2	1	0	0	3
	Percentage	66.7%	33.3%	0.0%	0.0%	
	Chisq PValue	0.24316	0.79335	0.46355	0.60423	
National	*n*	**20**	**29**	**12**	**6**	**67**
	Percentage	**29.9%**	**43.3%**	**17.9%**	**9.0%**	

Q44 Is there any further area of information/research you think is important for parasite management? How would you like this information delivered (e.g. face to face workshops, websites, decision guides, pamphlet)?

44.1 Preferred method of delivery of information

Table 44-1: Respondents' preferred method of delivery of information regarding parasite management and research (Total respondents for this question *n*=84 of which there were *n*=60 responses).

Method of information delivery	*n*	Proportion of respondents (%)
Face to Face workshops	32	53.3
Websites	14	23.4
All methods	3	5.0
Email	3	5.0
Pamphlets	2	3.3
Webinars	2	3.3
Grower group	1	1.7
Newspaper articles	1	1.7
Pamphlet	1	1.7
Scientific papers	1	1.7
Total Responses	**60**	**100.1***

**Note total adds to over 100% as some respondents indicated more than one method of delivery.*

44.2 Suggested areas for further information or research on parasite management

Table 44-2: The suggestions of respondents when asked if there was any further area of information/research they think is important for parasite management.

Suggestions	***n***
Breeding resistant animals	3
A quicker way to do worm monitoring	2
Accountability of producers for not controlling lice	2
More research for lice in long wool sheep	2
Race side WEC test	2
Need a social license to produce animal products	2
WEC training	2
Accreditation for PIC holders on lice control	1
Better reporting of lice infestations at point of sale	1
Biotechnology.	1
BioWorma will alleviate pressure on chemical reliance	1
Development of new chemical products	1
Development of vaccines	1
Fly vaccine and genome mapping is so important	1
Further research on cause and management of hypersensitivity scours as a high priority	1
Grey area between control and eradication of lice	1
Kits for worm resistance tests - small quantities of products to use with instructions	1
More drench combinations without a mectin added.	1
More independent information on product results and local resistance data	1
More research	1
More research into fluke control alternatives for Triclabendazole resistance.	1
Need ASBV indicator traits for worms and flystrike integrated into selection indices using weighting of genetic correlations between traits to ensure that production traits are not compromised	1

(table continued on next page)

Table 44-2 (contd): The suggestions of respondents when asked if there was any further area of information/research they think is important for parasite management.

Need to fast track genetic transfer of Worm & Fly strike resistance into stud flocks to maintain social licence	1
Quality assurance of WEC technique	1
Research into biological control of worms with fungi or bacteria	1
Research into using drench in troughs on large properties, an applicator plumbed into the delivery from the tank to trough to deliver the correct amount of drench	1
Research spread of lice through shedding breeds	1
Role of eucalyptus trees in reducing incidence of flystrike	1
Simple drench test on what actives the worms are resistant to	1
Test for lice or lice DNA in wool sample pre-shearing	1
The consumer is demanding meat that is clean and green, maintain social license-consequently I will be trying mineral licks with *Duddingtonia flagrans* fungi added to feed	1
The spread of the European Wasp is altering the insect biodiversity in ways we don't understand. It is also making management more difficult as there are no control measures available for use in reducing their impact on stock	1
Worm control at paddock level with biological sprays that can be used in pasture establishment, fertiliser and manipulation	1
Total responses	**41**

6. Discussion

The 2019 Benchmarking Australian Sheep Parasite Control survey provided a snapshot of the incidence of parasites and parasite control practices of Australian sheep producers and allowed for comparisons between wool and meat enterprises. Although the response rate was lower than in the previous benchmarking surveys conducted on 2003 and 2011 years (Reeve and Thompson 2005; Reeve and Walkden-Brown 2014) the results of the short survey and comparisons with the two previous surveys confirm that the main survey respondents are a true representation of Australian sheep producers. The lower response rate to this survey was likely due to continued and wide spread drought conditions across large parts of Australia, moving to an online platform (producers were more likely to participate in the survey after an email reminder), survey fatigue and the length of the survey.

The average age of participants in 2018 (57 years) was similar to 2011 (56 years) and slightly higher than 2003 (51 years). The majority of the respondents were Merino based enterprises with about 21% meat based enterprises. The main source of income on the reporting properties came from wool sheep (41.7%) followed by meat sheep (27.6%), cattle (11.9%) and cropping (13.2%) with significant differences between Regions as expected. The survey year (2018) was significantly drier with reported mean rainfall lower than the average annual rainfall in all Regions except Tasmania. This likely had an impact on the lower reported incidence of flystrike and lice in the survey year. Comparisons between the three benchmarking sheep parasite control surveys have been made throughout this report with some major comparisons outlined in Table 5.

Table 5: Comparisons of results between the three Benchmarking Australian sheep parasite control surveys.

Description of data	Year surveyed		
	2018	**2011**	**2003**
Number of respondents to main survey	354	575	1365
Number of respondents to short survey	250	444	958
Mean reported rainfall (mm)	407	650	611
Proportion using worm egg counts (%)	42	21 (ewes)	44
Frequency of worm egg count/year adult ewes	3.1	2.9	2.6
Frequency of worm egg count/year weaners	3.1	2.0	3.0
Frequency of anthelmintic treatment/ year adult ewes	2.1	2.8	2.1
Frequency of anthelmintic treatment/ year weaners	2.1	2.7	2.2
Conducted drench test over 5 years (%)	36.7	29	-
Using rams selected for resistance to worms using ASBV-WEC	22.7	8.0	10.2
Respondents reporting breech strike in ewes (%)	37.0	78	82
Incidence of breech strike in ewes (%)	2.4	4.1	2.3
Respondents reporting body strike in ewes (%)	14.4	68	45
Incidence of body strike in ewes (%)	2.1	5.5	1.0
Reported proportion mulesing sheep (%)	46.8	48 (ewes) 46 (wethers)	25.8
Use of pain relief with mulesing –ewes (%)	86.6	59	-
Use of pain relief with mulesing –wethers (%)	90.9	64	-
Use visual traits to select for sheep less susceptible to flystrike - Ewes (%)	55.5	61	-
Use ASBV traits to select for sheep less susceptible to flystrike - Rams (%)	17.3	10	-
Proportion of live lice seen in an average year (%)	13.9	18.6	20
Reported evidence of lice over 5 years (%)	55.8	66.3	-
Treated for lice in an average year (%)	73.3	73.5	41
Suspected lice resistance (%)	8.4	26	13
Total proportion visited WormBoss website (%)	63.2	20.9	-
Total proportion visited FlyBoss website (%)	58.6	13.4	-
Total proportion visited LiceBoss website (%)	57.3	15.4	-

Worms

There were few changes to worm control practices in 2018 compared with 2003 and 2011 with similar proportions using WEC, similar WEC and drench frequencies and anthelmintic treatments being the top method of worm control in 2011 and 2018. There was a slight increase in the proportion conducting a drench test over the previous 5 years, however a large proportion of respondents do not know their drench resistance status having not conducted any kind of drench test in the five years from 2014 to 2018. Around half of anthelmintic treatments used a single active and the top three actives used in 2011 were still the top three used in 2018 with very low use of newer anthelmintic actives such as monepantel, derquantel and praziquantel. This indicates a need for greater producer education on the benefits of well-considered worm control programmes.

There was good use of grazing management for worm control including preparing clean pastures by spelling paddocks, intensive rotational grazing, cattle rotation and using sheep treated with long acting anthelmintics. Feeding strategy was also popular with numbers doubling from 2011 (15%) to 2018 (31%). In 2018, a higher proportion of producers used rams selected for resistance to worms using Australian Sheep Breeding Value for worm egg count (22.7%) than in 2011 (8%) and 2003 (10.2%, Table 5). There was a low uptake of Barbervax® across the board with users of the vaccine confined to areas at high risk of Barber's Pole worm infestations (Central NSW 4.6%, Northern NSW/Qld 5.9%). Low proportions of respondents used 'leaving some sheep undrenched' (17.6%) except in WA where 37.8% used this technique.

Nearly two thirds applied a quarantine drench to introduced sheep for worms (60.6%) and requested an animal health history from vendors (64.6%). WormBoss was rated second for importance of sources of information for parasite control after 'other farmer or member of staff'. The increased use of the WormBoss website indicates a requirement of sheep producers for detailed and up to date information on worm control practices. Although respondents indicated they preferred face-to-face workshops for delivery of information, accessing information through websites was also acceptable to respondents.

Liver fluke

A low number of respondents answered questions on liver fluke (*n*=39) hence the data collected in this section may be less reliable than other survey sections. Liver fluke remains confined to the wetter areas of Australia with most respondents located in the eastern states. Just over half of liver fluke respondents tested for liver fluke in an average year (53%) and around half (47%) treated for liver fluke. Results from a liver fluke test was rated as the most important factor when deciding to treat for liver fluke which is supported by the statistic that over a 5 year period 65% tested at least once for liver fluke and 56% gave at least one treatment for liver fluke.

Flystrike

The proportion of respondents reporting breech and body strike was lower in 2018 than 2011 as was incidence within the flock. This may have been due to 2018 being a drier than average year. There was a slight reduction in the use of visual traits for selection of sheep that are less susceptible to flystrike from 2011 (61%) to 2018 (55.5%), however, there was an increase in the use of ASBV traits from 10% to 17%. Respondents favoured an integrated approach to flystrike control with timing of crutching, timing of shearing and preventative chemical treatment the top three methods of flystrike control. The overall proportion of respondents using mulesing in 2018 was similar to that in 2011 (Table 5). Merino x Merino producers were significantly more likely to mules their sheep (68%) but were also more likely to use genetic selection (58%) indicating a reliance on mulesing whilst planning to reduce the practice. The proportion of Merino x Merino enterprises using mulesing was similar to the proportion using mulesing reported in the 2017 AWI Merino Husbandry Practices Survey (63% mulesed wether lambs, 70% mulsed ewe lambs, Sloane 2018). Meat x Meat producers were significantly less likely to mules (9%) or use genetic selection for flystrike control (26%), this is unsurprising given the plainer body types and clearer breech areas typical of meat breeds. Of those respondents who used mulesing, there was a small reduction in the proportion of replacement sheep mulesed in 2018 (-2.5%) compared with 5 years ago, with the largest reduction occurring in Northern NSW/Qld (-21.1%) and very little change in other Regions.

A large proportion of respondents used pain relief with mulesing in 2018 up from 59% in ewes and 64% in wethers 2011 to 87% in ewes and 91% in wethers in 2018. Most used TriSolfen® (82%) which is a local anaesthetic and

antiseptic wound spray that provides at least 24 hours pain relief. Only a small number of producers used Buccalgesic® an oral non-steroidal anti-inflammatory on its own (0.8%) or in combination with TriSolfen® (3.4%), Buccalgesic® was only registered for use in 2016.

When chemical treatments were given for flystrike control they were generally given at the same time each year (66%), dicyclanil was the predominant chemical used with this method (55%) and backliner/spray on the most popular method of application (66%). There were very few respondents who suspect chemical resistance to flystrike control chemicals (5%). When asked what the most important change respondents had made for flystrike control in the last 5 years, breeding for flystrike resistance (21%) was the most popular.

Again, the FlyBoss website increased in popularity from 2011 to 2018 with a much higher visitation rate and usage of the website information to make changes to flystrike control practices.

Lice control

There was a reduction in the reporting of evidence of lice with only 14% seeing live lice in 2018 compared with 17% reporting live lice seen at last shearing in 2011 and 20% in 2003. Evidence of lice over 5 years also reduced with evidence of lice 68% in 2011 and 56% in 2018. However, the proportion treating for lice remained the same with 73.3% treating for lice both in 2018 and 72.6% in 2011. The mean number of years evidence of lice was reported was 1 year over the 5 year period from 2014 to 2018, although the range was 0 (no evidence of lice in any year) up to 5 (evidence of lice every year). This suggests that, on average, when lice infestations are detected they are treated successfully and do not generally persist in the years after treatment.

Only a low proportion reported suspected product resistance in lice (8.4%) with 50% of those suspecting resistance to insect growth regulators (IGR). There was a significant reduction in the use of IGR for backline application in 2018 (4%) from 2011 (50%). For long wool treatments, spinosad (58%) was used the most which is down from 74% using this active in 2011, the backliner/spray on method was most popular in 2018 (60%) which is higher than in 2011 (50%). Rotation of actives was considered by most as the most important change to their lice control practices in the last 5 years.

Biosecurity was a major concern of survey respondents regarding lice control with introduction through fences or from purchased sheep the most important factor in recurring lice infestations. Only 21% of respondents applied a quarantine lice treatment when introducing sheep into their flock, although 82% isolated sheep for at least 2 weeks and 65% requested an animal health history from seller. Biosecurity on farm is vital for lice prevention and includes maintaining boundary fences and treatment and inspection of introduced sheep for lice.

Comparisons between parasite control practices of wool and meat sheep enterprises

This was the first time that the Benchmarking Australian Sheep Parasite Control survey attempted to determine differences in parasite control practices between wool sheep and meat sheep. There were fewer differences in parasite control practices between chosen enterprises than there were between Regions. The major differences between chosen enterprises were in use of combination anthelmintic actives (Table 13-10), reported incidence of flystrike (Table 21-8) and methods to assist with blowfly control (Table 22-2). The largest difference between chosen enterprises was in the use of mulesing where Merino x Merino were significantly more likely to mules sheep and more likely to buy mulesed sheep. Merino x Other were less likely to mules but more likely to buy mulesed sheep (Table 22-2). Meat x Meat were also significantly less likely to mules. Merino x Merino were also more likely to use genetic selection than other chosen enterprises and Meat x Meat was less likely to use genetic selection for the specified traits related to flystrike control.

7. Impact on Wool Industry – Now & in 5 years time

The results of this project indicate large growth in the use of online resources by sheep producers and the need for these resources to be maintained with current knowledge on parasite control. Results from the survey will inform content on ParaBoss websites and face to face extension programmes allowing targeting of gaps in information or where there is a slow uptake in beneficial practices such as protection of parasite treatment actives.

The results of this project are immediately applicable to the Australian wool industry allowing wool producers to compare their parasite control practices with national, regional and enterprise benchmarks. The survey also provides benchmarks to measure change in future parasite incidence and control practices.

In terms of what the survey has revealed about the parasite control landscape in recent years the following observations can be made:

- There is little evidence of a significant breakdown in anthelmintic control of gastrointestinal nematodes. Drench frequency has not increased over time, and uptake of new generation anthelmintics and alternatives such as Barbervax is low. The use of combination anthelmintics, availability of next generation anthelmintics, coupled with alternative strategies such as the Barbervax vaccine, genetic selection and grazing management providing integrated parasite management options appears to be maintaining worm control within acceptable limits for producers.
- Attempts to reduce the rate of mulesing and develop alternatives have not been successful in creating major change in mulesing rates. However, there has been very high adoption of use of analgesics at mulesing and increasing adoption of genetic approaches to controlling blowfly strike.
- The landscape with regards to lice control appears to have improved slightly with a reducing trend for detection of lice and steady level of treatment for lice associated with strong uptake of newer generation chemicals for control in the Spinosyn and Neonicotinoid classes.

8. Conclusions

Wool growers continue to demonstrate their adaptability through increased use of worm control methods and techniques such as grazing management, use of WEC, use of quarantine drench for introduced sheep and use of ASBV-WEC for genetic selection in some Regions. However, when it comes to protecting their drench resistance status there is more that can be done such as greater use of WEC and larval identification, conducting regular drench resistance tests, rotating drench actives, use of quarantine drenches and using newer generation drench actives.

Whilst there was no reduction in the use of mulesing in merino enterprises, merino wool producers have responded to consumer concerns regarding animal welfare and have overwhelmingly adopted the use of pain relief during mulesing and are moving towards non-mulesed sheep with small increases in the adoption of genetic selection to breed sheep that are less susceptible to flystrike through visual traits and ASBVs.

Biosecurity and rotation of actives are paramount to maintaining lice free sheep and both methods have been adopted widely by respondents to this survey with the result being lower reporting of evidence of lice than in previous surveys.

The results of the Australian Sheep Parasite Survey show a considerable increase in the use of online resources which suggests a continued need for information delivery and grower education across the major sheep parasites. The ParaBoss suite of websites offers wool growers an invaluable resource for parasite control and allows instant access to up to date information. However, the average age of respondents to the survey and their preference for face to face workshops indicates that that form of learning is still vitally important in dissemination of information.

9. References

Heath, ACG, Levot, GW (2015) Parasiticide resistance in flies, lice and ticks in New Zealand and Australia: mechanisms, prevalence and prevention. *New Zealand Veterinary Journal* **63**, 199-210.

James, PJ, Cramp, AP, Hook, SE (2008) Resistance to insect growth regualtor insecticides in populations of sheep lice as assessed by a moulting disruption assay. *Medical and Veterinary Entomology* **22**, 326-330.

Jones, A, Curnow, M, van Burgel, AJ (2014) Report on the National Producers and Service Providers Surveys 2014. Sheep CRC.

Kahn, LP, Woodgate, RG (2012) Integrated parasite management: Products for adoption by the Australian sheep industry. *Veterinary Parasitology* **186**, 58-64.

Lane, J, Jubb, T, Shephard, R, Webb-Ware, J, Fordyce, G (2015) Priority list of endemic diseases for the red meat industries. Meat & Livestock Australia Limited.

Playford, M, Smith, A, Love, S, Besier, R, Kluver, P, Bailey, J (2014) Prevalence and severity of anthelmintic resistance in ovine gastrointestinal nematodes in Australia (2009–2012. *Australian Veterinary Journal* **92**, 464-471.

Reeve, I, Thompson, L (2005) Integrated parasite management in sheep project - Benchmark survey. University of New England, Institute for Rural Futures.

Reeve, I, Walkden-Brown, SW (2014) Benchmarking Australian sheep parasite control: cross-sectional survey report. University of New England, Australian Wool Innovation and Meat and Livestock Australia.

Savage, G (1998) The Residue implications of sheep ectoparasites - A report for the The Woolmark Company. Canberra, Australia.

Sloane, R (2018) AWI 2017 Merino Husbandry Practices Survey. . Australian Wool Innovation Limited.

Walkden-Brown, SW, Reeve, I, Thompson, L, Kahn, LP, Crampton, A, Larsen, JW, Woodgate, RG, James, PJ, de Fegely, CR, Williams, S T C (Ed.) (2006) 'IPMs project benchmarking survey: a national survey of parasite control practices., Proceedings of the Australian Sheep Veterinarians Annual Conference.' Wagga Wagga, NSW. (Australian Sheep Veterinarian Society: St Leonards, NSW)

Zhang, L, Yan, C, Guo, Q, Zhang, J, Ruiz-Menjivar, J (2018) The impact of agricultural chemical inputs on environment: global evidence from informetrics analysis and visualization. *International Journal of Low-Carbon Technologies* **13**, 338-352.

10. List of abbreviations

ANOVA	Analysis of variance
ASBV	Australian sheep breeding value
AWI	Australian Wool Innovation Limited
CE	Chosen enterprise
East Vic	Eastern Victoria
ELISA	Enzyme-linked immunosorbent assay
MLA	Meat and Livestock Australia
Region	Meat and Livestock Australia reporting region
SA Peninsula	South Australian Peninsula
SE	Standard error
WEC	Worm egg count
WECRT	Worm egg count reduction test

Appendices

Appendix 1 – Number of respondents per question

Table A1: Number of respondents per question.

Question number and description	***Number of respondents who answered this question***
Total number of survey respondents –Main survey	354
SECTION A: Property Details	
1. Post code	354
2. Rainfall – 2018	340
Rainfall – average annual	354
3. Property size	353
4. % Income	354
5. % Land use	354
6. Cattle numbers	354
7. Sheep numbers	354
8. Choose an enterprise	354
9. Lambing and weaning times	353
SECTION B: Internal Parasites – Worm and Liver fluke	
10. Worm control techniques and treatments -Did	278
Worm control techniques and treatments -Effectiveness	213
11. Worm egg count monitors and larval culture	143
12. Who carried out these worm egg count monitors	158
13. Number of drenches given	233
14. Drench resistance tests	188
15. Who carried out these drench resistance tests?	86
16. Important factors when deciding to drench ewes and weaners	243
17. Have you tested or treated for liver fluke in the last 5 years?	39
18a.Tests for liver fluke 2014-2018	39
18b. Treatments for liver fluke 2014-2018	32
19. Treatment for liver fluke in 2018	15
20. Important factors when deciding to treat for fluke	32
SECTION C: Blowfly Control	
21. Details of blowfly strike in 2018	131
22. Methods for blow fly control in 2018	237
23. Timing of shearing and crutching	236
24. Mulesing	122
25. Chemical treatments for flystrike	245
26. Do you suspect resistance to flystrike treatment products?	225
27. Which flystrike treatment products	12
28. Visual assessment for breeding more flystrike resistance sheep	136
29. ASBVs for breeding more flystrike resistant sheep	99
SECTION D: Lice Control	
30. Lice detection and treatment methods 2014-2018	238
31. Lice treatment 2018	140
32. Do you suspect resistance to a lice treatment product?	214
33. Which lice treatment products	14
34. Causes of recurring lice problems	122
SECTION E: General Parasite Management	
35. Did you introduce sheep in 2018	235
36. How did you manage introduction of sheep?	133
37. Sources of information for parasite control	226
38. Specific decisions – important people and resources	287

Table continued on next page

Table A1 (cont.): Number of respondents per question.

39. Most important changes in parasite management in last 5 years	80
40. What year were you born?	225
41. What is your role on the reporting property?	233
42. How useful are these websites for parasite control?	225
43. $ value of changes to parasite management using ParaBoss websites?	67
44. Is there any further information/ research you think is important?	84
45. Email address for notification of results	106

Appendix 2 – Main survey questionnaire

Welcome to the Australian Sheep Parasite Survey

Information Sheet for Participants

We wish to invite you to participate in the Australian Sheep Parasite Survey described below.

My name is Dr. Alison Colvin and I am conducting this research in the School of Environmental and Rural Science at the University of New England. My co-investigators are Professor Stephen Walkden-Brown and Dr. Ian Reeve.

About the project

This national survey of Australian sheep producers is being conducted to find out what parasite control methods are currently being used for the control of internal and external parasites in sheep. This survey will ensure that research, advice and information can be tailored to producers at a regional, state and national level, addressing the issues that are currently of greatest importance. The results of this survey will be compared to two previous surveys to estimate changes in control practices and provide benchmarks for parasite control and occurrence by region.

The survey aims to determine:

- what sheep parasite control options have been adopted by producers;
- how chemical resistance has changed;
- how producers monitor and manage their sheep parasite challenges;
- how producers access information and make decisions about parasite control;
- producer perceptions of what control methods are most effective; and
- differences in the above due to regional location and sheep type

About the survey and filling it in

This survey is aimed at any sheep producer with 100 sheep or more, it comprises 40 to 45 questions covering, in order, property and operation details, worm and liver fluke control, blowfly control, lice control and general parasite management. A small number of questions are marked with a red asterisk (*), these questions must be answered for the survey to be completed.

For your ease of use, please complete the survey on a computer or laptop rather than a tablet or mobile device.

The survey should take about 30 minutes to complete and mostly involves selecting an option for your answer. Having your *stock book* and/or *computer records* handy will make filling in the survey quicker and easier.

If you would like to save and return to the survey at a later time you will need to provide your email address so a link can be sent to you to resume the survey (please check your junk mail if the link doesn't arrive in your inbox). If you close the survey window in your browser part way through the survey without saving and entering your email address, your data will be saved to the database but you will not be able to return to complete the survey. Make sure you size your browser window to full screen so you can see all parts of the questions.

We understand that 2018 was a drought year for many, the survey allows you to indicate if 2018 was a normal year for rainfall, stock numbers and parasites.

Security of your information

Your response is completely anonymous and we will not hold any information as to the identity of the participants. All individual information from the survey will remain completely confidential.

Withdrawing from the study

Your involvement in this study is voluntary and you may withdraw at any time without consequence. However, any data which you have already provided cannot be withdrawn.

How your responses will be used and stored

The information from the survey will be used to inform content on the ParaBoss websites and extension material for sheep producers. It will also be used in articles, conference presentations and Beyond the Bale in 2020. The information will be presented by region and there will be no individual farms mentioned in the articles. All electronic data will be kept on cloud.une.edu.au, UNE's centrally managed cloud server managed by the research team. It will also be kept on a password protected computer in the same location. Only the research team will have access to the data. The data will be kept indefinitely so it can be compared to any future sheep parasite surveys.

Researchers
Feel free to contact the research team with any questions about this research or if you would like a *paper copy* to fill in. Contact details: Dr. Alison Colvin, email alison.colvin@une.edu.au, Prof. Stephen Walkden-Brown, email swalkden@une.edu.au or by phone on 02 6773 5152 or Dr. Ian Reeve, email ireeve@une.edu.au.

Potential issues
The survey questions are not of a sensitive nature: rather they are general, and will enable us to enhance our knowledge of producer's parasite control practices. It is unlikely that this research will raise any personal or upsetting issues but if it does you may wish to contact your local Community Health Centre or Lifeline on 13 11 14.

This project has been approved by the Human Research Ethics Committee of the University of New England (Approval No. HE18-286, Valid to 01/02/2020).

Should you have any complaints concerning the manner in which this research is conducted, please contact:

Mrs Jo-Ann Sozou
Research Ethics Officer
Research Services
University of New England
Armidale, NSW 2351
Tel: (02) 6773 3449
Email: ethics@une.edu.au

Thank you for considering taking part in this project.

Kind regards,

Dr. Alison Colvin

Online Implied Consent for Participants

Research Project: Australian Sheep Parasite Survey

1. I have read the information contained in the Information Sheet for Participants and any questions I have asked have been answered to my satisfaction.
2. I agree to participate in this study, with the understanding that:
    - *My participation is voluntary*
    - *My contribution is anonymous*
    - *Information concerning my identity will not be collected, and*
    - *I may withdraw at any time without consequences & without follow-up*
3. I agree that the anonymous research data collected for the study will be published, or presented at conferences as a later date.
4. I am over 18 years of age.
5. In preservation of anonymity, I understand that no name or signature is required of me to give consent. By activating the **"next"** button below I am agreeing to participate in this study.

Guide to answering the survey

The best person to fill in the survey is the person responsible for the management of livestock on the property.

A red asterisk (*) next to a question indicates a required answer.

Do you own or manage 100 or more sheep? *

- ☐ YES
- ☐ NO, we appreciate your participation in our survey, however, we require participants to manage 100 sheep or more.

SECTION A: Property and Operation Details

If you have more than one sheep property, please complete the questions for a single property where most of your sheep are grazed. This property will be your reporting property.

1. In which post code is your reporting property located? *

2. Please indicate your recorded rainfall for 2018 and the average annual rainfall for your reporting property:

	Rainfall	Please select a unit	
		mm	inches
Rainfall in 2018		☐	☐
Average annual rainfall		☐	☐

3. What is the size of your reporting property?

	Area	Please select a unit	
		hectares	acres
Property size		☐	☐

4. What is the percentage income from the various enterprises on your reporting property in 2018?

% Wool sheep
% Meat sheep
% Cattle
% Goats
% Cropping
% Other (Please describe in comments box below)

0 out of 100 Total

Comments

5. About what percentage of your reporting property is:

% Improved pasture
% Non-Improved pasture
% Crop (not primarily for grazing)
% Fodder crops (primarily for grazing)
% Undeveloped
% Other (please describe in comments box below)

0 out of 100 Total

Comments

6. How many cattle did you have at calf weaning time for reproducing herds or in November 2018 for non-reproducing herds?

	Number 2018	Number typically run if different from 2018
Cows		
Heifers		
Steers		

7. In 2018, how many sheep of different types (wool, meat, dual purpose, cross-bred) and classes did you have at weaning time in 2018 (or in November 2018 if you only run wethers)? Indicate if the total number you typically run is different to the number you had in 2018. *See front page for definition of classes.* *

	Adult ewes (over 2 yrs)	Maiden ewes (joined, 1 to 2 yrs)	Lambs and weaners (up to 2 yrs)	Unmated hoggets/ yearlings (1 to 2 yrs)	Adult wethers (over 2 yrs)	Rams (over 2 yrs)	Breeds	Typical total sheep numbers in last 5 years were:		
								More	Same	Less
Wool								☐	☐	☐
Meat								☐	☐	☐
Dual purpose								☐	☐	☐
Cross-breeds								☐	☐	☐

8. To simplify this questionnaire, please identify the main sheep enterprise that you will be referring to for the remaining questions.
This will be your chosen sheep enterprise. *

Choose the sheep enterprise you will refer to for the rest of the survey: *

- ☐ Merino ewes joined to Merino rams
- ☐ Merino ewes joined to Other (e.g. meat) rams
- ☐ Meat ewes joined to Meat rams
- ☐ Merino wethers
- ☐ Other enterprise (e.g. feedlotting), please specify in 'Comments' box below

Is your chosen sheep enterprise a commercial or stud operation?

- ☐ Commercial
- ☐ Stud
- ☐ Both

Comments

Please fill out the remaining questions for the sheep enterprise you have selected.

9. For your chosen sheep enterprise, in which months did you lamb and wean in 2018?

	Not applicable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Month of lambing	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Month of weaning lambs	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

SECTION B: Internal parasites - Worms and Liver fluke

10. In the last 5 years, which of the following treatments or techniques have you used for worm control in your chosen sheep enterprise? Please indicate if these were effective.

*What is 'Smart Grazing'? 'Smart Grazing' is a technique where sheep are used as a means of preparing clean pastures as an alternative to the use of cattle or cropping. Older sheep are treated with an effective drench then moved onto a paddock and grazed intensively (203 times the normal stocking rate) for 30 days or less before being removed. This ensures pasture utilistation with minimal additional contamination with worm eggs.

	Did you do this?		If used, how effective was this technique?				
	Yes	No	Very effective	Effective	Somewhat effective	Not effective	Not sure
Planned preventative treatments	☐	☐	☐	☐	☐	☐	☐
Treatment based on worm egg count (WEC)	☐	☐	☐	☐	☐	☐	☐
Treatment based on worm egg count (WEC) and worm species identification (larval culture)	☐	☐	☐	☐	☐	☐	☐
Prepare clean pastures by spelling/resting paddock ('long spelling')	☐	☐	☐	☐	☐	☐	☐
Prepare clean pastures by cropping paddock	☐	☐	☐	☐	☐	☐	☐
Prepare clean pastures by intensive rotational grazing	☐	☐	☐	☐	☐	☐	☐
Prepare clean pastures by 'Smart Grazing' techniques*	☐	☐	☐	☐	☐	☐	☐
Prepare clean paddocks using sheep treated with drench capsules or long acting injectable	☐	☐	☐	☐	☐	☐	☐
Prepare clean pasture or dilute sheep parasites using cattle	☐	☐	☐	☐	☐	☐	☐
Leave some sheep undrenched	☐	☐	☐	☐	☐	☐	☐
Feeding strategy	☐	☐	☐	☐	☐	☐	☐
Use rams selected for resistance to worms using Australian Sheep Breeding Value for worm egg count (WEC)	☐	☐	☐	☐	☐	☐	☐
Barbervax® vaccine	☐	☐	☐	☐	☐	☐	☐
FAMACHA® eye colour chart	☐	☐	☐	☐	☐	☐	☐

Comments

11. If you monitored worm egg counts in 2018, please indicate in the table below which class of sheep you monitored in which month and if you requested worm species identification. You can select several sheep classes in a month. If you monitored the same sheep class more than once in a month please add the details in the comment box below. *See front page for definition of sheep classes.*

	Worm egg counts						Did you request worm species identification tests (larval culture) with these worm egg counts?		
	Adult ewes	Maiden ewes	Lambs and weaners	Unmated hoggets/ yearlings	Adult wethers	Rams	Yes	No	Don't know
Jan	☐	☐	☐	☐	☐	☐	☐	☐	☐
Feb	☐	☐	☐	☐	☐	☐	☐	☐	☐
Mar	☐	☐	☐	☐	☐	☐	☐	☐	☐
Apr	☐	☐	☐	☐	☐	☐	☐	☐	☐
May	☐	☐	☐	☐	☐	☐	☐	☐	☐
Jun	☐	☐	☐	☐	☐	☐	☐	☐	☐
Jul	☐	☐	☐	☐	☐	☐	☐	☐	☐
Aug	☐	☐	☐	☐	☐	☐	☐	☐	☐
Sep	☐	☐	☐	☐	☐	☐	☐	☐	☐
Oct	☐	☐	☐	☐	☐	☐	☐	☐	☐
Nov	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dec	☐	☐	☐	☐	☐	☐	☐	☐	☐

Comments

12. If you used worm egg counts, who carried out the worm egg counts you listed in the table above?

- ☐ Self or employee
- ☐ Government laboratory
- ☐ Private laboratory
- ☐ Your vet or consultant
- ☐ Other - Write In

13. Please indicate the number and type of drenches given to each class of sheep in 2018. You can select several sheep classes in a month. If you drenched the same sheep classmore than once in a month please add the details in the comment box below.
**If two or more products used together indicate with a "+" between them. See front page for definition of sheep classes.*

	Sheep class(es)						Method of delivery			Product name(s) *
	Adult ewes	Maiden ewes	Lambs and weaners	Unmated hoggets/ yearlings	Adult wethers	Rams	Oral drench	Injectable	Capsule	
Jan	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Feb	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Mar	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Apr	☐	☐	☐	☐	☐	☐	☐	☐	☐	
May	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Jun	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Jul	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Aug	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Sep	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Oct	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Nov	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Dec	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Comments

14. Please indicate in the table below any drench resistance tests you have undertaken between 2014 and 2018

	2014	2015	2016	2017	2018
No drench resistance tests undertaken	☐	☐	☐	☐	☐
DrenchTest (formal on-farm multiple drench resistance test using worm egg count reduction WECRT)	☐	☐	☐	☐	☐
DrenchCheck (worm egg count just before drenching and again approximately 14 days after drenching)	☐	☐	☐	☐	☐
Worm egg count after drenching only (if 3 weeks or less after treatment)	☐	☐	☐	☐	☐

15. If you did undertake any drench resistance testing, who assisted with the testing?

- ☐ Vet or consultant
- ☐ Government agency advisor (e.g. Ag Departments, Local Land Services)
- ☐ Drug company representative
- ☐ Private laboratory
- ☐ Rural Merchandise retailer
- ☐ Other - Write In

16. Please rank how important the following factors are when deciding whether to treat ewes and weaners for worms.

	Factors important for treating **ewes**				Factors important for treating **lambs/weaners**			
	Very important	Important	Somewhat important	Not important	Very important	Important	Somewhat important	Not important
Seasonal weather conditions	☐	☐	☐	☐	☐	☐	☐	☐
Results from faecal worm egg count	☐	☐	☐	☐	☐	☐	☐	☐
Results from faecal worm egg count AND worm species identification (larval culture)	☐	☐	☐	☐	☐	☐	☐	☐
Planned preventative treatment, e.g. summer drench, pre-lambing	☐	☐	☐	☐	☐	☐	☐	☐
Condition score/appearance of sheep	☐	☐	☐	☐	☐	☐	☐	☐
Availability/quality of pasture	☐	☐	☐	☐	☐	☐	☐	☐
Time of year	☐	☐	☐	☐	☐	☐	☐	☐
Presence of daggy sheep in mob	☐	☐	☐	☐	☐	☐	☐	☐
Weak sheep when driven (poor exercise tolerance)	☐	☐	☐	☐	☐	☐	☐	☐
Convenience, e.g. when sheep are yarded for other purposes	☐	☐	☐	☐	☐	☐	☐	☐

17. Have you tested or treated for liver fluke in the last 5 years in your chosen enterprise?

- ☐ Yes
- ☐ No

18. Please fill out the table below for diagnostic testing and treatments for liver fluke from 2014 to 2018:

	Did you test for Liver fluke?			Did you treat for Liver fluke?	
	Did not test	Positive test for Liver Fluke	Negative test for liver fluke	Did not treat	Treated with chemicals
2014	☐	☐	☐	☐	☐
2015	☐	☐	☐	☐	☐
2016	☐	☐	☐	☐	☐
2017	☐	☐	☐	☐	☐
2018	☐	☐	☐	☐	☐

19. If you treated your sheep for liver fluke in 2018, please give details of those treatments below. You can select multiple classes of sheep for each month of treatment.

	Month	Sheep class						Product used
		Adult ewes	Maiden ewes	Lambs and weaners	Unmated hoggets/ yearlings	Adult wethers	Rams	
1		☐	☐	☐	☐	☐	☐	
2		☐	☐	☐	☐	☐	☐	
3		☐	☐	☐	☐	☐	☐	
4		☐	☐	☐	☐	☐	☐	
5		☐	☐	☐	☐	☐	☐	
6		☐	☐	☐	☐	☐	☐	

20. Please indicate how important the following factors are when deciding to treat for liver fluke.

	Very important	Important	Somewhat Important	Not important
Results from liver fluke test (faecal test, ELISA antibody blood test or faecal antigen test)	☐	☐	☐	☐
Time of year/strategic treatments	☐	☐	☐	☐
Appearance/condition of sheep	☐	☐	☐	☐
Seasonal weather conditions	☐	☐	☐	☐
After grazing 'flukey' paddocks	☐	☐	☐	☐
Enter another option	☐	☐	☐	☐
Enter another option	☐	☐	☐	☐

SECTION C: Blowfly Control

21. In 2018, if you had blowfly strike on your reporting property for your chosen enterprise, please provide details below, leave blank if no sheep struck. Other options may include wound, pizzle or poll strike, please include these if observed in 2018. *See front page for definition of sheep classes.*

	% Adult ewes affected	% Maiden ewes affected	% Lambs and weaners affected	% Unmated hoggets/ yearlings affected	% Adult wethers affected	% Rams affected
Breech strike						
Body strike						
Enter another option						
Enter another option						
Enter another option						

22. Did you use any of the following methods to assist with blowfly control in 2018? Please rate the importance of all the methods that you used.

	Used?		If you used this method, how important was it?				Compared to 5 years ago, in 2018 I have used this option:		
	Yes	No	Very important	Important	Somewhat important	Unsure	More	Same	Less
Mulesing replacement sheep	☐	☐	☐	☐	☐	☐	☐	☐	☐
Buying mulesed sheep	☐	☐	☐	☐	☐	☐	☐	☐	☐
Genetic selection	☐	☐	☐	☐	☐	☐	☐	☐	☐
Preventative chemical treatments	☐	☐	☐	☐	☐	☐	☐	☐	☐
Timing of shearing	☐	☐	☐	☐	☐	☐	☐	☐	☐
Timing of crutching	☐	☐	☐	☐	☐	☐	☐	☐	☐
Trapping flies (eg LuciTrap®)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Destroy maggots from infected sheep clippings	☐	☐	☐	☐	☐	☐	☐	☐	☐

Comments

23. Please indicate the months you shear and crutch each class of sheep, you can select multiple months for each class, if you don't crutch please tell us why in the box below.

	Adult ewes		Maiden ewes		Unmated hoggets/ yearlings		Adult Wethers		Adult rams	
	Shearing	Crutching	Shearing	Crutching	Shearing	Crutching	Shearing	Crutching	Shearing	Crutching
Jan	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Feb	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Mar	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Apr	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
May	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Jun	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Jul	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Aug	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Sep	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Oct	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Nov	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dec	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Comments

24. If you used mulesing in 2018 please provide details in the table below.

	Age at mulesing (months)	Percentage mulesed in 2018 (%)	Percentage mulesed 5 years ago (%)	Change in skin area removed compared to 5 years ago			Pain relief provided at mulesing				Some wool left on tail	
				No change	More now	Less now	No	Yes, TriSolfen®	Yes, Metacam®20	Yes, Buccalgesic®	Yes	No
Replacement ewe lambs				☐	☐	☐	☐	☐	☐	☐	☐	☐
Replacement wether lambs				☐	☐	☐	☐	☐	☐	☐	☐	☐
Other				☐	☐	☐	☐	☐	☐	☐	☐	☐

25. In 2018, if you used chemical treatments to prevent or treat flystrike please provide details in the table below.

	I usually do this		If used, month used 2018	If used, product used in 2018	If used, method used in 2018							
	Yes	No			Backliner/ spray on	Hand jet	Jetting race	Plunge dip	Shower dip	Cage dip	Electro-dip	Wound dressing
Treat your sheep with preventative chemicals for fly strike at approximately the same time every year	☐	☐			☐	☐	☐	☐	☐	☐	☐	☐
Treat your sheep with preventative chemicals only when the risk of flystrike is high	☐	☐			☐	☐	☐	☐	☐	☐	☐	☐
Treat your sheep with preventative chemicals when you are unable to check sheep e.g. during harvest, before going on holidays.	☐	☐			☐	☐	☐	☐	☐	☐	☐	☐
Treat the whole mob of sheep once flystrike is detected	☐	☐			☐	☐	☐	☐	☐	☐	☐	☐
Only treat individually struck sheep	☐	☐			☐	☐	☐	☐	☐	☐	☐	☐

Comments

26. Do you suspect resistance to a flystrike treatment product on your reporting property?

☐ Yes

☐ No

27. Which product do you suspect flies are resistant to and when did you first suspect resistance to this product?

	Product flies resistant to	Year(s) resistance suspected
1		
2		
3		
4		

28. In 2018, if you used visual assessment to breed for sheep that are less likely to get flystrike, please indicate which visual traits you used.

	Ewes	Ewe lambs	Rams	Ram lambs
Dag score	☐	☐	☐	☐
Breech wrinkle	☐	☐	☐	☐
Urine stain	☐	☐	☐	☐
Breech cover	☐	☐	☐	☐
Wool colour	☐	☐	☐	☐
Cull sheep with fleece rot	☐	☐	☐	☐
Cull sheep with body strike	☐	☐	☐	☐
Cull sheep with breech strike	☐	☐	☐	☐
Enter another option	☐	☐	☐	☐

29. In 2018, if you used Australian Sheep Breeding Values (ASBVs) to breed for sheep that are less likely to get flystrike, please indicate which traits you used.

What are ASBVs? ASBV stands for Australian Sheep Breeding Value which is an estimate of the genetic potential a sheep will pass onto it's progeny. ASBVs can be used to select for desirable traits in conjunction with visual assessment and are obtained through MERINOSELECT, DOHNE MERINO and LAMBPLAN.

	Ewes	Rams
Breech Wrinkle (BWR)	☐	☐
Breech Cover (BCOV)	☐	☐
Scouring and dags (DAG)	☐	☐
Worm Egg Count (WEC)	☐	☐
Co-efficient of variation of fibre diameter (FDCV)	☐	☐
Enter another option	☐	☐

SECTION D: Lice Control

30. For your chosen sheep enterprise on your reporting property, please summarise your lice detection and treatment methods between 2014 and 2018. *(please tick all that apply)*

	2014	2015	2016	2017	2018
No evidence of lice seen	☐	☐	☐	☐	☐
Sheep seen rubbing	☐	☐	☐	☐	☐
Live lice seen	☐	☐	☐	☐	☐
Lice detected by ELISA (Lab test)	☐	☐	☐	☐	☐
No lice treatment	☐	☐	☐	☐	☐
Lice treated off shears	☐	☐	☐	☐	☐
Lice treated short wool (1 day to 6 weeks)	☐	☐	☐	☐	☐
Lice treated long wool (over 6 weeks)	☐	☐	☐	☐	☐

31. If you treated for lice in 2018, which of the following lice control methods and products did you use?

	Application of chemical							Contractor used		Product(s) used
	Backliner/ Spray on	Hand jet	Jetting race	Plunge dip	Shower dip	Cage dip	Electrodip	Yes	No	
Off-shears or short wool (1 day to 6 weeks)	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Long wool (over 6 weeks)	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Comments

32. Do you suspect resistance to a lice product on your reporting property?

☐ Yes

☐ No

33. Which product do you suspect lice are resistant to and when did you first suspect resistance to this product?

	Product lice resistant to	Year(s) resistance suspected
1		
2		
3		

34. If you have a recurring lice problem, how important do you believe the following factors are in causing the problem?

	Very important	Important	Somewhat important	Not important
Resistance to lice control products	☐	☐	☐	☐
Problems with application	☐	☐	☐	☐
Incomplete mustering	☐	☐	☐	☐
Introduction through fences, or from purchased sheep	☐	☐	☐	☐
Whole flock not treated at the same time/multiple flock treatments	☐	☐	☐	☐
Partial flock treatment only	☐	☐	☐	☐
Enter another option	☐	☐	☐	☐
Enter another option	☐	☐	☐	☐

SECTION E: General Parasite Management

The questions in this section refer to <u>all</u> sheep enterprises on your reporting property.

35. Did you introduce sheep to the flock in 2018?

☐ Yes

☐ No

36. How did you manage the introduction of new sheep onto your reporting property in 2018?

	Number of sheep introduced	Management action					Chemical(s) used
		Did nothing	Requested an animal health history	Applied quarantine drench for worms	Applied quarantine lice treatment	Isolated sheep for at least 2 weeks	
1		☐	☐	☐	☐	☐	
2		☐	☐	☐	☐	☐	
3		☐	☐	☐	☐	☐	
4		☐	☐	☐	☐	☐	
5		☐	☐	☐	☐	☐	

Comments

37. How important are the following sources of information for parasite control on your reporting property?

	Very important	Important	Somewhat important	Not Important
Other farmer or member of my staff	☐	☐	☐	☐
Local Vet	☐	☐	☐	☐
Private veterinary consultant	☐	☐	☐	☐
Ag consultant	☐	☐	☐	☐
State Government Department (DPI)/Local Land Services (LLS) officer	☐	☐	☐	☐
Rural merchandise representative	☐	☐	☐	☐
Rural newspapers/magazines	☐	☐	☐	☐
WormBoss	☐	☐	☐	☐
FlyBoss	☐	☐	☐	☐
LiceBoss	☐	☐	☐	☐
Enter another option	☐	☐	☐	☐
Enter another option	☐	☐	☐	☐

38. When making specific parasite control decisions (e.g. to drench/jet) how important are the following people and resources on your reporting property?

	Worms and Liver fluke			Flies			Lice		
	Very important/ important	Somewhat important	Not important	Very important/ important	Somewhat important	Not important	Very important/ important	Somewhat important	Not important
Self	☐	☐	☐	☐	☐	☐	☐	☐	☐
Manager	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other staff on-farm	☐	☐	☐	☐	☐	☐	☐	☐	☐
Private veterinary consultant	☐	☐	☐	☐	☐	☐	☐	☐	☐
Ag consultant	☐	☐	☐	☐	☐	☐	☐	☐	☐
Rural merchandise representative	☐	☐	☐	☐	☐	☐	☐	☐	☐
WormBoss drench decision guide	☐	☐	☐	☐	☐	☐	☐	☐	☐
FlyBoss decision tools (e.g. Compare two management systems)	☐	☐	☐	☐	☐	☐	☐	☐	☐
LiceBoss decision tools (e.g. Long wool tool, Treatment tool)	☐	☐	☐	☐	☐	☐	☐	☐	☐

39. If you have changed your parasite management in the last five years, please describe the change(s) you regard as the most important.

Worms and fluke:

Blowfly:

Lice:

Finally, we just need a little information about you and your views

40. What year were you born?

41. What is your role on the reporting property (e.g. Owner, manager, farm worker)? *

42. How useful for parasite control are each of these websites to you?

	Never heard of it	Only heard of it	Actually visited site	Used site to make changes
WormBoss web site	☐	☐	☐	☐
FlyBoss web site	☐	☐	☐	☐
LiceBoss web site	☐	☐	☐	☐
AWI web site	☐	☐	☐	☐
MLA web site	☐	☐	☐	☐
Ag Department web site	☐	☐	☐	☐
Enter another option	☐	☐	☐	☐

43. If you have used WormBoss, FlyBoss or LiceBoss information to make changes to your parasite management, please estimate the annual dollar ($) value of these changes across your property from changes in labour costs, chemical costs, other costs or differences in production.

- ☐ $0 - $1000
- ☐ $1000 - $5000
- ☐ $5000 - $10,000
- ☐ more than $10,000

44. Is there any further area of information/research you think is important for parasite management? How would you like this information delivered (e.g. face to face workshops, web sites, decision guides, pamphlet)?

45. If you would like to be notified of the publication of the results of this survey please enter your email address below.

Thank You!

Thank you for participating in our survey. Your response is very important to us.

Results from this survey will be published in the ParaBoss feature articles and in the AWI publication Beyond the Bale in 2020. The results will also be the subject of conference papers and scientific journal articles.

If you have any questions regarding this survey please contact Dr. Alison Colvin at alison.colvin@une.edu.au or Prof. Stephen Walkden-Brown at swalkden@une.edu.au, phone: 02 6773 5152.

If you would like more information on managing parasites please visit the following websites:

WormBoss: http://www.wormboss.com.au/

FlyBoss: http://www.flyboss.com.au/

LiceBoss: http://www.liceboss.com.au/

Appendix 3 – Short survey questionnaire

Guide to answering the survey

The best person to fill in the survey is the person who is responsible for the management of livestock on the property.

Do you own or manage **100** or more sheep?

- ○ Yes
- ○ No

Australian Sheep Parasite Survey - Short Survey

Information Sheet for Participants

We wish to invite you to participate in the Australian Sheep Parasite Survey described below.

My name is Dr. Alison Colvin and I am conducting this research in the School of Environmental and Rural Science at the University of New England. My co-investigators are Professor Stephen Walkden-Brown and Dr. Ian Reeve.

About the project

A few weeks ago we asked sheep producers about what parasite control methods they are using in the National Sheep Parasite Survey. We have had a good response which has been invaluable in providing information about how some sheep producers are controlling parasites in their flocks.

So that we make sure this project is of maximum benefit to all sheep producers, we need a small amount of information from producers who didn't complete the longer survey.

Filling in the survey

This survey works best on a desktop computer and may take longer on a tablet or mobile device.

There are only 5 short questions to fill out, it should only take 3-4 minutes.

Security of your information

Your response is completely anonymous and we will not hold any information as to the identity of the participants. All individual information from the survey will remain completely confidential.

Withdrawing from the study

Your involvement in this study is voluntary and you may withdraw at any time without consequence. Data which you have already provided cannot be withdrawn.

How your responses will be used and stored

The information from the survey will be used to inform content on the ParaBoss websites and extension material for sheep producers. It will also be used in articles, conference presentations and Beyond the Bale in 2020. The information will be presented by region and there will be no individual farms mentioned in the articles. All electronic data will be kept on cloud.une.edu.au, UNE's centrally managed cloud server managed by the research team. It will also be kept on a password protected computer in the same location. Only the research team will have access to the data. The data will be kept indefinitely so it can be compared to any future sheep parasite surveys.

Researchers

Feel free to contact the research team with any questions about this research or if you would like a *paper copy* to fill in. Contact details: Dr. Alison Colvin, email alison.colvin@une.edu.au, Prof. Stephen Walkden-Brown, email swalkden@une.edu.au by phone on 02 6773 5152 or Dr. Ian Reeve email ireeve@une.edu.au.

Potential issues

The survey questions are not of a sensitive nature: rather they are general, and will enable us to enhance our knowledge of producer's parasite control practices. It is unlikely that this research will raise any personal or upsetting issues but if it does you may wish to contact your local Community Health Centre or Lifeline on 13 11 14.

This project has been approved by the Human Research Ethics Committee of the University of New England (Approval No. HE18-286, Valid to 01/02/2020).

Should you have any complaints concerning the manner in which this research is conducted, please contact:

Mrs Jo-Ann Sozou
Research Ethics Officer
Research Services
University of New England
Armidale, NSW 2351
Tel: (02) 6773 3449
Email: ethics@une.edu.au

Thank you for considering taking part in this project.
Kind regards,
Dr. Alison Colvin

Quick questions

Online Implied Consent for Participants

Research Project: Australian Sheep Parasite Survey

1. I have read the information contained in the Information Sheet for Participants and any questions I have asked have been answered to my satisfaction.
2. I agree to participate in this study, with the understanding that:
    - *My participation is voluntary*
    - *My contribution is anonymous*
    - *Information concerning my identity will not be collected, and*
    - *I may withdraw at any time without consequences & without follow-up*
3. I agree that the anonymous research data collected for the study will be published, or presented at conferences as a later date.
4. I am over 18 years of age.
5. In preservation of anonymity, I understand that no name or signature is required of me to give consent. By activating the **"next"** button below I am agreeing to participate in this study.

1. How many sheep and cattle did you run in 2018?

Sheep ☐

Cattle ☐

---

2. If you monitored worm egg counts in 2018, how many times did you monitor?

For adult ewes (over 2 years of age) ☐

For lambs and weaners (up to 12 months of age) ☐

---

3. Please indicate (tick box) in the table below any drench resistance tests you have undertaken between 2014 and 2018

	2014	2015	2016	2017	2018
No drench resistance tests undertaken	☐	☐	☐	☐	☐
DrenchTest (formal on-farm multiple drench resistance test using worm egg count reduction WECRT)	☐	☐	☐	☐	☐
DrenchCheck (worm egg count just before drenching and again approximately 14 days after drenching)	☐	☐	☐	☐	☐
Worm egg count after drenching only (if 3 weeks or less after treatment)	☐	☐	☐	☐	☐

4. If you treated for lice in 2018, which of the following lice control methods and products did you use?

	Application of chemical					Contractor used		Product(s) used
	Hand jet/ backliner	Automated jetting race	Plunge dip	Shower dip	Cage dip	Yes	No	
Off-shears or short wool (1 day to 6 weeks)	☐	☐	☐	☐	☐	○	○	
Long wool (over 6 weeks)	☐	☐	☐	☐	☐	○	○	

5. Did you use any of the following methods to assist with blowfly control in 2018? Please rate the importance of all the methods that you used.

	Used?		If you used this method, how important was it?				Compared to 5 years ago I have used this option:		
	Yes	No	Very important	Important	Not important	Unsure	More	Same	Less
Mulesing replacement sheep	○	○	○	○	○	○	○	○	○
Buying mulesed sheep	○	○	○	○	○	○	○	○	○
Genetic selection	○	○	○	○	○	○	○	○	○
Preventative chemical treatments	○	○	○	○	○	○	○	○	○
Timing of shearing	○	○	○	○	○	○	○	○	○
Timing of crutching	○	○	○	○	○	○	○	○	○
Trapping flies (Luci Trap®)	○	○	○	○	○	○	○	○	○
Destroy maggots from infected sheep clippings	○	○	○	○	○	○	○	○	○

Thank You!

Thank you for participating in our survey. Your response is very important to us.

Results from this survey will be published in the ParaBoss feature articles and in the AWI publication Beyond the Bale in 2020.

If you have any questions regarding this survey please contact Dr. Alison Colvin at alison.colvin@une.edu.au or Prof. Stephen Walkden-Brown at swalkden@une.edu.au, phone: 02 6773 5152.

If you would like more information on managing parasites please visit the following websites:

WormBoss: http://www.wormboss.com.au/

FlyBoss: http://www.flyboss.com.au/

LiceBoss: http://www.liceboss.com.au/