BENCHMARKING AUSTRALIAN SHEEP PARASITE CONTROL

CROSS-SECTIONAL SURVEY REPORT

February 2014

Final Report Prepared for:
Australian Wool Innovation and Meat and Livestock Australia

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EXECUTIVE SUMMARY

Background. In 2004, The IPM-sheep (Integrated Parasite Management – sheep) project funded by Australian Wool Innovation Ltd (AWI) conducted a large national survey to benchmark parasite control practices in sheep in Australia. This survey was largest of its kind in Australia with 2292 respondents to a questionnaire of 30 questions. In 2011 AWI and Meat and Livestock Australia (MLA) commissioned a follow up survey "Benchmarking Australian sheep parasite control" of which this report forms part. The objectives of the follow up survey were to

- Measure change in sheep parasite control practices and attitudes between 2003 and 2011, the years surveyed in the 2004 and 2012 surveys respectively.
- Provide a new benchmark against which to measure change in parasite control practices and attitudes into the future

The benchmarking Australian sheep parasite control survey of 2012 had two components:

- A longitudinal analysis of practice change amongst sheep producers who participated in both surveys
- A cross-sectional analysis of all of the responses to the 2012 survey.

This report is on the cross-sectional component of the survey.

Methods. In February 2012, a 10 page questionnaire was mailed to a random sample of 6361 producers in the same areas as those surveyed in 2004, asking about their worm, blow fly and lice control practices. A response rate of 21.3 per cent was obtained with one reminder, with a further 15.2 per cent responding to a one page follow-up questionnaire which sought information on a small number of questions central to the project. This approach made it possible to detect and, if necessary, control for, any non-response bias in the responses to the full questionnaire.

Organisation of this report. This report presents the results from the survey in a series of tables, starting with basic farm characteristics, clip characteristics and general animal husbandry practices and proceeding to a detailed examination of worm, blow fly and lice control practices at the time of the survey.

The main results are provided in the body of this report, together with basic explanatory information to assist in the reading of the tables. Appendix A1 provides further details on statistical aspects of the tables, together with a detailed account of the methods and the investigation of non-response bias.

Appendix A2 contains additional and more detailed tables, and these are referred to in the body of the report adjacent to the basic tables on the same topic. Appendix A3 contains copies of the questionnaires.

Summary of findings.

The cross sectional survey involved a total of 6361 mail outs in February 2012 to a random sample of producers in the same areas as those surveyed in 2004. The response rate to the full survey was 21.3 % and to the full and short follow up survey combined, 36.5 %. There were 1019 useable responses in total.

Some of the key findings are listed in summary form below. Comparisons between the 2012 and 2004 surveys are descriptive and not statistically analysed (see the longitudinal study report for a more accurate report of trends over time on the same properties, with statistical analysis of the change). While the surveys were run in 2004 and 2012, where annual data was requested it referred to calendar 2003 and calendar 2011 respectively. For brevity the emphasis is on overall proportions at a national rather than a regional level.

Survey size and responses

1. The full survey and total response rates of 21.3 and 36.5 % respectively from 6361 mail outs in 2012 were lower than the 30.4 and 52.3 % respectively from 6362 mail outs achieved in 2004. The 1019 useable responses were less than half the 2292 obtained from the 2004 survey. These results probably reflect a degree of "survey fatigue" and the longer 2012 survey which included far more questions on ectoparasites.

Farmer and enterprise details

2. The mean age of respondents was 56 years as opposed to 51 years for the 2004 survey.
3. Mean reported rainfall in 2011 (650 mm) was slightly higher than the 610 mm in 2003 and this was true across all regions.
4. Mean property area in 2011 (2263 ha) was similar to the 2174 ha in 2003 with no change in the proportion of enterprise income from sheep and wool (68 % in 2011, 67 % in 2004) and the proportion of the property cropped (18 % in 2011, 17 % in 2004). There was wide variation in the latter variable in 2011, from 40 % in WA to 3 % in New England. The proportion of pastures that were improved in 2011 (67 %) was similar to the 69 % reported in 2004.
5. The mean proportion of respondents grazing cattle in a typical year was slightly lower in the 2012 (47 %) than 2004 (53 %) surveys but the cattle DSEs grazed were higher in 2011 (3221) than 2003 (2530). However the median values for the latter were similar being 1444 and 1476 in 2003 and 2011 respectively.
6. Mean sheep DSEs on the other hand were slightly lower in 2011 (4454) than in 2003 (4753) and this was also true of the medians (2775 and 3000 respectively).
7. Flock composition differed in the two surveys with a higher mean percentage of ewes in 2011 than 2003 (65 % v 53 %) and a lower percentage of wethers (10 % v 21 %). This probably reflects a prolonged period of high sheep meat prices relative to wool prices.
8. Mean reported joining periods were a little shorter for 2011 than 2003 with values of 7.4 and 7.8 weeks respectively for Merino rams to Merino ewes, 7.8 and 9.0 weeks respectively for Meat breed rams to Merino ewes and 8.9 and 10.5 weeks respectively for Meat breed rams to Crossbred ewes.
9. Mean reported marking percentages were a little higher for 2011 than 2003 with values of 87.1 % and 86 % weeks respectively for Merino ewes mated to Merino rams, 93.0 % and 91 % respectively for Merino ewes mated to Meat breed rams and 116.4 % and 114 % respectively for Crossbred ewes mated to Meat breed rams.
10. In 2011 the most important objective of grazing management was improved animal productivity (score 1.9/5 for importance where 1 is most important) closely followed by worm control (2/5) and a range of other objectives (2.1-2.7/5). The proportion of respondents who had changed their grazing strategy in recent years was 38 % with the major reasons being improved pasture quality/quantity, changes in cropping, response to drought or end of drought, and internal parasite control.

Worm Control

11. The reported annual frequency of worm treatments was slightly higher in 2011 than 2003 in the major classes of sheep (Weaners 2.8 v 2.2; Ewes 2.7 v 2.1) although the question on this issue was worded differently between the two surveys. In 2011, treatment frequency was highest in the New England being 5.2 and 5.6 for the two classes respectively.
12. The proportion of treatments that used a capsule was lower in 2011 than 2003 in weaners (1.4 v 2.9 %) and but slightly higher in ewes (3.5 v 3.1). In 2011 the proportion of treatments that were injectable was 8.9 % in lambs and weaners and 8.5 % in ewes.
13. Amongst the anthelmintics used, levamisole (first released in 1968!) was the most frequently administered anthelmintic (21.9% of all anthelmintic treatments), followed by Moxidectin (15.4%), Abamectin (14.4%), Albendazole (11.1%), Napthalophos (5.6%) and a range of others.

14. The majority of anthelmintic treatments involved a single active constituent (57%) with declining proportions involving 2 (23%), 3 (19.1%) four (0.9%) actives. The most common combination used was Fenbendazole + Levamisole (used in 11.2% of treatments) followed by Oxfendazole + Levamisole + Abamectin (10.9%), Albendazole + Levamisole + Abamectin (7.8%), Levamisole + Napthalophos (5.8%) and Albendazole + Closantel + Levamisole (5.6%). There was significant regional variation in usage patterns.

15. Some anthelmintics were predominantly used alone (eg. Moxidectin LA, monepantel and ivermetin) while others were mostly used in combinations (eg. levamisole, albendazole, closantel, napthalophos) with the difference tending to reflect the length of time the products have been on the market.

16. The proportion of respondents reporting the use of faecal worm egg count (WEC) monitoring in 2011 in lambs and weaners (17 %) or ewes (21 %) was much lower than the 44 % of respondents who claimed to do WEC monitoring in 2003. This may reflect a true reduction, or differences in the way the question relating to this was structured in the two surveys, with more detailed information required in the 2012 survey. Mean number of WEC monitors of 1.97 for weaners and 2.86 for ewes in 2011 were similar to the 3.0 and 2.6 respectively, reported in 2003. The majority of WEC monitoring samples in 2011 were bulk flock samples (78 % in weaners and 77 % in ewes) rather than individual animal WECs (22 % in weaners, 23 % in ewes).

17. In 2012 the proportion of respondents who had conducted a drench resistance test in the last 5 years was 29 %, compared with 48 % who had ever conducted a drench resistance test in 2004. Again there were differences in the questions, with more detailed responses and a defined time frame required in 2012. In 2012 the proportions who reported using different methods of estimating drench resistance were 6 % for Faecal egg count reduction test (FERCT), 5 % for Drenchrite®, 7 % for WEC before and within 3 weeks after drenching, and 3 % for WEC within 3 weeks of drenching. In 2012 assistance with organising or running a drench resistance test came from private labs (38 %), vets or consultants (36 %), producers themselves (22 %) or government labs (10 %).

18. The proportions of producers reporting suspected major or moderate resistance to different anthelmintics on their properties varied widely, and in many cases was widely divergent from existing understanding about the incidence and severity of resistance for these chemicals. Resistance to Benzimidazoles, Levamisole and Organophosphates was suspected by 55 % of respondents in each case, 28 % for Abamectin, 21 % for Moxidectin, 17 % for Closantel, 13 % for Triclabendazole (fluke), 12 % for Ivermectin and 2 % for Monepantel.

19. The importance of factors in deciding to drench ewes in the 2012 survey in declining order of importance was time of year (84 % rated as important or very important), seasonal weather conditions (73 %), results from faecal worm egg counts (71 %), poor exercise tolerance (69 %), condition score (66 %), sheep appearance (65 %), presence of dags (55 %), availability of pasture (51 %), quality of pasture (49 %) and convenience (27 %). Not surprisingly there was significant regional variation in these proportions.

20. With regard to worm control methods the most widely used method was treatment with anthelmintics (87% of respondents) followed by preparation of clean pastures by spelling (62%), paddock preparation by cropping (39%), paddock preparation by cattle-sheep rotation (26%), paddock preparation by use of intensive rotational grazing (17%), feeding strategy (15%), use of rams selected for resistance to worms (13%) (62% of these use ASBVs for WEC), paddock preparation by use of "smart grazing" techniques (12%) and partial flock treatment/leaving some sheep undrenched (8%). In the last category the mean and median proportions of animals left undrenched were 16.6 and 5 % respectively.

Blowfly Control

21. The proportion of respondents reporting breech strike in ewes in 2011 (78 %) was slightly lower than the 82 % reported in 2003 but the incidence of struck ewes in 2011 (4.1 %) was higher than the 2.3 % in 2003. The reported occurrence of body strike on the other hand was higher (68 % of respondents in 2011 v 45 % in 2003), as was the incidence of struck ewes (5.5 % v 1.0 %), possibly reflecting the wetter conditions in 2011.

22. The proportion of respondents reporting breech and body strike in 2011 in weaners (35 and 34 % respectively) was lower than in 2003 (70 and 54 % respectively) but the incidence of struck sheep when they did occur, was higher (4.7 % and 7.1 % for breech and body strike in 2011 v. 2.2 % and 1.5 % respectively in 2003).

23. Approaches to chemical use to control fly strike varied. Most common was to treat routinely with preventative chemicals every year (46 % cf. 43 % in 2003), to apply preventative treatment only if the risk of fly strike is high (36 % cf 23 % in 2003), only treat individually struck sheep (35 % cf 68 % in 2003 – word "only" not included in 2004 survey), or treat whole mob once a struck sheep is detected (19 % cf. 24 % in 2003).

24. The most commonly used chemicals for preventive treatment was Dicyclanil (54 % of respondents) followed by Cyromazine (36 %) and Ivermectin (9 %). The same rankings were observed when treatment was during a high-risk period (Dicyclanil 42 %, Cyromazine 36 %, Ivermectin 14 %) but changed if mob treatment followed detection of flystrike (Cyromazine 38 % Dicyclanil 33 %, Ivermectin 16 %). When individually struck sheep were treated Spinosad was most commonly used (38 %), followed by diazinon (23 %), Cyromazine (17 %) and Ivermectin (14 %).

25. Mulesing of replacement ewe and wether lambs was practiced by 48 % and 46 % of respondents respectively with lower proportions in New England and S Qld than in the South and Southwest. This appears to be a reduction from 2003 when only 9.2 % of respondents reported that they did not mules in a differently worded question. Partial mulesing of mobs in 2011 was not frequent with means of 97 % and 99 % of ewe replacements and wethers mulesed when mulesing occurred. The mean age at mulesing was 2 months with some mulesing of older lambs in S Qld, New England and the Central and Southern tablelands.

26. Use of pain relief after mulesing was common, being reported by 59 % and 64 % of respondents for ewe lambs and wethers respectively. Use of pain relief tended to be lower in S Qld and New England than in more Southern regions. Mulesing was carried out by contractors (55.8 %) self (41.3 %) or employed farm staff (9.9 %). Of those carrying out mulesing 27 % were accredited, 67 % non-accredited and 6 % of uncertain accreditation status.

27. When asked about the change in the proportion of replacement sheep mulesed between 2003 and 2011 all regions reported a decline, with a mean decline in proportion of 18 %.

28. Tail docking length was to the tip of the vulva length (recommended) for 60.9 % of respondents (61 % in 2003), slightly shorter than tip of vulva for 26.5 % (18 % in 2003), longer than tip of the vulva for 18.6 % (17 % in 2003) or much shorter than the tip of the vulva for 7.0 % (4.0 % in 2003).

29. Uptake of Leader anti-flystrike clips was low with 1.2 and 1.7 % respectively reporting their use in replacement ewe lambs and wethers respectively.

30. With regards genetic modification of sheep to reduce susceptibility to fly strike 61 % and 45 % of respondents reported using some form of visual selection of ewes and rams respectively. The main methods employed were culling of sheep with fleece rot (81 % for ewes, 64 % for rams), culling of sheep with body strike (67 % for ewes, 55 % for rams), selection of plain bodied sheep (59 % for ewes, 65 % for rams) and selection for low breech wrinkle (51 % for ewes, 65 % for rams) with other methods being employed with lesser frequency

31. The use of Australian Sheep Breeding Values (ASBVs) for blowfly-associated traits was low with 5 % and 10 % of respondents reporting their use for ewe and ram selection decisions respectively. The predominant trait used by those using ASBVs was CV for fibre diameter (84.6 % for ewes, 80 % for rams) followed by breech wrinkle (26.9 % for ewes, 42 % for rams), dag score (23.1 % for ewes, 30.0 % for rams) and bare breech area (11.5 % for ewes, 18 % for rams).

32. Preventive measures against blowfly other than mulesing and its alternatives, or genetic selection were used by 77 % of respondents. Among these timing of crutching was most widely used (83 %) followed by timing of shearing (55 %) destruction of larvae from struck sheep (21 %) and trapping of flies (8 %).

Lice Control

33. With regard to the prevalence of lice infection, in 2011 the proportion of respondents reporting no evidence of lice was 54.1 %, rubbing sheep 27.1 % and visual detection of lice 23.3 %. The survey obtained detailed information on lice incidence over the 6 years 2006-2011 and the results showed a strong trend towards increased lice infestation in 2009-2011 compared to 2006-2007. The visual detection of lice by 27.1 % of respondents in 2011 is also higher than the 20 % who reported lousy sheep at shearing in 2003 in the previous survey.

34. With regard to the chemical treatment for lice infection, in 2011 the proportion of respondents reporting no treatment for lice was 19.7 %, off shears treatment 44.2 %, short wool treatment 15.1 % and long wool treatment also 15.1 %. In keeping with the increased reported incidence of lice over the 6 years 2006-2011 (see above) there was a strong trend towards increased frequency of all forms of treatment particularly during 2009-2011.

35. The short follow up survey asked about lice treatments in the previous 3 years and data from the main and follow up surveys combined showed the proportion of respondents reporting off shears treatment in the past 3 years was 65 %, short wool treatment 27 % and long wool treatment 26 %.

36. With regard to the method of chemical application used in 2009-2011 and the use of contractors the following results were obtained. For off shears and short wool treatments pour on backliners were the most used common form of application, being used by 73 % of respondents (44 % of these treatments by contractors), followed by plunge dipping (32 % of respondents, 70 % by contractors) and shower dipping (16 % of respondents, 44 % by contractors). For long wool treatments jetting was the most used common form of application, being used by 54 % of respondents (25 % of these treatments by contractors) closely followed by backline treatment (51 % of respondents, 18 % by contractors).

37. With regard to the chemicals used in 2009-2011 for the various application methods the following results were obtained. For plunge dipping Temephos was the most commonly used chemical (43 %) followed by Diazinon (39 %) and Spinosad (9 %). For shower dipping both Temephos and Diazinon were used by 33 % of respondents followed by Spinosad (15 %), Diflubenzuron (12 %). For pour on backliners Imidacloprid was the most commonly used chemical (33 %) followed by Spinosad (26 %), Triflumuron (24 %), Diflubenzuron (23 %) and Diazinon (21 %). For long wool jetting Ivermectin was the most commonly used chemical (48 %) followed by Spinosad (30 %), and Cyromazine (15 %). As Cyromazine has no claims for action against lice, some producers are clearly confusing fly and lice control. For long wool backline treatment Spinosad was the most commonly used chemical (74 %) followed by alpha Cypermethrin (11 %).

38. Resistance to chemicals used for lice control was suspected by 26 % of respondents. Among those who suspected resistance, resistance was most commonly suspected against Triflumuron (48 %) and Diflubenzuron (35 %) with no other lice chemical suspected of resistance by more than 6 % of those suspecting resistance. Resistance to Triflumuron and Diflubenzuron was suspected to have emerged in 2002-2003 with increasing frequency since.

39. With regard to factors contributing to recurring lice problems the most important factors identified were sheep introduction through fences or purchase (98 % rated this as very important or important), lice resistance to chemicals (85 %), incomplete mustering (81 %) and problems with chemical application (79 %).

General parasite management

40. In 2011 57 % of respondents reported introducing sheep on to their property. Amongst these, the mean scale of the introduction was 15 % of the total number of sheep on the property. The level and scale of introductions was greatest in southern Australia.

41. Amongst the wide range of treatment/quarantine options reported the major categories were internal parasite treatment (67 %), external parasite treatment (50 %), some form of quarantine (23 %) and use of information on the health status of the introduced animals (9 %).

42. Major changes in parasite management over the previous 5 years were reported for worm control (25 % of respondents), fluke control (3 %), blowfly control (22 %) and lice control (20 %).

    a. The most frequently reported major changes in worm control over the past 5 years were grazing management (various forms reported by 20.2 % of those reporting change)

drench rotation (17.6 %) WEC testing (12 %), use of capsules (6.3 %) less frequent drenching (5.6 %) drench only if indicated by WEC (4.9 %) and a range of other changes. Drench resistance testing (2.8 %) and use of ram selection (2.1 %) were uncommon changes made during the previous 5 years.

b. The most frequently reported major changes in fluke control over the past 5 years were testing for fluke (15 % of those reporting change), grazing management – various methods (15 %), regular drenching (10 %), drench rotation (10 %), less frequent drenching (10 %) and a range of other changes.

c. The most frequently reported major changes in blowfly control over the past 5 years were increased use of dicyclanil (34.4 % of those reporting change), routine preventive chemical treatment (8.8 %), decreased use of cyromazine (6.4 %), increased jetting (4.8 %), increased use of cyromazine (4.8 %) and a range of other changes. Changes relating to changing the genetic susceptibility of sheep to blowfly were reported by 8.8 % of respondents.

d. The most frequently reported major changes in lice control over the past 5 years were increased use of plunge dipping (15.7 % of those reporting change), chemical rotation (14.8 %), decreased use of backliner (6.1 %), increased use of immidacloprid (5.2 %), and a range of other changes.

43. With regard to the importance of different information sources for parasite control (worms, flies, lice) the most important source was the respondent or a member of their staff (score 1.6/5 where 1 is most important). This was followed by rural merchandise representative (2.7-2.8), rural papers and magazines (3.1-3.3), local vet (3.1-3.7) Ag Department (3.4-3.6), drug company representative (3.5-3.6), WormBoss, LiceBoss, and FlyBoss web sites (3.6-3.7) consultants (3.7-4), Sheep CRC Web site (4).

44. With regard to the usefulness of web sites for parasite control the majority of respondents had never heard of the Wormboss site (41 %), Flyboss site (51.3 %) the LiceBoss site (49.3 %) or the Sheep CRC web site (43.6 %). Many had heard of the sites but not visited them (38.1, 35.3, 35.3 and 37.7 % respectively), while smaller numbers had actually visited the sites (16.2, 11.4, 12.8 and 15.4 % respectively). Those who used a site to make parasite control changes made up 4.7, 2.0, 2.6 and 3.2 % of respondents respectively.

45. The perceived usefulness of several current or projected worm control initiatives was assessed as being very useful, useful, somewhat useful or not useful. The proportion of respondents in each of these categories for the various initiatives is summarised below.

    a. Regional worm control plans. 33.7, 31.8, 18.7, 15.8 % respectively

    b. Drench decision guides. 36.3, 35.9, 17.7, 10.1 % respectively

    c. Colour codes on drenches to identify drench groups. 31.8, 32.9, 19.7, 15.6 % respectively.

    d. Worm control workshops. 31.2, 32.9, 22.4, 13.5 % respectively.

ACKNOWLEDGMENTS

The Benchmarking Australian sheep parasite control project was funded by Australian Wool Innovation Ltd (AWI) and Meat and Livestock Australia (MLA).

We thank Lewis Kahn, Brown Besier, Jane Littlejohn, Geoff Lindon, Johann Schröder, Ian Carmichael, Peter James, Rob Woodgate and John Larsen for input into the survey design.

We are indebted to the farmers who kindly gave their time to fill in the questionnaire and without whom the benchmark study would not have been possible. Those who took the trouble to supply additional information and comment are thanked for the valuable insights they provided.

Survey logistics and data entry was managed by Cathy Coleman, set up of data structures by Michael Coleman, data entry by Ruth McGregor and Abby Partridge, data cleaning by Bright Asante.

1 INTRODUCTION

In 2011 Australian Wool Innovation Ltd (AWI) and Meat and Livestock Australia (MLA) commissioned a project "Bench marking Australian sheep parasite control" of which this report forms part. The project is a follow up on a 2004 benchmark survey on parasite control in sheep funded by AWI under the IPM-sheep (Integrated Parasite Management – sheep) project. That survey was largest of its kind in Australia with 2292 respondents to a questionnaire of 30 questions.

The objectives of the follow up "Bench marking Australian sheep parasite control" survey were to:

- measure change in sheep parasite control practices and attitudes between 2003 and 2011, the years surveyed in the two surveys, and
- provide a new benchmark against which to measure change in parasite control practices and attitudes into the future.

The 2012 survey had two components:

- a longitudinal analysis of practice change amongst sheep producers who participated in both surveys, and
- a cross sectional analysis of all of the responses to the 2012 survey.

This report is on the longitudinal component of the survey.

2 METHODS

2.1 Survey

The methods are described in full in Appendix A1. The results presented in this report are based on a random sample of wool producers drawn from a list of shareholder addresses supplied by Australian Wool Innovation Ltd. The list covers postcode areas covered in the 2004 Benchmark Survey. These postcode areas were identified in 2004 by regional IPM-sheep project managers as being within the 'sphere of influence' of the programs they intended to run. The content of the questionnaire was based on the 2004 questionnaire, with a number of improvements to layout of questions, the omission of some questions no longer required, and the addition of some questions in new areas of interest. A copy of the questionnaire is provided in Appendix A3. This questionnaire was mailed out to 6361 addresses during February 2012, with a reminder and second copy of the questionnaire mailed out to non-responders six weeks later. A short one-page questionnaire containing a small number of key questions was mailed to remaining non-responders six weeks after the reminder. The survey data to be analysed for this report was taken as all questionnaires received by 13 July 2012. The final response rates are shown in Table 2.1. Further details of the final response rates are provided in Table 1.1 of Appendix 1.

Table 2.1 Survey response rates for the main questionnaire and the short one-page questionnaire.

Region	Response rate – full questionnaire (%)	Response rate – full questionnaire together with short questionnaire (%)
QLD	23.1	38.7
New England	22.2	42.6
NSW(remainder)	22.7	36.3
VIC	20.7	35.4
SA	24.2	40.3
WA	18.2	33.7
TOTAL	21.3	36.5

2.2 Analysis

A number of quality control procedures were carried out with the survey data, including testing for non-response bias, caused when those responding to the survey are systematically different in particular respects to those not responding. These procedures are fully described in Appendix 1. A range of analysis techniques were used according to the information that was required from the data and a full description of these techniques is given in Appendix 1.

As described in sections A1.5 and A1.6 in Appendix 1, a comparative analysis of the data from those who filled in the full survey and those who did not respond to the full survey, but responded to the short survey, suggested that there is some minor non-response bias present in the responses to the full survey. This includes under-representation of producers with cattle and those who had, between 2003 and 2011 (for a full listing of differences between those responding to the full and short surveys, see Tables A1.2 to A1.9 in section A1.5 of Appendix 1). It was concluded from the analysis that the level of non-response bias was not sufficient to warrant adjusting all the findings from the full survey. However, the importance of the small set of questions chosen for the short survey (and common with the full survey) to the aims of the current study was considered as sufficient grounds for adjusting the findings from these questions to compensate for any non-response bias and provide the best possible estimates for generalising to the overall sheep producer population. A full account of the reasoning and supporting data for this decision is given in section A1.6 in Appendix 1. Tables with adjusted figures include those relating to:

- total cattle and sheep numbers,
- use of mulesing or Anti-Flystrike Clips,
- monitoring of worm egg counts, and
- testing for drench resistance.

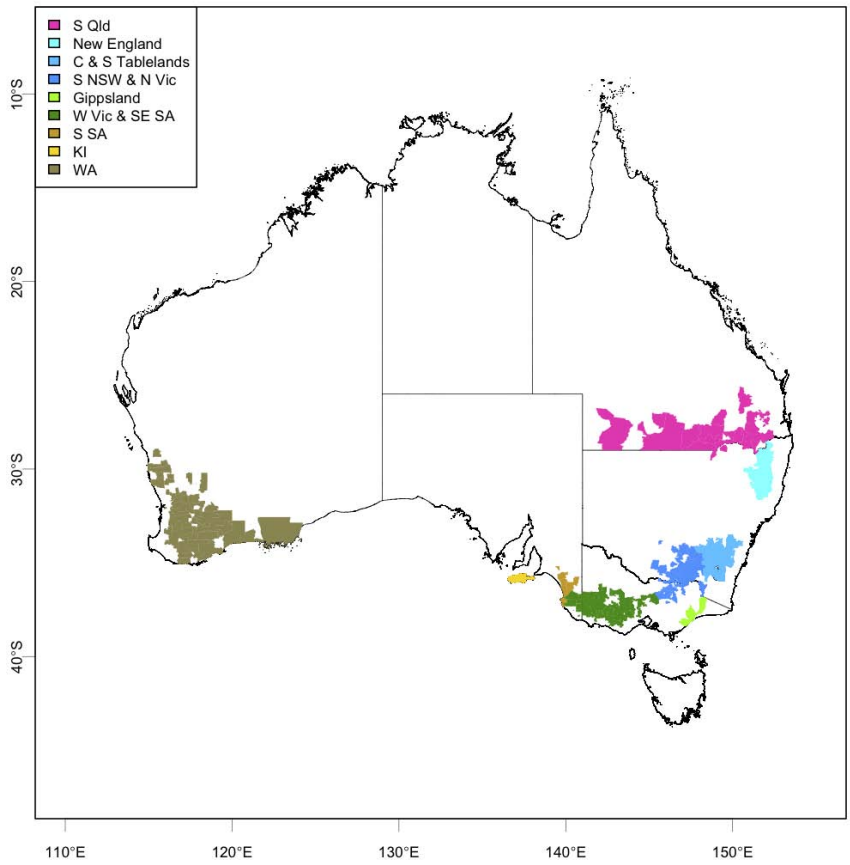
Tables with adjusted figures are noted as such where they occur in the report.

3 RESULTS

3.1 Location of Respondents

The regions from which responses were received are shown in Figure 3.1, below. The figure also shows the regions into which respondents have been grouped for the reporting of results in the ensuing sections. The number of responses from each postcode area within these regions is shown in Figure 3.2, below.

Figure 3.1 Regions in which respondents were located.

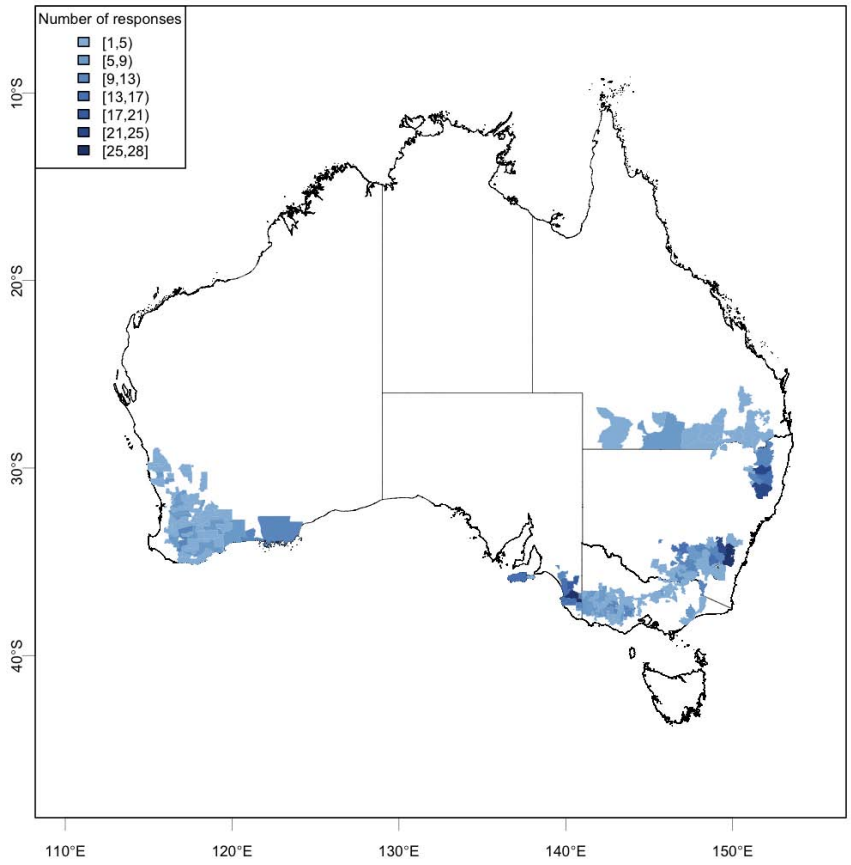


Abbreviation	Region
S Qld	South western Queensland, Granite Belt and Darling Downs
New England	New England region of New South Wales
C & S Tablelands	Central and southern tablelands of New South Wales
S NSW & N Vic	Southern New South Wales and northern Victoria
Gippsland	Gippsland region of Victoria
W Vic & SE SA	Western Victoria and south eastern South Australia
S SA	Southern region of South Australia
KI	Kangaroo Island
WA	South western region of Western Australia

3.1.1 Regional frequency of responses

The geographical distribution of responses is shown in Figure 3.2, below, together with the total number of usable responses to the full and short surveys from each of the regions in Figure 3.1 on the previous page.

Figure 3.2 Frequency of responses in each postcode area from which responses were received.



Region	Usable responses to full survey	Usable responses to short survey	Total
S Qld	25	27	52
New England	63	48	111
C & S Tablelands	79	44	123
S NSW & N Vic	72	50	122
Gippsland	9	4	13
W Vic & SE SA	154	127	281
S SA	28	22	50
KI	17	9	26
WA	128	113	241
All regions	575	444	1019

EXPLANATION OF TABLES

The tables presented in the ensuing sections show the results for each of the regions in Figure 3.1, above, as well as the results for all regions combined. The tables are of three types, depending on the type of data each question generated.

For continuous data, such as property size or flock size, the sample size (n), the minimum, median and maximum values, the mean and the 95% confidence interval on the estimate of the mean are provided. A small histogram of the frequency distribution is also provided. More information on the statistics presented in association with the summary tables for continuous data is provided in Appendix A1.7.1.

A number of questions provided ordinal data, such as ranking of importance of factors used in deciding whether to drench ewes. For these question, the findings are presented as proportions of respondents in each category. Where space permits, the upper and lower 95 per cent confident limits on the estimate of the proportion are provided in grey text either side of the proportion itself. The sample size (n) is also provided. Where the percentage in an individual cell is significantly higher than the percentage across all regions, this is indicated by bolding and underlining the percentage. When the percentage in an individual cell is significantly lower than the percentage across all regions, this is indicated by bolding only. For more information on the statistics presented in association with summary tables for ordinal data, see Appendix A1.7.2.

For nominal data, such as type of grazing strategy used, the findings are presented in the same way as for ordinal data, as described above.

Where questions are such that respondents could tick more than one choice, or give multiple answers, it is not possible to use a chi square test for significant regional differences. The tables of results for these questions carry a footnote explaining that the percentages for any one region sum to more than 100, due to the multiple choice or answers. More information on the analysis of multiple choice questions is given in Appendix A1.7.3.

Respondents who failed to complete particular questions are omitted from the tables that report on those questions. For this reason, the sample size reported in the table column headed “n” will vary from table to table and will generally be less than the 575 full survey responses and the 444 short survey responses. In some cases, where a question was asked in both the full and short surveys, the percentages reported in tables are based on both surveys. More information on how the full and short survey data was used to adjust for the slight non-response bias in the full survey is provided in Appendix A1.6.3.

3.2 Respondent age

There were significant differences between the regions in the age of respondents. Across all regions, the mean age of respondents was 56 years, with regional mean ages being up to 61 in S Qld and as low as 49 in S Gippsland. Further details of the age of respondents are provided in Appendix A2.1.

3.3 Property Details

Respondents were asked to provide a range of details about their property, including the rainfall in 2011, the proportion of their income derived from various sources and the areas under various land uses, and sheep flock and cattle herd details.

3.3.1 Rainfall

3.3.1.1 Total rainfall 2011 (mm)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	19	303	658	813	606	136	
New England	60	762	1000	1445	999	76	
C & S Tablelands	71	290	699	1160	696	66	
S NSW & N Vic	64	447	698	1465	718	82	
Gippsland	9	620	762	1135	811	260	
W Vic & SE SA	133	333	650	1219	667	54	
S SA	26	381	549	680	545	67	
KI	17	450	600	711	599	78	
WA	115	100	470	1183	485	51	
All Regions	514	100	650	1465	667	36	

Histogram class limits: 100 236.5 373 509.5 646 782.5 919 1055.5 1192 1328.5 1465
Anova: F=67.42, df=8, p<0.00005

3.3.2 *Income sources*

3.3.2.1 Proportion of income derived from sheep and wool (%)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	24	2	72	100	67	23	
New England	63	20	70	100	70	12	
C & S Tablelands	75	15	95	100	84	10	
S NSW & N Vic	71	0	62	100	62	13	
Gippsland	9	20	100	100	82	45	
W Vic & SE SA	146	10	80	100	76	8	
S SA	27	10	70	100	62	22	
KI	17	19	95	100	85	23	
WA	122	4	50	100	51	9	
All Regions	554	0	70	100	68	5	

Histogram class limits: 0 10 20 30 40 50 60 70 80 90 100
Anova: F=14.85, df=8, p<0.00005

In the 2004 survey, cluster analysis showed that respondents tended to fall into two groups: those mainly dependent on meat sheep (first and second cross prime lambs or store lambs), and those mainly dependent on income from wool sales. There were regional differences in the incidence of these two groups. However, for the 2012 survey, there was only weak cluster structure with results suggesting that respondents might fall into five groups. Since the measure of cluster structure fell below that regarded as sufficient to warrant interpretation, the grouping of respondents with respect to sources of income was not examined further.

3.3.2.2 Other sources of income

Across all regions and all respondents, the mean proportion of income derived from beef cattle was 11.7 percent. Among only those respondents with beef cattle, the mean proportion of their income from this source was 26.3 percent. The mean proportion of income from beef was significantly different across the regions (Anova: F=12.43, df=8, p<0.00005). The highest mean proportion of income from beef was in the New England region, with 28.2 per cent, while the lowest proportion was in Western Australia, with 3.3 per cent.

The mean proportion of income derived from cropping was 16.8 per cent across all regions. Among only those respondents with at least some income from cropping, the mean proportion was 37.3 per cent. The mean proportion of income from cropping was significantly different across the regions (Anova: F=37.52, df=8, p<0.00005). The highest mean proportion occurred in Western Australia (43.2.0 per cent) and the lowest in the Gippsland region (0.0 per cent).

The mean proportion of income derived from sources other than sheep, beef and cropping was 3.3 per cent and there is no significant difference between the regions. Across all regions, 86.0 per cent of respondents had no income derived from sources other than sheep, beef and cropping, while 97.3 per cent derived over half of their income from sheep, beef and/or cropping.

Among those with income from sources other than sheep, beef and cropping, 69.9 per cent derived income from some other primary production (such as stud stock sales, goats, pigs, farm forestry), 13.7 per ce

nt worked off-farm and 16.4 per cent derived income from off-farm investment.

3.3.3 Property size and land use

3.3.3.1 Total area of property (ha)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	25	131	10,000	181,800	20,462	30,331	
New England	62	104	873	9,400	1,329	734	
C & S Tablelands	76	96	600	5,656	947	478	
S NSW & N Vic	71	85	574	19,200	1,360	1,290	
Gippsland	9	200	727	1,050	605	511	
W Vic & SE SA	150	81	711	4,360	897	238	
S SA	28	215	900	7,000	1,357	999	
KI	17	140	631	2,000	749	529	
WA	124	85	2,000	13,908	2,569	828	
All Regions	562	81	889	181,800	2,263	1,448	

Histogram class limits: 80.8 672.7 1264.6 1856.6 2448.5 3040.4 3632.3 4224.2 4816.2 5408.1 6000
Anova: F=18.14, df=8, p<0.00005.
***Note**: respondents with properties larger than 6,000 ha (57) have been excluded from the histograms (and **only** from the histograms) to prevent the property size distribution being reduced to a single bar, due to the influence of the small number of very large properties.*

3.3.3.2 Proportion of total property area grazed (%)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	24	65	100	100	91	10	
New England	61	50	100	100	96	4	
C & S Tablelands	76	10	99	100	90	8	
S NSW & N Vic	69	17	79	100	72	12	
Gippsland	8	79	97	100	94	12	
W Vic & SE SA	148	9	90	100	83	7	
S SA	27	20	97	100	84	20	
KI	15	15	91	100	87	24	
WA	122	6	50	100	56	8	
All Regions	550	6	90	100	79	4	

Histogram class limits: 5.6 15.1 24.5 34 43.4 52.8 62.3 71.7 81.1 90.6 100
Anova: F=32.61, df=8, p<0.00005

3.3.3.3 Proportion of total property area cropped (%)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	25	0	0	30	5	7	
New England	61	0	0	50	3	4	
C & S Tablelands	76	0	0	89	6	7	
S NSW & N Vic	69	0	20	79	27	12	
Gippsland	8	0	2	20	6	12	
W Vic & SE SA	150	0	5	91	15	6	
S SA	27	0	0	80	13	19	
KI	15	0	7	65	11	19	
WA	124	0	40	99	40	9	
All Regions	555	0	6	99	18	4	

Histogram class limits: 0 9.9 19.7 29.6 39.4 49.3 59.2 69 78.9 88.7 98.6
Anova: F=30.21, df=8, p<0.00005

3.3.3.4 Proportion of pastures improved (%)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	24	0	22	100	39	35	
New England	61	0	40	100	48	19	
C & S Tablelands	76	0	61	100	60	13	
S NSW & N Vic	69	0	75	100	65	15	
Gippsland	8	50	68	100	70	28	
W Vic & SE SA	148	0	83	100	73	9	
S SA	27	48	82	100	82	13	
KI	15	25	95	100	77	35	
WA	122	0	89	100	76	11	
All Regions	550	0	80	100	67	5	

Histogram class limits: 0 10 20 30 40 50 60 70 80 90 100
Anova: F=9.07, df=8, p<0.000

3.3.3.5 Average paddock size (ha)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	24	5	419	13,985	1276	2,416	
New England	59	5	36	671	47	44	
C & S Tablelands	71	6	28	157	33	12	
S NSW & N Vic	67	4	27	295	42	24	
Gippsland	8	6	21	49	23	22	
W Vic & SE SA	131	6	25	140	30	7	
S SA	26	13	30	78	33	13	
KI	15	5	26	100	29	24	
WA	116	4	62	361	76	18	
All Regions	517	4	33	13,985	102	114	

Histogram class limits: 3 51.7 99.6 147.6 195.6 243.5 291.5 339.4 387.4 435.4 484
Anova: F=33.39, df=8, p<0.00005.

***Note**: respondents with average paddock sizes larger than 500 ha (27) have been excluded from the histograms (and **only** from the histograms) to prevent the average paddock size distribution being reduced to a single bar, due to the influence of the small number of very large average paddock sizes.*

3.3.4 Cattle

3.3.4.1 Proportion of respondents with cattle in a typical year

Region	n	Proportion with cattle (%)		
S Qld	52	61	**75**	86
New England	111	76	**84**	90
C & S Tablelands	123	43	52	61
S NSW & N Vic	122	30	38	48
Gippsland	13	39	71	91
W Vic & SE SA	281	44	50	56
S SA	50	45	60	74
KI	26	9	**25**	44
WA	241	15	**20**	26
All regions	1019	44	47	50

$\chi 2=163.350$, df=8 p<0.00005.
Note: percentages are adjusted for non-response bias as described in Appendix A1.6.3.

3.3.4.2 Cattle DSEs in a typical year

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	21	105	4216	66700	7258	12865	
New England	55	21	1892	43720	4327	4006	
C & S Tablelands	35	84	1164	14150	2047	2001	
S NSW & N Vic	29	59	879	9500	1825	1887	
Gippsland	3	974	1352	4290	2205	9019	
W Vic & SE SA	70	28	1254	27100	2647	1857	
S SA	20	84	2537	21660	3800	4798	
KI	9	95	708	1396	690	713	
WA	23	100	1488	18980	2805	3665	
All Regions	265	21	1476	66700	3221	1487	

Histogram class limits: 21 6688.9 13356.8 20024.7 26692.6 33360.5 40028.4 46696.3 53364.2 60032.1 66700
Anova: F=2.08, df=8, p=0.0382
***Note**: respondents with average cattle DSEs greater than 10,000 (23) have been excluded from the histograms (and **only** from the histograms) to prevent the average cattle DSE distribution being reduced to a single bar, due to the influence of the small number of very large average cattle DSEs.*

3.3.4.3 2011 compared to a typical year

Respondents with cattle who were carrying the same number of cattle DSEs in 2011 as in a typical year comprised 50.7 per cent of the sample. Those who were carrying less cattle in 2011 than in a typical year comprised 28.0 per cent of the sample, while the remaining 21.3 per cent of respondents were carrying more cattle DSEs in 2011, compared to a typical year.

There was no significant difference between the regions. Further details are provided in Appendix A2.2.

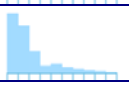
3.3.4.4 Calving

There was no significant difference between regions in the mean length of the calving period for cows in 2011, with mean of 2.3 months across all regions. The mean length of calving period for heifers across all regions was 2.0 months, and there was no significant difference between the regions in the length of the calving period for heifers. Further details on calving periods are provided in Appendix A2.3 – A2.4.

Time of calving tended to be later in the calendar year in northern regions – around August to December – and earlier in the southern regions – around February to August. Further details on the time of calving are provided in Appendix A2.5 – A2.6.

3.3.5 Sheep

3.3.5.1 Sheep DSEs in a typical year

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	25	480	4640	24000	6730	5331	
New England	62	49	2468	19110	3856	2066	
C & S Tablelands	77	9	2545	27900	4130	2217	
S NSW & N Vic	70	360	1696	31780	3277	2317	
Gippsland	9	354	2610	8100	2931	3578	
W Vic & SE SA	145	232	3040	20300	4770	1541	
S SA	27	114	2400	19848	3784	3346	
KI	17	140	3570	33960	5176	8047	
WA	123	15	3400	48540	4950	1903	
All Regions	555	9	2775	48540	4454	836	

Histogram class limits: 9 4862.1 9715.2 14568.3 19421.4 24274.5 29127.6 33980.7 38833.8 43686.9 48540
Anova: F=1.73, df=8, p=0.0897
***Note**: respondents with average sheep DSEs of 20,000 and over (30) have been excluded from the histograms (and **only** from the histograms) to prevent the average sheep DSE distribution being reduced to a single bar, due to the influence of the small number of very large average sheep DSEs.*

3.3.5.2 2011 compared to a typical year

Across all regions, 43 per cent of respondents carried the same number of sheep DSEs in 2011 as they did in a typical year, while 26 per cent carried less and 30 per cent carried more. There were significant differences between regions, with S Qld having relatively fewer respondents with 2011 sheep DSEs being at typical levels, and New England having relatively more. W Vic & SE SA and S SA had relatively more respondents with 2011 sheep DSEs greater than usual. Further details are provided in Appendix A2.7.

3.3.5.3 Flock composition in a typical year – ewes as a proportion of the total flock (%)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	25	0	53	100	53	25	
New England	62	0	56	100	61	14	
C & S Tablelands	77	0	53	100	57	12	
S NSW & N Vic	70	0	64	100	68	14	
Gippsland	9	39	59	98	66	36	
W Vic & SE SA	145	0	70	100	70	8	
S SA	27	42	80	100	77	17	
KI	17	42	66	100	69	21	
WA	123	0	59	100	63	8	
All Regions	555	0	60	100	65	4	

Histogram class limits: 0 10 20 30 40 50 60 70 80 90 100
Anova: F=3.44, df=8, p=0.0007

3.3.5.4 Flock composition in a typical year – wethers as a proportion of the total flock (%)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	25	0	15	100	27	28	
New England	62	0	0	100	13	10	
C & S Tablelands	77	0	0	100	14	10	
S NSW & N Vic	70	0	0	100	7	10	
Gippsland	9	0	10	29	11	19	
W Vic & SE SA	145	0	0	100	9	5	
S SA	27	0	0	8	1	2	
KI	17	0	0	28	7	10	
WA	123	0	0	100	7	5	
All Regions	555	0	0	100	10	3	

Histogram class limits: 0 10 20 30 40 50 60 70 80 90 100
Anova: F=4.84, df=8, p<0.00005

3.3.5.5 Flock composition in a typical year – weaners as a proportion of the total flock (%)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	25	0	10	50	18	16	
New England	62	0	24	100	24	10	
C & S Tablelands	77	0	31	100	27	9	
S NSW & N Vic	70	0	22	100	23	12	
Gippsland	9	0	28	41	22	26	
W Vic & SE SA	145	0	19	100	20	6	
S SA	27	0	13	57	20	16	
KI	17	0	23	54	22	17	
WA	123	0	32	97	26	7	
All Regions	555	0	24	100	23	3	

Histogram class limits: 0 10 20 30 40 50 60 70 80 90 100
Anova: F=1.55, df=8, p=0.1385

3.4 Animal Husbandry (Other Than Parasite Management)

3.4.1 Shearing and crutching

3.4.1.1 Proportion of respondents shearing and crutching ewes in each month of the year

Region	n	Proportion of respondents shearing in month	n	Proportion of respondents crutching in month
S Qld	22		17	
New England	59		58	
C & S Tablelands	71		71	
S NSW & N Vic	67		62	
Gippsland	9		9	
W Vic & SE SA	148		143	
S SA	25		24	
KI	17		17	
WA	120		107	
All Regions	538		508	

Figures for the histograms above are provided in Appendix A2.8.

3.4.1.2 Proportion of respondents shearing and crutching wethers in each month of the year

Region	n	Proportion of respondents shearing in month	n	Proportion of respondents crutching in month
S Qld	13		11	
New England	37		35	
C & S Tablelands	49		47	
S NSW & N Vic	18		15	
Gippsland	6		6	
W Vic & SE SA	68		68	
S SA	10		9	
KI	11		11	
WA	57		54	
All Regions	269		256	

Figures for the histograms above are provided in Appendix A2.9.

3.4.1.3 Proportion of respondents shearing and crutching weaners in each month of the year

Region	n	Proportion of respondents shearing in month	n	Proportion of respondents crutching in month
S Qld	17		14	
New England	49		42	
C & S Tablelands	59		55	
S NSW & N Vic	50		35	
Gippsland	9		8	
W Vic & SE SA	110		90	
S SA	17		13	
KI	12		11	
WA	105		68	
All Regions	428		336	

Figures for the histograms above are provided in Appendix A2.10.

3.4.2 *Breeding program*

3.4.2.1 Proportion of respondents putting rams with ewes each month of the year in 2011

Region	Merino ewes mated to Merino rams	Merino ewes mated to meat breed rams	Cross-bred ewes
S Qld			
New England			
C & S Tablelands			
S NSW & N Vic			
Gippsland			
W Vic & SE SA			
S SA			
KI			
WA			
All Regions			

Figures for the histograms above are provided in Appendix A2.11.

3.4.2.2 Number of weeks Merino rams left with Merino ewes

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	15	5.0	10.0	16.0	9.5	3.3	
New England	37	5.0	6.0	24.0	7.4	2.2	
C & S Tablelands	53	5.0	6.0	12.0	6.7	1.2	
S NSW & N Vic	31	5.0	7.0	24.0	7.9	2.6	
Gippsland	7	5.0	6.0	20.0	8.6	10.3	
W Vic & SE SA	63	2.6	6.4	30.0	7.3	1.8	
S SA	12	6.0	8.0	11.0	7.8	2.0	
KI	7	5.0	8.0	10.0	7.3	3.7	
WA	81	4.0	6.0	20.0	7.1	1.1	
All Regions	306	2.6	6.0	30.0	7.4	0.7	

Histogram class limits: 2 5.3 8.1 10.8 13.5 16.3 19 21.8 24.5 27.3 30
Anova: F=1.72, df=8, p=0.0922

3.4.2.3 Number of weeks meat breed rams left with Merino ewes

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	8	5.0	9.0	16.0	9.0	6.4	
New England	30	4.0	6.0	12.0	6.7	1.2	
C & S Tablelands	36	4.0	6.0	16.0	6.9	1.7	
S NSW & N Vic	29	3.0	8.0	20.0	8.9	2.8	
Gippsland	3	6.0	6.0	16.0	9.3	28.7	
W Vic & SE SA	77	4.0	8.0	16.0	8.3	1.3	
S SA	15	6.0	8.0	12.0	8.3	1.7	
KI	9	2.0	6.0	14.0	7.4	6.0	
WA	55	4.0	6.0	16.0	7.2	1.3	
All Regions	262	2.0	7.0	20.0	7.8	0.7	

Histogram class limits: 2 3.8 5.6 7.4 9.2 11 12.8 14.6 16.4 18.2 20
Anova: F=2.75, df=8, p=0.0063

3.4.2.4 Number of weeks rams left with Cross-bred ewes

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	2	6.0	6.0	6.0	6.0	0.0	
New England	19	4.0	7.0	16.0	8.4	3.5	
C & S Tablelands	26	3.0	8.0	12.0	7.6	1.9	
S NSW & N Vic	28	5.0	8.0	24.0	9.8	3.5	
Gippsland	1*	-	-	-	-	-	
W Vic & SE SA	80	4.0	8.0	20.0	9.8	1.6	
S SA	8	4.0	8.0	10.0	7.6	3.2	
KI	11	2.0	6.0	16.0	7.5	5.3	
WA	13	5.0	7.0	10.0	6.9	1.7	
All Regions	188	2.0	8.0	24.0	8.9	1.0	

Histogram class limits: 2 4.2 6.4 8.6 10.8 13 15.2 17.4 19.6 21.8 24
Anova: F=2.43, df=8, p=0.016

** Results are omitted to preserve confidentiality, but used in calculating totals.*

3.4.2.5 Typical marking percentage – Merino ewes mated to Merino rams

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	15	70.0	85.0	115.0	87.2	13.9	
New England	34	50.0	85.0	120.0	84.7	8.2	
C & S Tablelands	48	70.0	85.0	120.0	85.5	5.6	
S NSW & N Vic	23	45.0	90.0	110.0	89.9	12.5	
Gippsland	5	70.0	85.0	91.0	83.2	21.3	
W Vic & SE SA	52	65.0	90.0	118.0	87.9	6.1	
S SA	14	80.0	96.5	110.0	95.1	11.5	
KI	8	70.0	90.0	95.0	87.5	14.8	
WA	80	40.0	85.0	110.0	86.6	4.5	
All Regions	279	40.0	85.0	120.0	87.1	2.6	

Histogram class limits: 40 48 56 64 72 80 88 96 104 112 120
Anova: F=1.61, df=8, p=0.1218

3.4.2.6 Typical marking percentage – Merino ewes mated to meat breed rams

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	8	30.0	85.0	120.0	82.8	41.9	
New England	26	60.0	90.0	110.0	87.8	9.2	
C & S Tablelands	30	70.0	93.0	120.0	93.2	9.0	
S NSW & N Vic	22	80.0	95.0	120.0	96.8	9.9	
Gippsland	3	70.0	85.0	90.0	81.7	51.7	
W Vic & SE SA	66	70.0	95.0	140.0	96.9	7.4	
S SA	15	75.0	98.0	120.0	96.2	12.4	
KI	6	90.0	100.0	100.0	97.5	8.8	
WA	51	45.0	90.0	120.0	89.8	7.6	
All Regions	227	30.0	90.0	140.0	93.0	3.7	

Histogram class limits: 30 41 52 63 74 85 96 107 118 129 140
Anova: F=2.75, df=8, p=0.0065

3.4.2.7 Typical marking percentage – Cross-bred ewes

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	2	90.5	105.2	120.0	105.2	374.8	
New England	13	70.0	120.0	165.0	123.1	34.2	
C & S Tablelands	17	88.0	120.0	135.0	116.1	13.9	
S NSW & N Vic	21	90.0	120.0	150.0	120.6	13.8	
Gippsland	1*	-	-	-	-	-	
W Vic & SE SA	70	82.5	120.0	160.0	115.8	7.2	
S SA	9	80.0	130.0	155.0	123.9	38.0	
KI	9	100.0	110.0	130.0	113.9	17.5	
WA	14	78.0	102.5	140.0	104.5	19.2	
All Regions	156	70.0	120.0	165.0	116.4	5.5	

Histogram class limits: 70 79.5 89 98.5 108 117.5 127 136.5 146 155.5 165
Anova: F=1.85, df=8, p=0.0715

** Results are omitted to preserve confidentiality, but used in calculating totals.*

3.4.2.8 Marking percentages in 2011 compared to typical years

Across all regions, and for Merino ewes mated to Merino rams, Merino ewes mated to meat-breed rams, and cross-bred ewes, just under half of respondents reported higher marking percentages in 2011 compared to a typical year, while from one fifth to one third reported lower marking percentages in 2011 compared to a typical year. Exceptions in individual regions were S Qld, where the majority of respondents experienced lower marking percentages in 2011 than for a typical year for all three types of breeding program, and S NSW & N Vic where, for Merino ewes mated to Merino rams and Merino ewes mated to meat-breed rams, three quarters of respondents reported 2011 marking percentages higher than for a typical year

Detailed figures on the differences between 2011 marking percentages and those for a typical year are given in Appendix A2.12.

3.4.2.9 Proportion of respondents weaning lambs each month of the year in 2011

Region	Merino ewes mated to Merino rams	Merino ewes mated to meat breed rams	Cross-bred ewes
S Qld			
New England			
C & S Tablelands			
S NSW & N Vic			
Gippsland			
W Vic & SE SA			
S SA			
KI			
WA			
All Regions			

Figures for the histograms above are provided in Appendix A2.13.

3.5 Grazing Management

3.5.1 Importance of objectives when determining grazing strategies

Respondents rated a number of objectives on a scale of 1 to 5, where 1 denoted very important and 5 denoted not important

Region		Mean importance rating for objectives below						
		Ease of management	Improved pasture productivity	Improved pasture persistence, sustainability, weed control	Improved animal productivity	Parasite control	Utilise crops and stubbles	Other
S Qld		1.8	2.7	2.2	1.8	2.1	3.6	-
New England		2.1	2.5	2.3	1.9	1.8	3.3	3.5
C & S Tablelands		2.1	2	1.8	1.8	2	3.2	3
S NSW & N Vic		2.2	2.1	2.1	1.8	2.1	2.6	-
Gippsland		2.4	2.5	1.9	2.1	2	3	-
W Vic & SE SA		2.1	2	2.2	2	2.1	2.7	1.7
S SA		2.2	2.1	2.2	2	2.4	3.1	3
KI		1.8	1.9	2.1	1.8	1.9	2.2	1
WA		1.9	2.1	2.1	1.8	2.1	2.3	1
All Regions		2.1	2.1	2.1	1.9	2	2.7	2.1
Anova	*F*	*0.67*	*1.55*	*0.86*	*0.61*	*0.58*	*4.15*	*1.12*
	df	*8*	*8*	*8*	*8*	*8*	*8*	*5*
	p value	*0.7156*	*0.1385*	*0.5494*	*0.7664*	*0.7965*	*0.0001*	*0.4207*
	n	*525*	*524*	*523*	*525*	*526*	*437*	*14*

Other objectives given by respondents related to various aspects of profitability, stock health, and weed control.

3.5.2 Proportion who had changed their grazing strategy in recent years

Region	n	Proportion with changed (%)		
S Qld	24	19	38	59
New England	61	33	46	59
C & S Tablelands	75	34	45	57
S NSW & N Vic	68	27	38	51
Gippsland	8	24	62	91
W Vic & SE SA	143	21	**29**	37
S SA	28	28	46	66
KI	17	7	24	50
WA	121	29	37	46
All regions	545	34	38	42

$\chi^2=13.06$, $p=0.1085$.

3.5.3 Reason for changing grazing strategy

Those who indicated they had changed their grazing strategy in recent years were asked in an open question the reason or reasons they made the change. The reasons given were allocated to 29 categories.

Reason for changing grazing strategy	Proportion of respondents (%)	Region where reason most often given
Internal parasite control	13.5	C & S Tablelands
Improve pasture quality	11.9	C & S Tablelands
Increased sown pastures	10.8	W Vic & SE SA
Utilise crops	10.8	WA
Response to drought	9.2	W Vic & SE SA
Improve pasture production	8.1	WA
Improve feed utilisation	7	W Vic & SE SA
Response to end of drought	6.5	C & S Tablelands
Change in sheep husbandry	6.5	W Vic & SE SA
Improve pasture management	5.9	WA
Improve sheep condition and/or growth	5.9	C & S Tablelands, New England, S NSW & N Vic, W Vic & SE SA, WA
Increased internal subdivision	4.3	S NSW & N Vic
Change in sheep numbers	3.8	C & S Tablelands" "WA
Increased mob size	3.2	C & S Tablelands
Weed control	3.2	New England, WA
Ease of management	3.2	C & S Tablelands, WA
Response to declining profitability	2.2	W Vic & SE SA
Change in cattle husbandry	1.1	New England, WA
Change in cattle numbers	1.1	S NSW & N Vic,S Qld
Decreased sheep numbers	1.1	New England, WA
Improve stock health	1.1	C & S Tablelands, Gippsland
Result of learning from courses	1.1	KI, New England
Change in sheep breed	0.5	S Qld
Decreased internal subdivision	0.5	New England
Decreased mob size	0.5	WA
Increased sheep numbers	0.5	W Vic & SE SA
Improve wool quality	0.5	WA
Increase marking percentage	0.5	WA

n=185
Note: percentages sum to more than 100 as respondents could give more than one reason.

3.6 Worm Control

3.6.1 Number, timing and type of treatment – 2011

3.6.1.1 Lambs and/or weaners

Region	n*	Prop'n treating lambs and/or weaners (%)	Mean number of times treated	Prop'n capsules (%)**	Prop'n injectable (%)**	Month(s) with highest prop'n of treatments**	Prop'n of treatments with the most popular anthelmintic - Levamisole (%)**
S Qld	16	64.0	4.0	3.1	9.2	Jan	31.7
New England	48	76.2	5.2	0.4	6.3	Jan	47.5
C & S Tablelands	59	74.7	3.0	1.1	7.9	Nov	29.6
S NSW & N Vic	51	70.8	2.3	2.7	11.6	Nov	31.0
Gippsland	6	66.7	3.0	0.0	5.6	Feb	75.0
W Vic & SE SA	110	71.4	2.7	2.4	8.4	Feb	40.2
S SA	23	82.1	1.9	0.0	12.2	Dec	28.2
KI	14	82.4	2.9	0.0	12.8	Feb, Apr, May, Jul	25.0
WA	90	70.3	1.8	0.6	11.5	Dec	17.4
All Regions	417	72.5	2.8	1.4	8.9	Dec	35.4

Chi-squared test for proportion treating lambs and/or weaners: $\chi 2=4.31$, $p=0.8291$.
Kruskal-Wallis test for number of times treated: $\chi 2=101.97$, d.f.=8, $p<0.00005$.
** the sample size given is for the proportion treating lambs and/or weaners (next column). For the remaining figures in the table, the sample size will be equal to the sample size given, multiplied by the proportion treating lambs and/or weaners.*
*** proportion of treatments – a treatment is one or more anthelmintics administered to one or more classes of sheep at the one time.*

Further details for the treatments for worm control in lambs and/or weaners are provided in Appendix A2.14.1 and A2.14.2.

3.6.1.2 Maiden ewes

Region	n*	Prop'n treating maiden ewes (%)	Mean number of times treated	Prop'n capsules (%)**	Prop'n injectable (%)**	Month(s) with highest prop'n of treatments**	Prop'n of treatments with the most popular anthelmintic - Levamisole (%)**
S Qld	3	12.0	1.7	16.7	16.7	Jan, Apr, Dec	20.0
New England	3	4.8	3.7	0.0	20.0	Apr	9.1
C & S Tablelands	2	2.5	1.0	0.0	0.0	Jun	50.0
S NSW & N Vic	4	5.6	2.2	0.0	0.0	Sep	12.5
Gippsland	0	–	–	–	–	–	–
W Vic & SE SA	12	7.8	1.8	0.0	27.8	Jun, Sep	5.0
S SA	2	7.1	1.0	0.0	0.0	Jul	0.0
KI	1	–	–	–	–	–	–
WA	4	3.1	1.2	0.0	0.0	Mar	25.0
All Regions	31	5.4	1.8	1.7	15.7	Sep	43.4

Chi-squared test for proportion treating maiden ewes: $\chi 2=7.18$, $p=0.5048$.
Kruskal-Wallis test for number of times treated: $\chi 2=8.17$, d.f.=8, $p=0.3177$.
** the sample size given is for the proportion treating maiden ewes (next column). For the remaining figures in the table, the sample size will be equal to the sample size given, multiplied by the proportion treating maiden ewes. When sample size = 1, results are omitted to preserve confidentiality, but used in calculating totals.*
*** proportion of treatments – a treatment is one or more athelmintics administered to one or more classes of sheep at the one time*

Further details for the treatments for worm control in maiden ewes are provided in Appendix A2.14.3 and Appendix A2.14.4.

3.6.1.3 Adult ewes

Region	n*	Prop'n treating adult ewes (%)	Mean number of times treated	Prop'n capsules (%)**	Prop'n injectable (%)**	Month(s) with highest prop'n of treatments**	Prop'n of treatments with the most popular anthelmintic - Levamisole (%)**
S Qld	17	68.0	3.6	1.6	12.7	Jan	27.4
New England	53	84.1	5.6	1.4	6.2	Jan	47.4
C & S Tablelands	61	77.2	2.6	3.8	12.2	Nov	24.2
S NSW & N Vic	53	73.6	2.1	3.7	13.1	Jan	22.6
Gippsland	7	77.8	2.7	0.0	10.5	Aug	70.6
W Vic & SE SA	126	81.8	2.6	5.2	5.2	Dec	38.9
S SA	25	89.3	1.6	5.0	20.0	Dec	28.9
KI	15	88.2	2.7	4.9	9.8	Apr	22.9
WA	83	64.8	1.6	3.3	7.4	Oct	27.7
All Regions	440	76.5	2.7	3.5	8.5	Jan	35.4

Chi-squared test for proportion treating adult ewes: $\chi 2=19.37$, $p=0.0140$.
Kruskal-Wallis test for number of times treated: $\chi 2=142.79$, d.f.=8, $p<0.00005$.
** the sample size given is for the proportion treating adult ewes (next column). For the remaining figures in the table, the sample size will be equal to the sample size given, multiplied by the proportion treating adult ewes.*
*** proportion of treatments – a treatment is one or more anthelmintics administered to one or more classes of sheep at the one time*

Further details for the treatments for worm control in lambs and/or weaners are provided in Appendix A2.14.5 and A2.14.6.

3.6.1.4 Wethers

Region	n*	Prop'n treating wethers (%)	Mean number of times treated	Prop'n capsules (%)**	Prop'n injectable (%)**	Month(s) with highest prop'n of treatments**	Prop'n of treatments with the most popular anthelmintic - Levamisole (%)**
S Qld	8	32.0	3.0	0.0	0.0	Jan, Dec	29.2
New England	19	30.2	4.5	1.2	4.8	Dec	48.8
C & S Tablelands	30	38.0	2.5	0.0	2.8	Nov	26.1
S NSW & N Vic	10	13.9	1.5	0.0	0.0	Nov	33.3
Gippsland	4	44.4	3.0	0.0	0.0	Aug	70.0
W Vic & SE SA	45	29.2	1.7	3.9	0.0	Nov	55.1
S SA	2	7.1	1.0	0.0	0.0	Nov, Dec	0.0
KI	5	29.4	2.0	0.0	10.0	Jan, May, Jul, Sep, Oct	37.5
WA	19	14.8	1.3	0.0	4.3	Oct, Dec	13.6
All Regions	142	24.7	2.3	1.3	2.5	Nov	40.3

Chi-squared test for proportion treating wethers: $\chi 2=28.85$, $p=0.0006$.
Kruskal-Wallis test for number of times treated: $\chi 2=52.71$, d.f.=8, $p<0.00005$.
** the sample size given is for the proportion treating wethers (next column). For the remaining figures in the table, the sample size will be equal to the sample size given, multiplied by the proportion treating wethers. When sample size = 1, results are omitted to preserve confidentiality, but used in calculating totals.*
*** proportion of treatments – a treatment is one or more anthelmintics administered to one or more classes of sheep at the one time*

Further details for the treatments for worm control in maiden ewes are provided in Appendix A2.14.7 and Appendix A2.14.8.

3.6.2 Anthelmintics and method of administration: drench, injectable or capsule – all sheep

Anthelmintic Class and/or active constituent	Proportion of sheep class treatments* (%)	Proportion of anthelmintics used in sheep class treatments (%)	Method of administration (% of sheep class treatments*)		
			Drench	Injectable	Capsule
Levamisole	35.8	21.9	100.0	0.0	0.0
ML Abamectin	23.6	14.4	98.4	0.0	1.6
ML Moxidectin	22.4	13.7	81.1	18.9	0.0
BZ Albendazole	18.2	11.1	95.8	0.0	4.2
OP Naphthalophos	9.2	5.6	100.0	0.0	0.0
BZ Fenbendazole	8.2	5.0	100.0	0.0	0.0
Closantel	7.4	4.5	100.0	0.0	0.0
Unspecified drench	6.6	4.1	100.0	0.0	0.0
BZ Oxfendazole	6.2	3.8	100.0	0.0	0.0
ML Ivermectin	5.9	3.6	95.3	0.0	4.7
BZ unspecified	3.5	2.2	100.0	0.0	0.0
Monepantel	3.4	2.1	100.0	0.0	0.0
ML Moxidectin LA	2.7	1.7	0.0	100.0	0.0
ML unspecified	2.6	1.6	100.0	0.0	0.0
Praziquantel	2.4	1.5	100.0	0.0	0.0
Triclabendazole	1.9	1.2	100.0	0.0	0.0
OP Pyraclofos	1.8	1.1	100.0	0.0	0.0
Alternative	1.7	1.0	100.0	0.0	0.0
Organophosphate unspecified	0.2	0.1	100.0	0.0	0.0

** A sheep class treatment is one or more anthelmintics administered to a single class of sheep within a particular month.*

468 respondents, 2995 sheep class treatments. The column for proportions of sheep class treatments adds to more than 100% as sheep class treatments could involve more that one anthelmintic. The row percentages for method of administration, however, sum to 100% as each use of an anthelmintic involves only one method of administration.

Anthelmintic class abbreviations – ML: Macrocyclic lactone, BZ: Benzimidazole, and OP:Organophosphate.

3.6.3 Anthelmintic use singly and in combination, by region

Region	n	Proportion of sheep class treatments using combinations of anthelmintics (%)				
		One only	Combination of two	Combination of three	Combination of four	Combination of five
S Qld	180	76.1	12.8	7.2	3.9	0.0
New England	778	47.3	36.2	15.9	0.5	0.0
C & S Tablelands	457	56.7	20.1	20.8	2.2	0.2
S NSW & N Vic	279	60.9	17.6	21.1	0.4	0.0
Gippsland	50	22.0	44.0	34.0	0.0	0.0
W Vic & SE SA	724	53.2	19.5	27.3	0.0	0.0
S SA	95	67.4	18.9	12.6	1.1	0.0
KI	87	56.3	33.3	10.3	0.0	0.0
WA	345	76.8	9.6	12.8	0.9	0.0
All regions	2995	57.0	23.0	19.1	0.9	0.0

$\chi 2 = 287.62$, $p < 0.00005$.

A combination of anthelmintics may be contained within a single product or within several products

3.6.4 *Anthelmintic use singly and in combination, by anthelmintic*

Anthelmintic Class and/or active constituent	n*	Proportion of anthelmintic uses singly or in combination with other anthelmintics (%)				
		Used by itself	Used with one other	Used with two others	Used with three others	Used with four others
Alternative	50	48.0	44.0	2.0	6.0	0.0
BZ Albendazole	544	22.1	23.7	49.6	4.2	0.4
BZ Fenbendazole	246	1.2	58.5	39.8	0.4	0.0
BZ Oxfendazole	185	0.0	20.5	77.3	2.2	0.0
BZ unspecified	106	17.0	65.1	17.9	0.0	0.0
Closantel	222	18.0	40.5	34.2	7.2	0.0
Levamisole	1073	19.3	34.2	44.0	2.4	0.1
ML Abamectin	708	39.1	17.5	41.2	2.0	0.1
ML Ivermectin	178	68.5	2.8	28.1	0.0	0.6
ML Moxidectin	670	83.6	8.1	7.2	1.2	0.0
ML Moxidectin LA	81	93.8	6.2	0.0	0.0	0.0
ML unspecified	79	69.6	24.1	5.1	1.3	0.0
Monepantel	101	84.2	13.9	2.0	0.0	0.0
OP Naphthalophos	276	12.0	62.7	25.0	0.4	0.0
Organophosphate unspecified	7	57.1	42.9	0.0	0.0	0.0
Praziquantel	73	0.0	93.2	4.1	2.7	0.0
OP Pyraclofos	53	0.0	18.9	81.1	0.0	0.0
Triclabendazole	57	36.8	38.6	22.8	1.8	0.0
Unspecified drench	199	31.7	11.1	55.3	2.0	0.0
All products	4908	57.0	23.0	19.1	0.9	0.0

$\chi^2 = 2251.70$, $p < 0.00005$.

** The unit of analysis in this table is the administration of an anthelmintic to a single class of sheep at one time. The administration may or may not be accompanied by additional anthelmintics, which may be a single active constituent contained in a product or one of several active constituents in a product.*

Anthelmintic class abbreviations – ML: Macrocyclic lactone, BZ: Benzimidazole, and OP:Organophosphate.

3.6.5 *Five most frequently used combinations of anthelmintics, by region*

Region	n*	Proportion of sheep class treatments using combinations of anthelmintics (%)				
		BZ Fenbendazole + Levamisole	BZ Oxfendazole + Levamisole + ML Abamectin	BZ Albendazole + Levamisole + ML Abamectin	Levamisole + OP Naphthalophos	BZ Albendazole + Closantel + Levamisole
S Qld	43	7.0	0.0	0.0	2.3	9.3
New England	410	2.7	4.6	4.6	15.9	5.6
C & S Tablelands	198	6.6	15.7	16.2	1.0	4.0
S NSW & N Vic	109	7.3	16.5	11.0	0.0	0.9
Gippsland	39	28.2	0.0	5.1	17.9	20.5
W Vic & SE SA	339	16.2	17.4	7.4	0.0	4.1
S SA	31	32.3	9.7	3.2	0.0	9.7
KI	38	57.9	0.0	0.0	0.0	0.0
WA	80	13.8	12.5	11.2	0.0	13.8
All regions	1287	11.2	10.9	7.8	5.8	5.6

$\chi 2$ =1983.33, $p < 0.00005$. (These statistics apply to the full table, not just the five most frequently used combinations shown above.
** The unit of analysis in this table is sheep class treatments that involved a combination of anthelmintics, either contained within a single product, or within several products.*

The full list of combinations of anthelmintics used across all regions is provided in Appendix 2.14.9

3.6.6 *Proportion of respondents monitoring worm egg counts*

Respondents provided information about any worm egg counts they had done in 2011, including the class of sheep on which the counts were done.

3.6.6.1 Lambs and/or weaners

Region	n	Proportion of respondents monitoring worm egg counts (%)		
S Qld	24	1	8	27
New England	63	8	16	27
C & S Tablelands	77	10	18	29
S NSW & N Vic	71	9	17	28
Gippsland	9	7	33	70
W Vic & SE SA	152	17	**23**	31
S SA	28	6	18	37
KI	17	7	24	50
WA	127	5	**9**	16
All regions	568	14	17	20

$\chi 2$ =12.64, p =0.1226.

3.6.6.2 Maiden and/or adult ewes

Region	n	Proportion of respondents monitoring worm egg counts (%)		
S Qld	24	5	17	37
New England	63	14	24	36
C & S Tablelands	77	13	22	33
S NSW & N Vic	71	12	21	32
Gippsland	9	7	33	70
W Vic & SE SA	152	18	24	32
S SA	28	13	29	49
KI	17	14	35	62
WA	127	6	**10**	17
All regions	568	18	21	24

χ^2 =14.50, p =0.0672.

3.6.6.3 Wethers

Region	n	Proportion of respondents monitoring worm egg counts (%)		
S Qld	15	0	7	32
New England	30	1	7	22
C & S Tablelands	40	4	12	27
S NSW & N Vic	17	0	0	20
Gippsland	5	1	20	72
W Vic & SE SA	59	6	14	25
S SA	7	0	0	41
KI	11	2	18	52
WA	46	1	7	18
All regions	230	6	10	14

χ^2 =6.53, p =0.5813.

3.6.7 *Number of times worm egg counts monitored in 2011*

3.6.7.1 Lambs and/or weaners

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	2	2.00	2.00	2.00	2.00	0.00	
New England	10	1.00	2.00	4.00	2.20	1.76	
C & S Tablelands	14	1.00	2.00	3.00	1.71	0.84	
S NSW & N Vic	12	1.00	1.50	6.00	2.42	2.45	
Gippsland	3	1.00	4.00	5.00	3.33	10.34	
W Vic & SE SA	35	1.00	1.00	6.00	1.74	0.98	
S SA	5	1.00	2.00	4.00	2.40	3.77	
KI	4	1.00	1.50	2.00	1.50	1.84	
WA	12	1.00	1.50	4.00	1.92	1.38	
All Regions	97	1.00	1.00	6.00	1.97	0.54	

Histogram class limits: 1 2 3 4 5 6. Anova: F=0.89, df=8, p=0.5301

3.6.7.2 Maiden and/or adult ewes

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	22	1.00	3.00	8.00	3.18	1.88	
New England	51	1.00	3.00	12.00	4.00	1.64	
C & S Tablelands	43	1.00	2.00	12.00	2.40	1.28	
S NSW & N Vic	43	1.00	2.00	15.00	2.88	1.99	
Gippsland	2*	–	–	–	–	–	
W Vic & SE SA	135	1.00	2.00	15.00	2.59	0.63	
S SA	11	1.00	1.00	15.00	2.64	5.58	
KI	12	2.00	3.00	8.50	3.79	2.26	
WA	45	1.00	2.00	12.00	2.23	1.47	
All Regions	364	1.00	2.00	15.00	2.86	0.52	

** Results are omitted to preserve confidentiality, but used in calculating totals.*
Histogram class limits: 1 2.8 4.5 6.2 8 9.8 11.5 13.2 15. Anova: F=3.47, df=8, p=0.0007.
Note: percentages are adjusted for non-response bias as described in Appendix A1.6.3.

3.6.8 *Type of worm egg count*

Respondents also indicated which types of worm egg counts they had carried out. The tables below show the proportions of worm egg counts of each type

3.6.8.1 Lambs and/or weaners

Region	n	Individual animal WEC (%)*			Bulk mob WEC (%)*		
S Qld	7	0	0	41	59	100	100
New England	47	28	**43**	58	42	**57**	72
C & S Tablelands	38	13	26	43	57	74	87
S NSW & N Vic	55	30	**44**	58	42	**56**	70
Gippsland	10	0	0	31	69	100	100
W Vic & SE SA	116	4	**9**	15	85	**91**	96
S SA	19	0	**0**	18	82	**100**	100
KI	20	27	**50**	73	27	**50**	73
WA	38	2	**8**	21	79	**92**	98
All regions	350	18	22	27	73	78	82

**Percentage of worm egg counts. $\chi 2 = 6.28$, < 0.00005.*

3.6.8.2 Maiden and/oradult ewes

Region	n	Individual animal WEC (%)*			Bulk mob WEC (%)*		
S Qld	18	0	**0**	19	81	**100**	100
New England	66	42	**55**	67	33	**45**	58
C & S Tablelands	58	18	29	43	57	71	82
S NSW & N Vic	72	25	**36**	48	52	**64**	75
Gippsland	10	0	0	31	69	100	100
W Vic & SE SA	149	6	**11**	17	83	**89**	94
S SA	26	0	**4**	20	80	**96**	100
KI	25	21	**40**	61	39	**60**	79
WA	53	1	**6**	16	84	**94**	99
All regions	477	19	23	27	73	77	81

**Percentage of worm egg counts. $\chi 2 = 8.52$, < 0.00005.*

3.6.8.3 Wethers

Region	n	Individual animal WEC (%)*			Bulk mob WEC (%)*		
S Qld	11	0	0	28	72	100	100
New England	27	39	**59**	78	22	**41**	61
C & S Tablelands	26	37	**58**	77	23	**42**	63
S NSW & N Vic	26	17	35	56	44	65	83
Gippsland	6	0	0	46	54	100	100
W Vic & SE SA	87	3	**7**	14	86	**93**	97
S SA	7	0	0	41	59	100	100
KI	22	24	**45**	68	32	**55**	76
WA	23	0	**4**	22	78	**96**	100
All regions	235	19	24	30	70	76	81

**Percentage of worm egg counts. $\chi 2 = 6.76$, <0.00005.*

3.6.9 Drench resistance testing

3.6.9.1 Proportion who had tested one or more times in previous five years

Region	n	Proportions of respondents who had tested for drench resistance in the last five years (%)		
S Qld	50	21	34	49
New England	92	37	**48**	58
C & S Tablelands	86	17	26	36
S NSW & N Vic	94	20	29	39
Gippsland	8	16	50	84
W Vic & SE SA	240	29	**35**	41
S SA	42	9	19	34
KI	18	22	44	69
WA	213	10	**14**	19
All regions	843	26	29	32

$\chi 2 = 50.02$, $p<0.00005$.
Note: percentages are adjusted for non-response bias as described in Appendix A1.6.3.

3.6.9.2 Type of drench resistance test

Region	n	Proportions of respondents who had used FECRT in the last five years (%)		
S Qld	50	0	4	14
New England	92	9	**15**	24
C & S Tablelands	86	0	1	6
S NSW & N Vic	95	0	**1**	6
Gippsland	7	0	0	41
W Vic & SE SA	240	4	7	11
S SA	41	0	0	9
KI	17	1	12	36
WA	212	2	5	9
All regions	840	4	6	7

χ^2 =28.66, p=0.0017.
Note: percentages are adjusted for non-response bias as described in Appendix A1.6.3.

Region	n	Proportions of respondents who had used DrenchRite in the last five years (%)		
S Qld	50	0	0	7
New England	92	0	1	6
C & S Tablelands	86	0	1	6
S NSW & N Vic	94	6	**12**	20
Gippsland	8	3	**25**	65
W Vic & SE SA	241	4	7	12
S SA	42	0	0	8
KI	17	0	0	20
WA	213	2	5	8
All regions	843	4	5	7

χ^2 =29.55, p=0.0016.
Note: percentages are adjusted for non-response bias as described in Appendix A1.6.3.

Region	n	Proportions of respondents who had used, in the last five years, WEC before drenching and again within three weeks after drenching (%)		
S Qld	50	5	12	24
New England	91	5	10	18
C & S Tablelands	86	2	6	13
S NSW & N Vic	95	3	7	15
Gippsland	7	0	0	41
W Vic & SE SA	240	7	10	15
S SA	41	1	5	17
KI	18	0	6	27
WA	213	2	**4**	8
All regions	841	6	7	9

$\chi 2$ =9.10, p=0.3233.
Note: percentages are adjusted for non-response bias as described in Appendix A1.6.3.

Region	n	Proportions of respondents who had used, in the last five years, WEC only within three weeks after drenching (%)		
S Qld	50	2	8	19
New England	92	3	8	15
C & S Tablelands	86	3	7	15
S NSW & N Vic	95	0	2	7
Gippsland	8	0	0	37
W Vic & SE SA	240	2	4	8
S SA	42	0	0	8
KI	17	0	0	20
WA	212	0	0	2
All regions	842	2	3	5

$\chi 2$ =21.99, p=0.0116.
Note: percentages are adjusted for non-response bias as described in Appendix A1.6.3.

3.6.10 Person or organisation assisting with drench resistance testing

Respondents provided information on who assisted with their drench resistance tests. The question allowed for multiple responses

Region	n	Proportion of respondents with drench resistance testing assisted by the persons or organisations below (%)			
		Self	Government lab	Private lab	Vet or consultant
S Qld	9	33	44	22	33
New England	20	25	0	70	5
C & S Tablelands	33	30	30	33	18
S NSW & N Vic	19	11	21	63	5
Gippsland	3	33	0	33	33
W Vic & SE SA	57	18	0	30	58
S SA	9	11	0	56	44
KI	7	14	0	14	71
WA	24	25	4	25	50
All regions	181	22	10	38	36

Note: Row percentages may sum to more than 100, as respondents were able to name more than one category.

3.6.11 Drench resistance status of drench groups

Respondents provided their views as to the drench resistance status of the major drench groups for the main worm species on their properties. Major resistance was defined as less than 80% reduction in WEC, moderate resistance as 80-95% reduction in WEC and no resistance as over 95% reduction in WEC.

Drench group	n	Proportion of respondents giving drench resistance rating (%)			
		Major resistance	Moderate resistance	No resistance	Don't know
BZ (white drenches)	337	29	26	8	36
Levamisole (clear drench)	337	29	26	8	36
Organophosphate	336	26	29	10	35
Ivermectin	306	1	11	32	56
Abamectin	335	8	20	32	41
Moxidectin	318	4	17	33	45
Closantel	341	4	13	45	38
Triclabendazole (for fluke)	297	6	7	14	73
Monepantel	290	0	2	16	81

3.6.12 Views about the importance of factors when deciding whether to drench ewes

3.6.12.1 Ewes – results from faecal worm egg count

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	17	18	41	67	18	41	67	1	12	36	0	6	29
New England	42	32	48	64	14	26	42	3	10	23	7	17	31
C & S Tablelands	56	47	61	74	12	21	34	6	14	26	0	**4**	12
S NSW & N Vic	50	34	48	63	13	24	38	5	12	24	7	16	29
Gippsland	8	9	38	76	3	25	65	0	0	37	9	38	76
W Vic & SE SA	103	43	53	63	11	17	26	8	14	22	9	16	24
S SA	20	36	60	81	12	30	54	0	0	17	1	10	32
KI	12	28	58	85	2	17	48	2	17	48	0	8	38
WA	81	27	**37**	48	11	19	29	15	**23**	34	13	21	31
All regions	389	44	49	54	18	22	26	11	14	18	11	15	19

$\chi 2$ =32.32, p=0.1177.

3.6.12.2 Ewes – condition score of sheep

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	19	13	32	57	24	47	71	3	16	40	0	5	26
New England	57	14	25	38	24	37	51	18	30	43	3	9	19
C & S Tablelands	65	14	23	35	37	49	62	12	22	33	2	6	15
S NSW & N Vic	58	17	28	41	22	34	48	17	28	41	4	10	21
Gippsland	9	14	44	79	14	44	79	0	11	48	0	0	34
W Vic & SE SA	123	22	30	39	33	41	51	15	22	30	3	7	12
S SA	20	9	25	49	6	20	44	27	**50**	73	0	5	25
KI	13	2	15	45	9	31	61	14	38	68	2	15	45
WA	100	15	23	32	31	41	51	17	25	35	6	11	19
All regions	464	22	26	31	36	40	45	22	25	30	6	8	11

$\chi 2$ =20.63, p=0.6671.

3.6.12.3 Ewes – time of year

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	18	17	39	64	13	33	59	4	17	41	1	11	35
New England	60	45	**58**	71	22	33	47	1	5	14	0	3	12
C & S Tablelands	72	28	39	51	28	39	51	7	14	24	3	8	17
S NSW & N Vic	59	30	42	56	25	37	51	7	15	27	1	5	14
Gippsland	9	14	44	79	7	33	70	3	22	60	0	0	34
W Vic & SE SA	131	35	44	52	33	41	50	8	14	21	0	**2**	5
S SA	25	39	60	79	12	28	49	1	8	26	0	4	20
KI	15	21	47	73	12	33	62	0	7	32	2	13	40
WA	103	30	40	50	35	45	55	3	8	15	3	8	15
All regions	492	40	45	49	34	39	43	9	11	15	3	5	8

χ^2 =24.87, p=0.4075.

3.6.12.4 Ewes – seasonal weather conditions

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	19	29	53	76	13	32	57	3	16	40	0	0	18
New England	60	48	**62**	74	20	32	45	1	**5**	14	0	**2**	9
C & S Tablelands	65	35	**48**	60	29	42	54	2	**6**	15	1	5	13
S NSW & N Vic	56	20	32	46	25	38	51	10	20	32	4	11	22
Gippsland	9	14	44	79	14	44	79	0	11	48	0	0	34
W Vic & SE SA	123	17	**24**	33	33	41	51	17	**24**	33	5	10	16
S SA	21	1	**10**	30	30	52	74	15	33	57	0	5	24
KI	12	2	17	48	10	33	65	5	25	57	5	**25**	57
WA	100	15	**23**	32	30	40	50	15	23	32	8	**14**	22
All regions	465	29	34	38	35	39	44	15	18	22	6	9	12

χ^2 =66.76, p=<0.00005.

3.6.12.5 Ewes – availability of pasture

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	15	2	13	40	12	33	62	16	40	68	2	13	40
New England	56	14	**25**	38	23	36	50	17	29	42	4	11	22
C & S Tablelands	63	9	17	29	29	41	54	21	32	45	4	10	20
S NSW & N Vic	53	5	13	25	25	38	52	23	36	50	5	13	25
Gippsland	9	0	11	48	21	56	86	3	22	60	0	11	48
W Vic & SE SA	123	12	18	26	29	37	47	26	34	43	6	11	17
S SA	21	0	5	24	5	19	42	34	**57**	78	5	19	42
KI	12	0	8	38	21	50	79	10	33	65	0	8	38
WA	93	4	9	16	21	30	40	24	33	44	19	**28**	38
All regions	445	12	15	19	31	36	41	30	34	39	12	15	18

$\chi 2$ =33.44, p=0.0932.

3.6.12.6 Ewes – quality of pasture

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	15	4	20	48	4	20	48	16	40	68	4	20	48
New England	57	14	25	38	20	32	45	21	33	47	4	11	22
C & S Tablelands	62	9	18	30	28	40	54	20	31	44	5	11	22
S NSW & N Vic	52	6	13	26	20	33	47	22	35	49	10	19	33
Gippsland	9	7	33	70	7	33	70	3	22	60	0	11	48
W Vic & SE SA	120	10	17	25	27	36	45	25	33	43	8	14	22
S SA	21	0	5	24	5	19	42	26	48	70	11	29	52
KI	10	0	10	45	12	40	74	3	20	56	7	30	65
WA	96	5	10	18	19	28	38	27	36	47	17	**25**	35
All regions	442	13	16	20	28	33	37	30	34	39	14	17	21

$\chi 2$ =25.05, p=0.4040.

3.6.12.7 Ewes – presence of daggy sheep in mob

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	15	2	13	40	4	20	48	21	47	73	4	20	48
New England	59	19	31	44	14	24	37	24	36	49	4	10	21
C & S Tablelands	64	19	30	42	22	33	46	18	28	41	4	9	19
S NSW & N Vic	56	8	16	28	30	43	57	20	32	46	3	9	20
Gippsland	9	7	33	70	0	11	48	14	44	79	0	11	48
W Vic & SE SA	128	12	18	26	28	37	46	28	36	45	5	9	16
S SA	24	0	**0**	14	13	29	51	45	**67**	84	0	4	21
KI	12	0	8	38	2	17	48	15	42	72	10	**33**	65
WA	101	14	22	31	30	40	50	21	30	40	4	9	16
All regions	468	17	21	25	30	34	38	31	35	40	7	10	13

χ^2 =39.79, p=0.0215.

3.6.12.8 Ewes – weak sheep when driven (poor exercise tolerance)

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	19	43	**68**	87	9	26	51	0	5	26	0	0	18
New England	60	60	**73**	84	12	**22**	34	0	**3**	12	0	**2**	9
C & S Tablelands	65	32	**45**	57	21	32	45	9	17	28	2	6	15
S NSW & N Vic	53	12	23	36	22	34	48	15	26	40	8	17	30
Gippsland	9	14	44	79	7	33	70	3	22	60	0	0	34
W Vic & SE SA	121	12	**18**	26	35	44	53	20	**28**	37	5	10	17
S SA	20	0	**5**	25	41	**65**	85	9	25	49	0	5	25
KI	11	2	18	52	6	27	61	2	18	52	11	**36**	69
WA	100	13	**21**	30	30	40	50	13	21	30	11	**18**	27
All regions	458	28	32	37	32	37	42	17	20	24	8	11	14

χ^2 =111.13, p<0.00005.

3.6.12.9 Ewes – convenience, e.g. when sheep are yarded for other purposes

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	18	6	**22**	48	22	**44**	69	6	22	48	1	**11**	35
New England	54	3	9	20	12	22	36	21	33	47	23	35	49
C & S Tablelands	65	3	8	17	10	18	30	17	28	40	34	46	59
S NSW & N Vic	49	1	6	17	10	20	34	10	20	34	38	53	67
Gippsland	9	0	11	48	0	11	48	3	22	60	21	56	86
W Vic & SE SA	120	2	5	11	13	19	27	30	**39**	48	28	37	46
S SA	20	0	0	17	1	10	32	9	25	49	41	65	85
KI	10	0	0	31	7	30	65	0	**0**	31	35	70	93
WA	93	3	8	15	11	18	28	15	24	34	40	51	61
All regions	438	5	7	10	16	20	24	25	29	33	39	44	49

$\chi 2$ =39.84, p=0.0224.

3.6.12.10 Ewes – appearance of sheep

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	20	19	40	64	12	30	54	9	25	49	0	5	25
New England	60	32	**45**	58	28	40	53	5	**12**	23	0	3	12
C & S Tablelands	67	17	27	39	31	43	56	12	21	33	3	9	18
S NSW & N Vic	55	8	16	29	24	36	50	25	**38**	52	3	9	20
Gippsland	9	3	22	60	7	33	70	7	33	70	0	11	48
W Vic & SE SA	130	20	27	35	29	37	46	20	28	36	4	8	15
S SA	21	0	**5**	24	5	19	42	34	**57**	78	5	19	42
KI	12	5	25	57	2	17	48	2	17	48	15	**42**	72
WA	102	18	26	36	32	42	52	11	18	26	8	14	22
All regions	476	23	27	32	33	38	42	21	25	29	8	10	13

$\chi 2$ =58.21, p=0.0001.

3.6.13 Views on the importance of factors when deciding whether to drench weaners

3.6.13.1 Weaners – results from faecal worm egg count

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	15	16	40	68	21	**47**	73	0	7	32	0	7	32
New England	42	39	55	70	10	21	37	4	12	26	4	12	26
C & S Tablelands	54	51	65	77	15	26	40	1	6	15	0	**4**	13
S NSW & N Vic	46	39	54	69	8	17	31	5	13	26	6	15	29
Gippsland	8	16	50	84	9	38	76	0	0	37	0	12	53
W Vic & SE SA	100	48	58	68	8	14	22	9	15	24	7	13	21
S SA	20	41	65	85	6	20	44	0	5	25	1	10	32
KI	9	30	67	93	0	0	34	0	11	48	3	22	60
WA	83	28	**39**	50	14	23	33	11	**19**	29	11	19	29
All regions	377	48	54	59	17	21	25	10	13	17	10	13	17

χ^2 =32.97, p=0.1023.

3.6.13.2 Weaners – condition score of sheep

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	16	11	31	59	20	44	70	2	12	38	2	12	38
New England	54	26	39	53	23	35	49	9	19	31	2	7	18
C & S Tablelands	63	25	37	50	32	44	58	7	14	25	1	5	13
S NSW & N Vic	52	19	31	45	24	37	51	17	**29**	43	0	4	13
Gippsland	8	9	38	76	16	50	84	0	12	53	0	**0**	37
W Vic & SE SA	119	28	37	46	33	42	51	12	18	27	1	3	7
S SA	21	3	14	36	22	43	66	18	38	62	0	5	24
KI	10	0	10	45	19	50	81	3	20	56	3	20	56
WA	101	24	33	43	34	44	54	6	12	20	6	**12**	20
All regions	444	29	34	38	37	42	46	15	18	22	4	7	9

χ^2 =30.17, p=0.1750.

3.6.13.3 Weaners – time of year

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	17	10	29	56	23	47	72	4	18	43	0	6	29
New England	57	46	**60**	72	21	33	47	0	**2**	9	1	5	15
C & S Tablelands	66	33	45	58	22	33	46	5	12	22	3	9	19
S NSW & N Vic	57	26	39	52	28	40	54	9	18	30	0	4	12
Gippsland	8	16	50	84	0	12	53	3	25	65	0	12	53
W Vic & SE SA	124	35	44	54	33	42	51	6	11	18	1	2	7
S SA	22	24	45	68	21	41	64	1	9	29	0	5	23
KI	13	14	38	68	19	46	75	0	0	25	2	15	45
WA	109	32	41	51	34	43	53	4	9	16	3	6	13
All regions	473	40	44	49	35	40	44	8	11	14	4	5	8

$\chi 2$ =26.68, p=0.3158.

3.6.13.4 Weaners – seasonal weather conditions

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	17	18	41	67	23	47	72	1	12	36	0	0	20
New England	55	39	53	66	24	36	50	2	7	18	0	4	13
C & S Tablelands	66	33	45	58	30	42	55	3	8	17	1	5	13
S NSW & N Vic	53	18	30	44	30	43	58	9	19	32	2	8	18
Gippsland	8	9	38	76	9	38	76	3	25	65	0	0	37
W Vic & SE SA	117	17	24	33	39	49	58	14	21	29	3	7	13
S SA	23	3	13	34	13	30	53	27	48	69	1	9	28
KI	9	0	11	48	14	44	79	0	0	34	14	44	79
WA	99	13	20	29	33	43	54	14	21	31	9	15	24
All regions	447	26	31	35	39	43	48	14	18	22	6	9	11

$\chi 2$ =71.91, p=<0.00005.

3.6.13.5 Weaners – availability of pasture

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	15	2	13	40	8	27	55	32	**60**	84	0	0	22
New England	54	16	28	42	29	43	57	12	22	36	2	7	18
C & S Tablelands	63	18	29	41	33	46	59	9	**17**	29	3	8	18
S NSW & N Vic	50	12	22	36	28	42	57	16	28	42	2	8	19
Gippsland	8	0	12	53	24	62	91	3	25	65	0	0	37
W Vic & SE SA	112	17	25	34	30	39	49	19	27	36	4	9	16
S SA	22	1	9	29	3	**14**	35	24	45	68	14	**32**	55
KI	7	0	0	41	4	29	71	4	29	71	10	**43**	82
WA	94	11	18	27	22	31	41	24	33	43	11	**18**	27
All regions	425	18	22	26	33	38	42	24	28	33	9	12	15

χ^2 =49.41, p=0.0017.

3.6.13.6 Weaners – quality of pasture

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	15	15	2	13	40	16	40	68	16	40	68	0	7
New England	57	55	19	31	45	25	38	52	13	24	37	2	7
C & S Tablelands	62	63	17	27	40	35	48	61	**7**	14	25	5	11
S NSW & N Vic	52	50	10	20	34	25	38	53	18	30	45	5	12
Gippsland	9	8	3	25	65	16	50	84	3	25	65	0	0
W Vic & SE SA	120	114	16	24	33	31	40	50	19	27	36	4	9
S SA	21	23	1	9	28	**3**	13	34	**27**	48	69	**13**	30
KI	10	7	0	14	58	4	29	71	0	0	41	**18**	57
WA	96	95	12	19	28	24	34	44	18	26	36	**13**	21
All regions	442	430	18	22	27	33	38	43	22	26	30	11	14

χ^2 =47.00, p=0.0029.

3.6.13.7 Weaners – presence of daggy sheep in mob

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	16	11	31	59	7	25	52	7	25	52	4	19	46
New England	56	28	**41**	55	13	**23**	36	20	32	46	0	4	12
C & S Tablelands	65	20	31	43	31	43	56	11	20	32	2	6	15
S NSW & N Vic	54	11	20	34	24	37	51	24	37	51	1	6	15
Gippsland	8	9	38	76	3	25	65	3	25	65	0	12	53
W Vic & SE SA	121	13	20	28	29	38	47	26	34	43	4	8	15
S SA	21	0	**0**	16	38	**62**	82	11	29	52	1	10	30
KI	10	0	10	45	12	40	74	3	20	56	7	**30**	65
WA	100	19	27	37	35	45	55	10	**17**	26	6	11	19
All regions	451	21	25	30	34	39	43	23	27	32	6	9	12

$\chi 2 = 44.62$, $p = 0.0073$.

3.6.13.8 Weaners – weak sheep when driven (poor exercise tolerance)

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	16	30	56	80	11	31	59	2	12	38	0	0	21
New England	57	60	**74**	84	13	**23**	36	0	**2**	9	0	2	9
C & S Tablelands	62	42	**55**	68	17	27	40	6	13	24	1	5	13
S NSW & N Vic	52	17	29	43	30	44	59	11	21	35	1	6	16
Gippsland	8	3	25	65	24	62	91	0	12	53	0	0	37
W Vic & SE SA	117	20	**27**	36	28	37	46	20	**28**	37	4	8	14
S SA	22	8	23	45	11	27	50	14	32	55	5	18	40
KI	10	7	30	65	3	20	56	3	20	56	7	**30**	65
WA	98	18	**27**	36	31	41	51	10	17	26	9	**15**	24
All regions	442	33	38	43	30	35	39	15	19	22	6	9	12

$\chi 2 = 81.67$, $p < 0.00005$.

3.6.13.9 Weaners – convenience, e.g. when sheep are yarded for other purposes

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	15	4	20	48	21	**47**	73	2	13	40	4	20	48
New England	51	4	12	24	11	22	35	22	35	50	19	**31**	46
C & S Tablelands	62	5	11	22	12	21	33	14	24	37	31	44	57
S NSW & N Vic	48	2	8	20	9	19	33	10	21	35	37	52	67
Gippsland	8	3	25	65	0	12	53	3	25	65	9	38	76
W Vic & SE SA	114	3	6	12	14	21	30	23	**32**	41	32	41	51
S SA	22	0	0	15	3	14	35	5	18	40	45	**68**	86
KI	7	0	0	41	4	29	71	0	0	41	29	71	96
WA	95	3	7	15	16	24	34	10	17	26	41	52	62
All regions	422	6	9	12	18	22	26	20	24	29	40	45	50

χ^2 =35.26, p=0.0649.

3.6.13.10 Weaners – appearance of sheep

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	14	5	21	51	29	57	82	0	7	34	2	14	43
New England	53	32	**45**	60	26	40	54	4	11	23	0	4	13
C & S Tablelands	64	27	39	52	24	36	49	9	17	29	3	8	17
S NSW & N Vic	53	15	26	40	32	45	60	12	23	36	1	6	16
Gippsland	7	0	14	58	10	43	82	4	29	71	0	14	58
W Vic & SE SA	122	22	30	39	30	39	48	16	23	31	4	8	15
S SA	20	0	**5**	25	19	40	64	27	**50**	73	0	5	25
KI	10	3	20	56	3	20	56	3	20	56	12	**40**	74
WA	101	20	29	39	33	43	53	10	17	26	6	12	20
All regions	444	26	31	35	36	40	45	16	20	24	7	9	12

χ^2 =43.08, p=0.0107.

3.6.14 Treatments or techniques used for sheep worm control

3.6.14.1 Treat for worms (drenching, injection, capsule

Region	n	Proportion of respondents (%)		
S Qld	25	64	84	95
New England	63	85	94	98
C & S Tablelands	79	75	85	92
S NSW & N Vic	72	74	85	92
Gippsland	9	52	89	100
W Vic & SE SA	154	81	87	92
S SA	28	88	**100**	100
KI	17	64	88	99
WA	128	79	86	91
All regions	575	84	87	90

$\chi 2 = 7.82$, $p=0.4476$.

3.6.14.2 Prepare clean pastures by spelling or resting paddock ('long spelling'

Region	n	Proportion of respondents (%)		
S Qld	25	24	44	65
New England	63	60	73	83
C & S Tablelands	79	61	72	82
S NSW & N Vic	72	55	67	77
Gippsland	9	52	89	100
W Vic & SE SA	154	47	**55**	63
S SA	28	59	79	92
KI	17	23	47	72
WA	128	49	58	66
All regions	575	58	62	66

$\chi 2 = 22.48$, $p=0.0034$.

3.6.14.3 Prepare clean pastures by cropping paddock

Region	n	Proportion of respondents (%)		
S Qld	25	0	**4**	20
New England	63	8	**16**	27
C & S Tablelands	79	16	**25**	36
S NSW & N Vic	72	38	50	62
Gippsland	9	7	33	70
W Vic & SE SA	154	28	35	43
S SA	28	13	29	49
KI	17	23	47	72
WA	128	58	**67**	75
All regions	575	35	39	43

$\chi^2 = 82.28, p<0.00005$.

3.6.14.4 Prepare clean pastures by cattle sheep alternation

Region	n	Proportion of respondents (%)		
S Qld	25	7	20	41
New England	63	49	**62**	74
C & S Tablelands	79	16	25	36
S NSW & N Vic	72	13	22	34
Gippsland	9	14	44	79
W Vic & SE SA	154	16	23	30
S SA	28	22	39	59
KI	17	10	29	56
WA	128	8	**13**	20
All regions	575	23	26	30

$\chi^2 = 58.43, p<0.00005$.

3.6.14.5 Prepare clean pastures by intensive rotational grazing

Region	n	Proportion of respondents (%)		
S Qld	25	0	4	20
New England	63	10	19	31
C & S Tablelands	79	17	**27**	38
S NSW & N Vic	72	10	18	29
Gippsland	9	14	**44**	79
W Vic & SE SA	154	10	15	22
S SA	28	19	**36**	56
KI	17	1	12	36
WA	128	5	**9**	16
All regions	575	14	17	20

$\chi^2 = 26.15, p=0.0013$.

3.6.14.6 Prepare clean pastures by using 'Smart Grazing' techniques

Region	n	Proportion of respondents (%)		
S Qld	25	1	8	26
New England	63	10	19	31
C & S Tablelands	79	11	19	29
S NSW & N Vic	72	3	8	17
Gippsland	9	7	33	70
W Vic & SE SA	154	4	8	13
S SA	28	6	18	37
KI	17	0	6	29
WA	128	6	11	18
All regions	575	10	12	15

$\chi 2 = 15.81$, $p=0.0465$.

3.6.14.7 Leave some sheep un-drenched

Region	n	Proportion of respondents (%)		
S Qld	25	0	4	20
New England	63	0	**0**	6
C & S Tablelands	79	0	3	9
S NSW & N Vic	72	0	3	10
Gippsland	9	3	22	60
W Vic & SE SA	154	9	**14**	21
S SA	28	0	4	18
KI	17	0	6	29
WA	128	7	12	19
All regions	575	6	8	11

$\chi 2 = 25.89$, $p=0.0025$.

3.6.14.8 Proportion of sheep left un-drenched (%)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
All Regions	40	0.8	5.0	100.0	16.6	17.8	

Histogram class limits: 0 10.7 20.6 30.5 40.5 50.4 60.3 70.2 80.2 90.1 100
Note: a small number of respondents indicated that a proportion of sheep were left un-drenched only sometimes, or that only a proportion of sheep in better condition were left un-drenched.

3.6.14.9 Feeding strategy

Region	n	Proportion of respondents (%)		
S Qld	25	0	4	20
New England	63	7	14	25
C & S Tablelands	79	5	11	21
S NSW & N Vic	72	5	11	21
Gippsland	9	3	22	60
W Vic & SE SA	154	12	18	25
S SA	28	4	14	33
KI	17	0	6	29
WA	128	13	20	27
All regions	575	12	15	18

$\chi^2 = 8.76$, $p=0.3586$.

3.6.14.10 Use rams selected for resistance to worms

Region	n	Proportion of respondents (%)		
S Qld	25	7	20	41
New England	63	18	**29**	41
C & S Tablelands	79	3	8	16
S NSW & N Vic	72	2	**6**	14
Gippsland	9	3	22	60
W Vic & SE SA	154	5	9	15
S SA	28	1	7	24
KI	17	7	24	50
WA	128	10	16	23
All regions	575	10	13	16

$\chi^2 = 26.14$, $p=0.0017$.

3.6.14.11 Proportion of those selecting rams, who used ASBV for WEC

Region	n	Proportion of respondents (%)		
S Qld	7	29	71	96
New England	21	58	81	95
C & S Tablelands	12	28	58	85
S NSW & N Vic	7	18	57	90
Gippsland	3	1	33	91
W Vic & SE SA	23	43	65	84
S SA	3	9	67	99
KI	6	36	83	100
WA	27	25	**44**	65
All regions	109	53	62	71

$\chi^2 = 9.50$, $p=0.3090$.

3.7 Blow Fly Control

3.7.1 Incidence of blow fly strike in 2011

The following tables show the proportion of respondents reporting various types of fly strike and, where respondent numbers are sufficient, the percentage of animals affected.

3.7.1.1 Breech strike in ewes

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	22	55	77	92
New England	47	72	85	94
C & S Tablelands	64	64	77	86
S NSW & N Vic	64	63	75	85
Gippsland	9	66	100	100
W Vic & SE SA	122	66	75	82
S SA	26	56	77	91
KI	16	62	88	98
WA	105	69	78	86
All regions	475	74	78	82

$\chi 2 = 6.83$, $p = 0.5567$.

3.7.1.2 Percentage of ewes reported as affected with breech strike

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	17	0.5	3.0	30.0	5.3	8.0	
New England	41	0.2	1.0	90.0	4.2	8.8	
C & S Tablelands	49	0.0	1.0	10.0	2.0	1.2	
S NSW & N Vic	49	0.1	2.0	40.0	4.8	4.0	
Gippsland	9	0.5	1.0	99.0	13.1	49.8	
W Vic & SE SA	91	0.0	2.0	60.0	5.2	4.2	
S SA	20	0.1	2.5	10.0	3.2	2.8	
KI	14	0.0	2.0	15.0	2.9	4.2	
WA	83	0.0	1.0	75.0	2.9	3.6	
All Regions	373	0.0	2.0	99.0	4.1	2.0	

Histogram class limits: 0 12.4 24.8 37.1 49.5 61.9 74.3 86.6 99. Anova: F=1.63, df=8, p=0.1147

3.7.1.3 Body strike in ewes

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	22	45	68	86
New England	47	34	**49**	64
C & S Tablelands	64	43	**56**	69
S NSW & N Vic	64	66	**78**	87
Gippsland	9	52	89	100
W Vic & SE SA	122	80	**87**	92
S SA	26	33	54	73
KI	16	35	62	85
WA	105	46	**56**	66
All regions	475	63	68	72

$\chi^2 = 48.22$, $p<0.00005$.

3.7.1.4 Percentage of ewes reported as affected with body strike

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	15	0.1	1.0	30.0	4.1	8.3	
New England	23	0.0	1.0	10.0	2.3	2.8	
C & S Tablelands	36	0.1	1.0	90.0	4.4	10.0	
S NSW & N Vic	52	0.1	2.0	80.0	6.3	7.3	
Gippsland	8	0.5	1.0	5.0	1.5	2.5	
W Vic & SE SA	106	0.0	4.0	80.0	8.9	5.6	
S SA	14	0.2	2.0	10.0	3.2	3.7	
KI	10	0.1	1.0	5.0	1.7	2.5	
WA	59	0.0	1.0	20.0	2.5	2.0	
All Regions	323	0.0	2.0	90.0	5.5	2.5	

Histogram class limits: 0 11.3 22.5 33.8 45 56.3 67.5 78.8 90. Anova: F=2.35, df=8, p=0.018

3.7.1.5 Poll strike in ewes

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	22	0	0	15
New England	47	0	0	8
C & S Tablelands	64	3	8	17
S NSW & N Vic	64	1	5	13
Gippsland	9	0	11	48
W Vic & SE SA	122	6	**11**	19
S SA	26	0	4	20
KI	16	0	0	21
WA	105	3	7	13
All regions	475	4	7	9

$\chi 2 = 11.26, p=0.1817$.

3.7.1.6 Percentage of ewes reported as affected with poll strike

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	0	–	–	–	–	–	
New England	0	–	–	–	–	–	
C & S Tablelands	5	0.2	1.0	5.0	2.2	5.3	
S NSW & N Vic	4	1.0	1.0	5.0	2.0	6.4	
Gippsland	1*	–	–	–	–	–	
W Vic & SE SA	14	0.0	1.5	45.0	4.6	13.5	
S SA	1*	–	–	–	–	–	
KI	0	–	–	–	–	–	
WA	7	1.0	1.0	10.0	2.4	6.2	
All Regions	32	NA	1.0	NA	3.2	5.7	

** Results are omitted to preserve confidentiality, but used in calculating totals.*
Histogram class limits: 0 5.6 11.3 16.9 22.5 28.1 33.8 39.4 45. Anova: F=0.14, df=5, p=0.9807

3.7.1.7 Wound strike in ewes

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	22	0	0	15
New England	47	0	0	8
C & S Tablelands	64	0	3	11
S NSW & N Vic	64	0	3	11
Gippsland	9	0	0	34
W Vic & SE SA	122	3	**7**	14
S SA	26	0	4	20
KI	16	0	0	21
WA	105	1	4	9
All regions	475	2	4	6

$\chi^2 = 7.76$, $p=0.4292$.

3.7.1.8 Breech strike in wethers

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	13	19	46	75
New England	26	30	50	70
C & S Tablelands	36	16	31	48
S NSW & N Vic	15	12	33	62
Gippsland	5	48	**100**	100
W Vic & SE SA	53	42	57	70
S SA	7	10	43	82
KI	11	17	45	77
WA	39	23	38	55
All regions	205	38	45	52

$\chi^2 = 17.78$, $p=0.0220$.

3.7.1.9 Percentage of wethers reported as affected with breech strike

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	6	1.0	1.5	30.0	7.5	24.3	
New England	13	0.1	1.0	2.0	1.0	0.5	
C & S Tablelands	11	1.0	1.0	5.0	1.7	1.7	
S NSW & N Vic	5	1.0	2.0	3.0	1.8	2.1	
Gippsland	5	0.5	2.0	99.0	20.9	108.4	
W Vic & SE SA	30	1.0	2.0	50.0	3.9	6.7	
S SA	3	1.0	1.0	5.0	2.3	11.5	
KI	5	1.0	2.0	5.0	2.4	4.2	
WA	15	0.1	2.0	75.0	12.2	25.6	
All Regions	93	0.1	1.0	99.0	5.5	6.2	

Histogram class limits: 0 12.4 24.8 37.2 49.5 61.9 74.3 86.6 99. Anova: F=1.46, df=8, p=0.1858

3.7.1.10 Body strike in wethers

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	13	46	77	95
New England	26	12	**27**	48
C & S Tablelands	36	28	44	62
S NSW & N Vic	15	16	40	68
Gippsland	5	15	60	95
W Vic & SE SA	53	54	**68**	80
S SA	7	4	29	71
KI	11	11	36	69
WA	39	26	41	58
All regions	205	42	49	56

$\chi 2$ = 20.61, p=0.0061.

3.7.1.11 Percentage of wethers reported as affected with body strike

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	10	1.0	2.0	30.0	7.0	13.2	
New England	7	1.0	1.0	3.0	1.4	1.5	
C & S Tablelands	16	0.0	1.0	10.0	2.1	2.6	
S NSW & N Vic	6	0.5	1.5	10.0	3.2	7.9	
Gippsland	3	0.5	1.0	2.0	1.2	3.8	
W Vic & SE SA	36	0.2	3.5	80.0	8.4	10.4	
S SA	2	2.0	2.5	3.0	2.5	12.7	
KI	4	1.0	2.5	5.0	2.8	5.4	
WA	16	0.2	2.5	60.0	7.5	15.6	
All Regions	100	0.0	2.0	80.0	5.7	4.6	

Histogram class limits: 0 10 20 30 40 50 60 70 80. Anova: F=0.76, df=8, p=0.6402

3.7.1.12 Pizzle strike in wethers

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	13	32	62	86
New England	26	9	23	44
C & S Tablelands	36	28	44	62
S NSW & N Vic	15	8	27	55
Gippsland	5	5	40	85
W Vic & SE SA	53	33	47	61
S SA	7	0	14	58
KI	11	6	27	61
WA	39	17	31	48
All regions	205	31	38	45

χ^2 = 11.98, p=0.1494.

3.7.1.13 Percentage of wethers reported as affected with pizzle strike

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	8	1.0	2.0	30.0	5.2	16.8	
New England	6	1.0	1.0	1.0	1.0	0.0	
C & S Tablelands	16	0.2	1.0	10.0	2.0	2.6	
S NSW & N Vic	4	0.5	1.5	10.0	3.4	14.2	
Gippsland	2	1.0	1.5	2.0	1.5	12.7	
W Vic & SE SA	25	0.5	2.0	50.0	4.9	8.1	
S SA	1	2.0	2.0	2.0	2.0	NaN	
KI	3	1.0	1.0	2.0	1.3	2.9	
WA	12	0.1	1.0	60.0	8.6	21.9	
All Regions	77	0.1	1.0	60.0	4.3	4.3	

Histogram class limits: 0 7.6 15.1 22.6 30.1 37.5 45 52.5 60. Anova: F=0.58, df=8, p=0.7903

3.7.1.14 Poll strike in wethers

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	13	0	8	36
New England	26	1	8	25
C & S Tablelands	36	5	14	29
S NSW & N Vic	15	0	7	32
Gippsland	5	1	20	72
W Vic & SE SA	53	15	**26**	40
S SA	7	0	0	41
KI	11	0	0	28
WA	39	3	10	24
All regions	205	9	14	19

$\chi 2 = 11.98$, $p=0.1494$.

3.7.1.15 Wound strike in wethers

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	13	0	0	25
New England	26	0	4	20
C & S Tablelands	36	1	6	19
S NSW & N Vic	15	0	0	22
Gippsland	5	0	0	52
W Vic & SE SA	53	1	6	16
S SA	7	0	0	41
KI	11	0	0	28
WA	39	0	0	9
All regions	205	1	3	6

$\chi^2 = 5.06$, $p=0.7126$.

3.7.1.16 Breech strike in weaners

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	18	31	56	78
New England	40	29	45	62
C & S Tablelands	52	30	44	59
S NSW & N Vic	44	8	18	33
Gippsland	6	12	50	88
W Vic & SE SA	88	33	43	54
S SA	18	10	28	53
KI	13	19	46	75
WA	88	13	**20**	30
All regions	367	30	35	40

$\chi^2 = 8.39$, $p=0.4000$.

3.7.1.17 Percentage of weaners reported as affected with breech strike

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	15	0.5	2.0	30.0	5.7	11.0	
New England	28	1.0	2.0	10.0	3.1	2.2	
C & S Tablelands	37	0.5	3.0	20.0	4.5	3.5	
S NSW & N Vic	31	0.1	2.0	20.0	3.5	2.9	
Gippsland	6	1.0	2.0	99.0	18.3	83.0	
W Vic & SE SA	52	0.3	2.0	40.0	4.6	4.1	
S SA	11	0.1	2.0	5.0	2.5	2.5	
KI	8	1.0	2.0	15.0	3.9	7.8	
WA	58	0.0	2.0	75.0	5.1	5.5	
All Regions	246	0.0	2.0	99.0	4.7	2.3	

Histogram class limits: 0 12.4 24.8 37.1 49.5 61.9 74.3 86.6 99. Anova: F=1.95, df=8, p=0.0537

3.7.1.18 Body strike in weaners

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	18	31	56	78
New England	40	29	45	62
C & S Tablelands	52	29	42	57
S NSW & N Vic	44	8	18	33
Gippsland	6	22	67	96
W Vic & SE SA	88	28	39	50
S SA	18	6	22	48
KI	13	25	54	81
WA	88	14	22	32
All regions	367	29	34	39

$\chi 2$ = 8.93, p=0.3507.

3.7.1.19 Percentage of weaners reported as affected with body strike

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	14	0.5	1.5	50.0	12.4	21.4	
New England	29	0.5	1.0	10.0	2.3	1.9	
C & S Tablelands	38	0.1	3.5	80.0	8.2	9.6	
S NSW & N Vic	32	0.1	2.0	90.0	7.8	12.2	
Gippsland	5	1.0	1.0	2.0	1.2	1.1	
W Vic & SE SA	61	0.5	4.0	80.0	10.6	8.4	
S SA	13	0.1	2.0	40.0	5.6	12.9	
KI	7	1.0	2.0	5.0	2.4	3.4	
WA	51	0.1	2.0	25.0	4.3	3.1	
All Regions	250	0.1	2.0	90.0	7.1	3.3	

Histogram class limits: 0 11.3 22.6 33.8 45.1 56.3 67.5 78.8 90. Anova: F=1.96, df=8, p=0.0526

3.7.1.20 Pizzle strike in weaners

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	18	10	**28**	53
New England	40	1	5	17
C & S Tablelands	52	4	12	23
S NSW & N Vic	44	1	5	15
Gippsland	6	0	17	64
W Vic & SE SA	88	9	16	25
S SA	18	4	17	41
KI	13	2	15	45
WA	88	2	6	13
All regions	367	8	11	15

χ^2 = 16.45, p=0.0369

3.7.1.21 Percentage of weaners reported as affected with pizzle strike

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	7	0.5	1.0	3.0	1.2	1.5	
New England	2	0.5	0.8	1.0	0.8	6.4	
C & S Tablelands	8	0.2	1.0	5.0	1.6	2.8	
S NSW & N Vic	4	0.5	1.0	10.0	3.1	14.6	
Gippsland	2	0.5	0.8	1.0	0.8	6.4	
W Vic & SE SA	15	0.5	3.0	20.0	3.9	5.4	
S SA	3	1.0	2.0	10.0	4.3	24.5	
KI	2	1.0	1.5	2.0	1.5	12.7	
WA	9	0.1	1.0	30.0	6.4	16.7	
All Regions	52	0.1	1.0	30.0	3.3	3.1	

Histogram class limits: 0 3.8 7.6 11.3 15 18.8 22.5 26.3 30. Anova: F=0.68, df=8, p=0.7074

3.7.1.22 Poll strike in weaners

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	18	0	6	27
New England	40	2	8	20
C & S Tablelands	52	6	**13**	26
S NSW & N Vic	44	0	2	12
Gippsland	6	0	0	46
W Vic & SE SA	88	4	9	17
S SA	18	0	6	27
KI	13	0	0	25
WA	88	1	3	10
All regions	367	4	7	10

$\chi 2$ = 9.15, p=0.3198.

3.7.1.23 Wound strike in weaners

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	18	0	0	19
New England	40	3	10	24
C & S Tablelands	52	0	4	13
S NSW & N Vic	44	0	0	8
Gippsland	6	0	0	46
W Vic & SE SA	88	1	3	10
S SA	18	0	6	27
KI	13	0	0	25
WA	88	0	2	8
All regions	367	2	3	6

$\chi^2 = 5.01$, $p=0.757$

3.7.1.24 Breech strike in rams

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	20	0	5	25
New England	45	5	13	27
C & S Tablelands	56	8	16	28
S NSW & N Vic	57	5	12	24
Gippsland	9	7	33	70
W Vic & SE SA	106	13	20	29
S SA	23	13	30	53
KI	13	2	15	45
WA	95	20	**28**	39
All regions	424	16	20	24

$\chi^2 = 5.01$, $p=0.7570$.

3.7.1.25 Percentage of rams reported as affected with breech strike

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	1*	–	–	–	–	–	
New England	6	1.0	1.0	2.0	1.2	0.9	
C & S Tablelands	9	1.0	1.0	10.0	2.6	4.7	
S NSW & N Vic	7	0.1	1.0	5.0	1.7	2.9	
Gippsland	3	1.0	2.0	99.0	34.0	279.7	
W Vic & SE SA	21	0.5	1.0	10.0	2.1	2.0	
S SA	7	1.0	2.0	5.0	2.7	3.0	
KI	2	1.0	3.0	5.0	3.0	50.8	
WA	27	0.1	1.0	75.0	4.3	11.2	
All Regions	83	0.1	1.0	99.0	4.3	6.0	

** Results are omitted to preserve confidentiality, but used in calculating totals.*
Histogram class limits: 0 12.5 24.8 37.2 49.6 61.9 74.3 86.6 99. Anova: F=2.79, df=8, p=0.0093

3.7.1.26 Body strike in rams

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	20	3	15	38
New England	45	1	4	15
C & S Tablelands	56	5	12	24
S NSW & N Vic	57	7	16	28
Gippsland	9	0	0	34
W Vic & SE SA	106	12	**19**	28
S SA	23	1	9	28
KI	13	0	0	25
WA	95	4	9	17
All regions	424	9	12	16

$\chi 2 = 5.01$, $p=0.7570$.

3.7.1.27 Pizzle strike in rams

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	20	0	5	25
New England	45	1	4	15
C & S Tablelands	56	1	5	15
S NSW & N Vic	57	0	2	9
Gippsland	9	0	11	48
W Vic & SE SA	106	3	7	13
S SA	23	0	4	22
KI	13	0	8	36
WA	95	2	6	13
All regions	424	3	5	8

$\chi^2 = 2.77$, $p=0.9606$.

3.7.1.28 Poll strike in rams

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	20	23	45	68
New England	45	30	44	60
C & S Tablelands	56	38	52	65
S NSW & N Vic	57	13	23	36
Gippsland	9	7	33	70
W Vic & SE SA	106	26	35	45
S SA	23	10	26	48
KI	13	32	62	86
WA	95	45	56	66
All regions	424	37	42	47

$\chi^2 = 5.81$, $p=0.6307$.

3.7.1.29 Percentage of rams reported as affected with poll strike

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	9	0.5	2.0	50.0	7.1	24.8	
New England	20	0.5	1.0	20.0	2.7	4.0	
C & S Tablelands	29	0.0	2.0	20.0	4.7	4.1	
S NSW & N Vic	13	0.5	5.0	40.0	7.5	13.0	
Gippsland	3	2.0	2.0	10.0	4.7	22.9	
W Vic & SE SA	37	0.2	2.0	20.0	4.2	3.5	
S SA	6	1.0	2.0	2.0	1.7	1.1	
KI	8	0.1	1.5	10.0	2.9	5.4	
WA	53	0.5	2.0	25.0	3.5	2.7	
All Regions	178	0.0	2.0	50.0	4.2	1.9	

Histogram class limits: 0 6.3 12.5 18.8 25 31.3 37.5 43.8 50. Anova: F=1.06, df=8, p=0.3972

3.7.1.30 Wound strike in rams

Region	n	Proportion of respondents reporting fly strike (%)		
S Qld	20	0	0	17
New England	45	1	4	15
C & S Tablelands	56	0	2	10
S NSW & N Vic	57	0	2	9
Gippsland	9	0	0	34
W Vic & SE SA	106	0	0	3
S SA	23	0	4	22
KI	13	0	0	25
WA	95	0	2	7
All regions	424	1	2	3

$\chi 2 = 5.81$, $p=0.6312$.

3.7.2 *Usual chemical treatments for fly strike*

3.7.2.1 Treat routinely with preventative chemicals every year

Region	n	Proportion of respondents (%)		
S Qld	25	28	48	69
New England	63	36	49	62
C & S Tablelands	79	47	**58**	69
S NSW & N Vic	72	42	54	66
Gippsland	9	30	67	93
W Vic & SE SA	154	36	44	52
S SA	28	16	32	52
KI	17	18	41	67
WA	128	29	**38**	46
All regions	575	42	46	50

$\chi^2 = 14.77$, $p=0.0622$.

3.7.2.2 Treat with preventative chemicals only risk of fly strike is high

Region	n	Proportion of respondents (%)		
S Qld	25	24	44	65
New England	63	29	41	54
C & S Tablelands	79	24	34	46
S NSW & N Vic	72	29	40	53
Gippsland	9	14	44	79
W Vic & SE SA	154	29	37	45
S SA	28	13	29	49
KI	17	7	24	50
WA	128	25	33	42
All regions	575	32	36	40

$\chi^2 = 4.85$, $p=0.7798$.

3.7.2.3 Treat whole mob once fly strike is detected

Region	n	Proportion of respondents (%)		
S Qld	25	15	32	54
New England	63	7	14	25
C & S Tablelands	79	10	18	28
S NSW & N Vic	72	11	19	30
Gippsland	9	7	33	70
W Vic & SE SA	154	15	21	29
S SA	28	2	11	28
KI	17	0	**0**	20
WA	128	14	20	28
All regions	575	16	19	23

$\chi 2 = 10.86, p=0.2055$.

3.7.2.4 Only treat individually struck sheep

Region	n	Proportion of respondents (%)		
S Qld	25	12	28	49
New England	63	17	27	40
C & S Tablelands	79	16	25	36
S NSW & N Vic	72	19	29	41
Gippsland	9	3	22	60
W Vic & SE SA	154	25	32	40
S SA	28	41	61	78
KI	17	18	41	67
WA	128	37	46	55
All regions	575	31	35	39

$\chi 2 = 23.13, p=0.0032$.

3.7.3 *Month treatment carried out in 2011*

3.7.3.1 Treat routinely with preventative chemicals every year and only treat when fly risk is high

Region	n	Proportion of respondents treating routinely	n	Proportion of respondents treating when risk is high
S Qld	13		11	
New England	29		23	
C & S Tablelands	45		21	
S NSW & N Vic	39		17	
Gippsland	6		3	
W Vic & SE SA	61		37	
S SA	9		5	
KI	6		3	
WA	42		32	
All Regions	250		152	

Figures for the histograms above are provided in Appendix A2.15.1.

3.7.3.2 Treat treat whole mob once fly strike is detected, and treat individually struck sheep

Region	n	Proportion of respondents treating whole mob	n	Proportion of respondents treating individually
S Qld	5		2	
New England	5		4	
C & S Tablelands	12		3	
S NSW & N Vic	8		7	
Gippsland	2		0	
W Vic & SE SA	19		17	
S SA	3		5	
KI	0		3	
WA	16		22	
All Regions	70		63	

Figures for the histograms above are provided in Appendix A2.15.1.

3.7.4 Chemicals used for fly strike in 2011

3.7.4.1 Treat routinely with preventative chemicals every year

Region	n	Proportion of respondents (%)															
		Cyromazine	Dicyclanil	Ivermectin	Abamectin	Spinosad	Diazinon	Propetamphos	Clorfenvinphos	Temephos	Imidacloprid	Alpha cypermethrin	Pyrethrin	Diflubenzuron	Triflumuron	Vinegar	Unspecified product
S Qld	12	42	33	33	0	0	0	0	0	0	0	8	0	0	0	0	0
New England	30	43	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C & S Tablelands	43	30	74	0	0	0	0	0	0	0	0	0	0	0	0	0	2
S NSW & N Vic	39	28	64	8	0	0	0	0	0	0	3	0	0	0	0	0	5
Gippsland	6	50	33	0	0	17	0	0	0	0	0	0	0	0	0	0	0
W Vic & SE SA	59	39	51	5	0	3	2	0	0	2	3	0	0	0	2	0	3
S SA	9	44	44	0	0	0	0	0	0	0	0	0	0	0	0	0	11
KI	5	60	0	20	0	20	0	0	0	0	0	0	0	0	0	0	0
WA	44	30	43	25	0	2	2	0	0	0	0	0	0	0	0	0	2
All regions	247	36	54	9	0	2	1	0	0	0	1	0	0	0	0	0	3

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

3.7.4.2 Treat with preventative chemicals only risk of fly strike is high

Region	n	Proportion of respondents (%)															
		Cyromazine	Dicyclanil	Ivermectin	Abamectin	Spinosad	Diazinon	Propetamphos	Clorfenvinphos	Temephos	Imidacloprid	Alpha cypermethrin	Pyrethrin	Diflubenzuron	Triflumuron	Vinegar	Unspecified product
S Qld	9	44	22	11	0	0	0	0	0	0	0	11	0	0	0	0	11
New England	18	11	67	11	0	6	0	0	0	0	0	0	0	0	0	0	11
C & S Tablelands	24	42	50	4	0	8	0	0	0	0	0	0	0	0	0	0	8
S NSW & N Vic	20	55	35	5	0	5	0	0	0	0	0	0	5	5	0	0	5
Gippsland	4	25	50	0	0	0	0	0	0	0	0	0	0	0	0	0	25
W Vic & SE SA	29	41	41	10	0	7	3	3	0	0	0	0	0	0	0	0	3
S SA	6	67	33	0	0	17	0	0	0	0	0	0	0	0	0	0	0
KI	4	25	0	25	0	0	50	0	0	0	0	0	0	0	0	0	0
WA	35	26	40	34	0	3	0	0	0	0	0	0	0	0	0	0	3
All regions	149	36	42	14	0	5	2	1	0	0	0	1	1	1	0	0	6

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

3.7.4.3 Treat whole mob once fly strike is detected

Region	n	Proportion of respondents (%)															
		Cyromazine	Dicyclanil	Ivermectin	Abamectin	Spinosad	Diazinon	Propetamphos	Clorfenvinphos	Temephos	Imidacloprid	Alpha cypermethrin	Pyrethrin	Diflubenzuron	Triflumuron	Vinegar	Unspecified product
S Qld	4	50	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New England	5	60	40	0	0	0	20	0	0	0	0	0	0	0	0	0	0
C & S Tablelands	7	29	57	14	0	0	0	0	0	0	0	0	0	0	0	0	0
S NSW & N Vic	6	50	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gippsland	2	50	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0
W Vic & SE SA	13	31	23	8	0	15	23	0	0	0	0	0	0	0	0	0	0
S SA	2	100	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0
KI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WA	16	25	25	38	0	6	0	0	0	0	0	0	0	0	0	0	6
All regions	55	38	33	16	0	9	7	0	0	0	0	0	0	0	0	0	2

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

3.7.4.4 Treat individually struck sheep

Region	n	Proportion of respondents (%)															
		Cyromazine	Dicyclanil	Ivermectin	Abamectin	Spinosad	Diazinon	Propetamphos	Clorfenvinphos	Temephos	Imidacloprid	Alpha cypermethrin	Pyrethrin	Diflubenzuron	Triflumuron	Vinegar	Unspecified product
S Qld	4	25	0	25	0	50	0	0	0	0	0	0	0	0	0	0	0
New England	8	12	0	0	0	38	38	0	0	0	0	0	0	0	0	0	12
C & S Tablelands	11	27	0	18	0	45	9	0	0	0	0	0	0	0	0	0	18
S NSW & N Vic	11	0	9	0	0	55	36	0	0	0	0	0	0	0	0	0	0
Gippsland	2	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	50
W Vic & SE SA	22	18	0	9	5	27	32	18	5	0	0	0	0	0	0	0	5
S SA	11	27	0	18	0	36	18	9	0	0	0	0	0	0	0	0	9
KI	3	0	0	33	0	67	0	0	0	0	0	0	0	0	0	0	0
WA	30	17	7	20	0	33	17	3	0	0	0	0	0	0	0	3	10
All regions	102	17	4	14	1	38	23	6	1	0	0	0	0	0	0	1	9

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

3.7.5 *Mulesing*

3.7.5.1 Proportion of respondents mulesing replacement ewe lambs

Region	n	Proportion of respondents mulesing (%)		
S Qld	24	16	33	55
New England	60	17	**28**	41
C & S Tablelands	74	43	55	67
S NSW & N Vic	68	32	44	57
Gippsland	9	14	44	79
W Vic & SE SA	138	34	43	51
S SA	27	32	52	71
KI	17	33	59	82
WA	119	52	**61**	70
All regions	536	43	48	52

$\chi^2 = 5.81$, $p=0.6312$.

3.7.5.2 Proportion of respondents mulesing wethers

Region	n	Proportion of respondents mulesing (%)		
S Qld	15	2	**13**	40
New England	30	15	30	49
C & S Tablelands	40	36	52	68
S NSW & N Vic	17	18	41	67
Gippsland	5	15	60	95
W Vic & SE SA	59	34	47	61
S SA	7	10	43	82
KI	11	39	73	94
WA	46	39	54	69
All regions	230	40	46	53

$\chi^2 = 5.81$, $p=0.6312$.

3.7.5.3 Proportion of replacement ewe lambs mulesed

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	8	70.00	100.00	100.00	96.25	17.73	
New England	17	100.00	100.00	100.00	100.00	0.00	
C & S Tablelands	41	98.00	100.00	100.00	99.95	0.20	
S NSW & N Vic	30	22.00	100.00	100.00	97.40	10.64	
Gippsland	4	100.00	100.00	100.00	100.00	0.00	
W Vic & SE SA	59	40.00	100.00	100.00	96.44	6.96	
S SA	14	100.00	100.00	100.00	100.00	0.00	
KI	10	50.00	100.00	100.00	95.00	22.62	
WA	73	1.00	100.00	100.00	95.95	8.11	
All Regions	256	1.00	100.00	100.00	97.40	3.15	

Histogram class limits: 1 13.4 25.8 38.1 50.5 62.9 75.2 87.6 100. Anova: F=0.59, df=8, p=0.7877

3.7.5.4 Proportion of wethers mulesed

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	2*						–
New England	9	100.00	100.00	100.00	100.00	0.00	
C & S Tablelands	21	98.00	100.00	100.00	99.90	0.40	
S NSW & N Vic	7	100.00	100.00	100.00	100.00	0.00	
Gippsland	3	100.00	100.00	100.00	100.00	0.00	
W Vic & SE SA	28	70.00	100.00	100.00	98.93	4.40	
S SA	3	100.00	100.00	100.00	100.00	0.00	
KI	8	100.00	100.00	100.00	100.00	0.00	
WA	25	85.00	100.00	100.00	99.32	2.48	
All Regions	106	70.00	100.00	100.00	99.25	1.67	

Results are omitted to preserve confidentiality, but used in calculating totals.
Histogram class limits: 70 80 90 100. Anova: F=3.43, df=8, p=0.0016.

3.7.5.5 Age at which replacement ewe lambs mulesed

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	8	1.0	4.5	10.0	4.9	5.8	
New England	20	1.0	2.5	9.0	4.0	2.6	
C & S Tablelands	37	1.0	2.0	8.0	2.5	1.2	
S NSW & N Vic	28	1.0	2.0	6.0	2.3	0.8	
Gippsland	3	2.0	2.0	2.0	2.0	0.0	
W Vic & SE SA	59	0.8	2.0	5.0	2.4	0.5	
S SA	13	1.5	2.0	3.0	2.0	0.5	
KI	9	1.5	2.0	3.0	1.9	0.7	
WA	66	1.0	2.0	10.0	2.1	0.6	
All Regions	243	0.8	2.0	10.0	2.5	0.4	

Histogram class limits: 0 1.9 3.1 4.2 5.4 6.5 7.7 8.8 10. Anova: F=6.12, df=8, p<0.00005

3.7.5.6 Age at which wethers mulesed

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	3	1.0	4.0	7.0	4.0	14.9	
New England	10	1.0	2.0	8.0	3.7	3.9	
C & S Tablelands	20	1.0	1.5	7.5	2.4	1.7	
S NSW & N Vic	6	0.8	2.2	3.0	2.0	2.1	
Gippsland	2	2.0	2.0	2.0	2.0	0.0	
W Vic & SE SA	29	1.0	2.0	5.0	2.5	0.8	
S SA	4	1.5	2.0	3.0	2.1	2.4	
KI	7	1.5	2.0	2.0	1.8	0.5	
WA	26	1.0	1.9	3.5	1.9	0.5	
All Regions	107	0.8	2.0	8.0	2.4	0.6	

Histogram class limits: 0 1.7 2.6 3.5 4.4 5.3 6.2 7.1 8. Anova: F=2.3, df=8, p=0.0263.

3.7.5.7 Use of pain relief after mulesing – replacement ewe lambs

Region	n	Proportion of respondents using pain relief (%)		
S Qld	8	0	**12**	53
New England	17	14	**35**	62
C & S Tablelands	39	58	**74**	87
S NSW & N Vic	28	48	68	84
Gippsland	4	7	50	93
W Vic & SE SA	56	49	62	75
S SA	13	32	62	86
KI	9	21	56	86
WA	70	43	56	68
All regions	244	53	59	65

$\chi 2 = 16.62$, $p=0.0301$.

3.7.5.8 Use of pain relief after mulesing – wethers

Region	n	Proportion of respondents using pain relief (%)		
S Qld	3	1	33	91
New England	8	3	**25**	65
C & S Tablelands	21	53	76	92
S NSW & N Vic	7	29	71	96
Gippsland	3	1	33	91
W Vic & SE SA	29	53	72	87
S SA	3	9	67	99
KI	8	16	50	84
WA	25	43	64	82
All regions	107	54	64	73

$\chi 2 = 10.77$, $p=0.2126$.

3.7.5.9 Person carrying out mulesing

Region	n	Proportion of respondents with mulesing carried out by the person below (%		
		Self	Farm staff	Contractor
S Qld	8	50.0	0.0	50.0
New England	21	57.1	4.8	38.1
C & S Tablelands	42	42.9	16.7	50.0
S NSW & N Vic	33	36.4	6.1	66.7
Gippsland	4	25.0	25.0	50.0
W Vic & SE SA	70	51.4	8.6	50.0
S SA	15	53.3	20.0	40.0
KI	10	40.0	20.0	40.0
WA	80	27.5	7.5	70.0
All regions	283	41.3	9.9	55.8

Note: percentages may sum to more than 100 as respondents could name more than one person who carried out their mulesing.

3.7.5.10 Accreditation status of respondents carrying out mulesing

Region	n	Proportion of respondents (%)								
		Accredited			Not accredited			Unsure		
S Qld	4	7	50	93	7	50	93	0	0	60
New England	11	17	45	77	17	45	77	0	9	41
C & S Tablelands	16	4	19	46	41	69	89	2	12	38
S NSW & N Vic	12	2	17	48	52	83	98	0	0	26
Gippsland	1	0	0	98	3	100	100	0	0	98
W Vic & SE SA	35	10	23	40	54	71	85	1	6	19
S SA	8	9	38	76	16	50	84	0	12	53
KI	4	0	0	60	40	100	100	0	0	60
WA	22	14	32	55	41	64	83	0	5	23
All regions	113	19	27	36	58	67	76	3	6	12

χ^2 =11.02, p=0.8011.

3.7.5.11 Accreditation status of contractors carrying out mulesing

Region	n	Proportion of respondents (%)								
		Accredited			Not accredited			Unsure		
S Qld	5	28	80	99	0	0	52	1	20	72
New England	8	63	100	100	0	0	37	0	0	37
C & S Tablelands	22	55	77	92	1	9	29	3	14	35
S NSW & N Vic	21	64	86	97	0	5	24	1	10	30
Gippsland	2	16	100	100	0	0	84	0	0	84
W Vic & SE SA	39	64	79	91	2	8	21	4	13	27
S SA	6	36	83	100	0	0	46	0	17	64
KI	4	40	100	100	0	0	60	0	0	60
WA	58	73	84	93	0	3	12	5	12	23
All regions	165	77	84	89	2	5	9	7	12	17

$\chi 2$ =5.87, p=0.9922.

3.7.5.12 Change in proportion of replacement sheep mulesed 2003 – 2011

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	16	-90.00	0.00	50.00	-20.62	40.72	
New England	60	-100.00	-35.00	0.00	-45.17	23.92	
C & S Tablelands	47	-100.00	0.00	20.00	-26.38	25.12	
S NSW & N Vic	47	-100.00	0.00	0.00	-11.91	17.54	
Gippsland	4	-100.00	-50.00	20.00	-45.00	203.78	
W Vic & SE SA	174	-100.00	0.00	100.00	-15.10	11.37	
S SA	30	-100.00	0.00	50.00	-12.00	22.74	
KI	18	-100.00	0.00	0.00	-30.56	44.77	
WA	172	-100.00	0.00	100.00	-9.62	11.35	
All Regions	568	-100.00	0.00	100.00	-17.98	6.60	

Histogram class limits: -100 -75 -50 -25 0 25 50 75 100. Anova: F=5.81, df=8, p<0.00005. Figures are adjusted for non-response bias as described in Appendix A1.6.3.

3.7.6 Use of Leader Products Anti-Flystrike Clips

Due to the very small numbers of respondents reporting that they used Anti-flystrike Clips, only the figures for all regions in aggregate are reported.

3.7.6.1 Proportion of respondents using Anti-flystrike Clips

Class of sheep	n	Proportion of respondents using Anti-flystrike Clips (%)		
Replacement ewe lambs	536	0.4	1.2	2.4
Wethers	230	0.5	1.7	4.4

3.7.6.2 Proportion of replacement ewe lambs and wethers treated with Anti-flystrike Clips

Class of sheep	n	Minimum	Median	Maximum	Mean
Replacement ewe lambs	6	100.0	100.0	100.0	100.0
Wethers	4	80.0	100.0	100.0	95.0

3.7.6.3 Person carrying out clipping

n	Proportion of respondents with clipping carried out by the person below (%		
	Self	Farm staff	Contractor
10	60.0	10.0	40.0

Note: percentages sum to more than 100 as respondents could name more than one person who carried out their clipping.

3.7.7 Length to which lambs' tails were docked

Region	n	Proportion of respondents docking tails to the length below (%)			
		Much shorter than tip of vulva in ewes	Just shorter than tip of vulva	Equal to tip of vulva	Longer than tip of vulva
S Qld	20	0.0	35.0	55.0	15.0
New England	60	15.0	25.0	53.3	18.3
C & S Tablelands	72	1.4	33.3	62.5	9.7
S NSW & N Vic	68	5.9	30.9	63.2	14.7
Gippsland	9	11.1	44.4	33.3	11.1
W Vic & SE SA	145	9.0	27.6	57.2	22.8
S SA	23	8.7	34.8	60.9	17.4
KI	17	0.0	23.5	76.5	5.9
WA	118	5.9	15.3	67.8	24.6
All regions	532	7.0	26.5	60.9	18.6

Note: percentages may sum to more than 100 as respondents could name more than length to which tails were docked.

3.7.8 Genetic selection for fly strike control

Because of the small numbers of respondents indicating that they used ASBV selection methods, only national aggregates are reported for the types of ASBV selection method used.

3.7.8.1 Proportion of respondents using some form of visual selection for ewes

Region	n	Proportion of respondents using some form of visual selection (%)		
S Qld	24	41	62	81
New England	59	60	73	84
C & S Tablelands	73	52	64	75
S NSW & N Vic	66	46	59	71
Gippsland	9	30	67	93
W Vic & SE SA	136	43	**51**	60
S SA	27	39	59	78
KI	17	38	65	86
WA	118	57	66	75
All regions	529	57	61	66

$\chi 2 = 10.71$, $p=0.2187$.

3.7.8.2 Methods used by those using some form of visual selection for ewes

Region	n	Proportion of respondents using method below (%)							
		Cull sheep with fleece rot	Cull sheep with body strike	Cull sheep with breech strike	Select for plain bodied sheep	Select for low breech wrinkle	Select for bare breech area	Select for low CV of fibre diameter	Select for low dag score
S Qld	15	60	67	47	53	40	7	7	0
New England	46	85	74	48	59	54	15	22	20
C & S Tablelands	47	85	91	53	68	66	21	38	32
S NSW & N Vic	39	85	67	15	54	38	18	18	10
Gippsland	6	100	50	17	83	67	50	50	50
W Vic & SE SA	78	88	51	27	49	42	15	23	31
S SA	16	75	69	25	62	44	25	25	31
KI	11	73	55	18	55	45	0	0	0
WA	84	73	68	42	64	57	24	36	39
All regions	342	81	67	36	59	51	19	27	27

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

3.7.8.3 Proportion of respondents using some form of ASBV selection for ewes

Region	n	Proportion of respondents using some form of visual selection (%)		
S Qld	24	0	0	14
New England	59	0	3	12
C & S Tablelands	73	4	10	19
S NSW & N Vic	66	2	6	15
Gippsland	9	0	0	34
W Vic & SE SA	136	2	5	10
S SA	27	0	0	13
KI	17	0	6	29
WA	118	1	4	10
All regions	529	3	5	7

$\chi^2 = 7.16$, $p=0.4981$.

3.7.8.4 Methods used by those using some form of ASBV selection for ewes

n	Proportion of respondents using method below (%)			
	Select for low breech wrinkle	Select for bare breech area	Select for low CV of fibre diameter	Select for low dag score
26	26.9	11.5	84.6	23.1

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

3.7.8.5 Proportion of respondents using some form of visual selection methods for rams

Region	n	Proportion of respondents using some form of visual selection (%)		
S Qld	23	23	43	66
New England	57	34	47	61
C & S Tablelands	63	30	43	56
S NSW & N Vic	62	25	37	50
Gippsland	9	21	56	86
W Vic & SE SA	119	31	39	49
S SA	24	19	38	59
KI	14	23	50	77
WA	109	45	**55**	65
All regions	480	40	45	49

$\chi^2 = 8.82$, $p=0.3618$.

3.7.8.6 Methods used by those using some form of visual selection for rams

Region	n	Proportion of respondents using method below (%)							
		Cull sheep with fleece rot	Cull sheep with body strike	Cull sheep with breech strike	Select for plain bodied sheep	Select for low breech wrinkle	Select for bare breech area	Select for low CV of fibre diameter	Select for low dag score
S Qld	10	30	40	30	70	80	30	30	0
New England	29	79	69	45	79	79	24	41	28
C & S Tablelands	30	63	63	40	57	70	33	43	20
S NSW & N Vic	25	68	52	20	64	52	16	28	16
Gippsland	5	80	60	20	60	60	60	80	40
W Vic & SE SA	52	75	60	38	46	48	23	33	35
S SA	11	55	45	18	64	55	27	45	55
KI	7	29	29	14	100	86	29	29	14
WA	68	56	49	37	72	71	32	53	43
All regions	237	64	55	35	65	65	28	42	31

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

3.7.8.7 Proportion of respondents using some form of ASBV selection for rams

Region	n	Proportion of respondents using some form of visual selection (%)		
S Qld	23	3	13	34
New England	57	2	7	17
C & S Tablelands	63	6	13	23
S NSW & N Vic	62	5	11	22
Gippsland	9	0	0	34
W Vic & SE SA	119	4	8	15
S SA	24	0	4	21
KI	14	8	29	58
WA	109	7	12	20
All regions	480	8	10	14

$\chi 2 = 9.06$, $p=0.3317$.

3.7.8.8 Methods used by those using some form of ASBV selection for rams

n	Proportion of respondents using method below (%)			
	Select for low breech wrinkle	Select for bare breech area	Select for low CV of fibre diameter	Select for low dag score
50	42.0	18.0	80.0	30.0

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

3.7.9 *Preventative methods to assist with blow fly control*

3.7.9.1 Proportion of respondents using one or more preventative methods

Region	n	Proportion of respondents using one or more preventative methods (%)		
S Qld	25	51	72	88
New England	63	66	78	87
C & S Tablelands	79	76	86	93
S NSW & N Vic	72	68	79	88
Gippsland	9	52	89	100
W Vic & SE SA	154	62	70	77
S SA	28	59	79	92
KI	17	57	82	96
WA	128	71	79	86
All regions	575	74	77	81

$\chi^2 = 9.71$, $p=0.2866$.

3.7.9.2 Methods used by those using one or more preventative methods

Region	n	Proportion of respondents using method below (%)			
		Timing of shearing	Timing of crutching	Trapping flies	Destroy maggots from treated sheep clippings
S Qld	18	50	72	22	17
New England	49	55	80	6	24
C & S Tablelands	68	56	85	12	25
S NSW & N Vic	57	58	81	4	23
Gippsland	8	62	75	12	12
W Vic & SE SA	108	57	79	9	27
S SA	22	32	91	0	9
KI	14	36	100	0	7
WA	101	59	89	7	16
All regions	445	55	83	8	21

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

3.8 Lice Control

3.8.1 Detection and treatment by year, 2006 to 2011

The full survey allowed respondents to provide details of lice detection and treatment for the six years from 2006 to 2011.

3.8.1.1 Proportion of respondents (%) reporting no evidence of lice seen

Region	n	2006	2007	2008	2009	2010	2011
S Qld	25	36.0	36.0	32.0	36.0	28.0	32.0
New England	63	74.6	74.6	65.1	63.5	69.8	71.4
C & S Tablelands	79	74.7	70.9	70.9	64.6	62.0	59.5
S NSW & N Vic	72	68.1	63.9	72.2	70.8	62.5	58.3
Gippsland	9	88.9	88.9	77.8	66.7	66.7	44.4
W Vic & SE SA	154	63.6	62.3	57.8	56.5	50.6	51.3
S SA	28	64.3	64.3	64.3	60.7	50.0	53.6
KI	17	58.8	70.6	58.8	41.2	41.2	52.9
WA	128	48.4	43.8	33.6	35.2	46.9	48.4
All Regions	575	62.6	60.5	56.3	54.4	53.9	54.1
	χ^2	*31.1*	*34.6*	*51.7*	*38.2*	*22.5*	*16.5*
	p value	*0.0001*	*0.0000*	*0.0000*	*0.0000*	*0.0037*	*0.03379*

3.8.1.2 Proportion of respondents (%) reporting sheep seen rubbing

Region	n	2006	2007	2008	2009	2010	2011
S Qld	25	12.0	12.0	20.0	20.0	40.0	36.0
New England	63	7.9	6.3	15.9	17.5	15.9	15.9
C & S Tablelands	79	3.8	3.8	6.3	13.9	16.5	24.1
S NSW & N Vic	72	6.9	13.9	5.6	12.5	27.8	27.8
Gippsland	9	0.0	0.0	11.1	22.2	22.2	44.4
W Vic & SE SA	154	7.1	9.7	14.9	20.1	24.7	26.0
S SA	28	3.6	7.1	3.6	10.7	35.7	25.0
KI	17	0.0	0.0	11.8	17.6	29.4	23.5
WA	128	26.6	27.3	40.6	42.2	31.2	33.6
All Regions	575	10.8	12.5	17.9	22.4	25.7	27.1
	χ^2	*45.6*	*39.0*	*65.4*	*40.0*	*13.3*	*9.8*
	p value	*0.0000*	*0.0001*	*0.0000*	*0.0000*	*0.0988*	*0.2825*

3.8.1.3 Proportion of respondents (%) reporting live lice seen

Region	n	2006	2007	2008	2009	2010	2011
S Qld	25	8.0	12.0	16.0	16.0	28.0	32.0
New England	63	9.5	7.9	14.3	20.6	17.5	20.6
C & S Tablelands	79	3.8	2.5	6.3	15.2	16.5	24.1
S NSW & N Vic	72	6.9	8.3	9.7	11.1	18.1	23.6
Gippsland	9	0.0	0.0	11.1	22.2	22.2	33.3
W Vic & SE SA	154	8.4	10.4	14.9	18.8	24.0	24.0
S SA	28	10.7	10.7	10.7	17.9	25.0	25.0
KI	17	11.8	0.0	5.9	35.3	29.4	35.3
WA	128	16.4	15.6	21.1	30.5	17.2	18.8
All Regions	575	9.6	9.6	13.9	20.5	20.3	23.3
	χ^2	*11.9*	*13.4*	*11.8*	*16.0*	*5.5*	*4.8*
	p value	*0.1496*	*0.0986*	*0.1547*	*0.0400*	*0.7057*	*0.7853*

3.8.1.4 Proportion of respondents (%) reporting no lice treatments

Region	n	2006	2007	2008	2009	2010	2011
S Qld	25	12.0	12.0	12.0	12.0	12.0	16.0
New England	63	42.9	39.7	34.9	38.1	34.9	36.5
C & S Tablelands	79	22.8	20.3	21.5	19.0	15.2	12.7
S NSW & N Vic	72	36.1	36.1	37.5	38.9	30.6	26.4
Gippsland	9	55.6	55.6	33.3	44.4	33.3	22.2
W Vic & SE SA	154	29.2	26.6	24.0	24.0	24.0	19.5
S SA	28	17.9	14.3	17.9	17.9	10.7	10.7
KI	17	17.6	11.8	11.8	11.8	11.8	23.5
WA	128	21.1	20.3	19.5	15.6	14.8	14.1
All Regions	575	27.7	25.7	24.5	24.0	21.4	19.7
	χ^2	*22.5*	*24.1*	*17.0*	*27.6*	*21.1*	*20.2*
	p value	*0.0037*	*0.0021*	*0.0292*	*0.0005*	*0.0071*	*0.0099*

3.8.1.5 Proportion of respondents (%) reporting lice treated off shears

Region	n	2006	2007	2008	2009	2010	2011
S Qld	25	52.0	52.0	52.0	52.0	52.0	64.0
New England	63	20.6	22.2	25.4	30.2	38.1	34.9
C & S Tablelands	79	19.0	20.3	22.8	26.6	30.4	35.4
S NSW & N Vic	72	19.4	20.8	20.8	25.0	30.6	36.1
Gippsland	9	11.1	11.1	22.2	33.3	33.3	33.3
W Vic & SE SA	154	25.3	29.2	31.8	35.1	39.0	40.9
S SA	28	42.9	46.4	42.9	42.9	64.3	53.6
KI	17	29.4	35.3	35.3	35.3	41.2	35.3
WA	128	50.0	48.4	54.7	57.8	56.2	58.6
All Regions	575	30.6	32.2	35.0	38.3	42.3	44.2
	χ^2	*45.9*	*37.4*	*41.2*	*35.5*	*26.9*	*23.9*
	p value	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0006*	*0.0018*

3.8.1.6 Proportion of respondents (%) reporting lice treated short wool

Region	n	2006	2007	2008	2009	2010	2011
S Qld	25	4.0	4.0	4.0	4.0	4.0	4.0
New England	63	1.6	0.0	4.8	4.8	1.6	3.2
C & S Tablelands	79	0.0	0.0	3.8	8.9	5.1	11.4
S NSW & N Vic	72	8.3	8.3	6.9	8.3	13.9	20.8
Gippsland	9	0.0	0.0	0.0	0.0	22.2	33.3
W Vic & SE SA	154	11.7	9.7	13.6	14.9	16.2	17.5
S SA	28	3.6	3.6	3.6	3.6	21.4	17.9
KI	17	0.0	0.0	5.9	5.9	11.8	11.8
WA	128	11.7	12.5	16.4	21.1	24.2	18.0
All Regions	575	7.3	6.8	9.7	12.0	14.3	15.1
	χ^2	*20.5*	*22.0*	*18.1*	*21.3*	*28.5*	*16.2*
	p value	*0.0130*	*0.0087*	*0.0234*	*0.0084*	*0.0008*	*0.0395*

3.8.1.7 Proportion of respondents (%) reporting lice treated long wool

Region	n	2006	2007	2008	2009	2010	2011
S Qld	25	12.0	12.0	12.0	16.0	28.0	28.0
New England	63	6.3	3.2	4.8	7.9	11.1	11.1
C & S Tablelands	79	0.0	0.0	1.3	6.3	6.3	7.6
S NSW & N Vic	72	2.8	2.8	4.2	5.6	11.1	8.3
Gippsland	9	0.0	0.0	0.0	0.0	0.0	0.0
W Vic & SE SA	154	1.9	1.9	3.2	7.1	14.9	9.7
S SA	28	0.0	0.0	0.0	3.6	3.6	7.1
KI	17	5.9	0.0	0.0	5.9	5.9	11.8
WA	128	1.6	2.3	7.8	12.5	13.3	11.7
All Regions	575	7.3	6.8	9.7	12.0	14.3	15.1
	χ^2	*16.8*	*14.2*	*12.0*	*8.2*	*13.7*	*11.0*
	p value	*0.0498*	*0.0854*	*0.1512*	*0.4044*	*0.0869*	*0.1960*

3.8.2 Treatment in the previous three years

The short survey simply asked for whether or not sheep had been treated for lice in the previous three years. This data can be combined with the full survey data for the years 2009 to 2011 and, using the weighting procedure described in Appendix A1.6.3, adjusted to provide estimates of proportions by regions based on the combined sample and adjusted for non-response bias.

3.8.2.1 Proportion of respondents (%) reporting lice treated off shears in the last three years

Region	n	Proportion treating lice (%)		
S Qld	60	53	67	78
New England	110	44	**54**	63
C & S Tablelands	104	55	65	74
S NSW & N Vic	116	56	66	74
Gippsland	10	35	70	93
W Vic & SE SA	289	47	**53**	59
S SA	50	53	68	80
KI	22	60	82	95
WA	256	75	**80**	85
All regions	1017	62	65	68

χ^2=54.77, df=8 p<0.00005.

Note: percentages are adjusted for non-response bias as described in Appendix A1.6.3.

3.8.2.2 Proportion of respondents (%) reporting lice treated short wool in the last three years

Region	n	Proportion treating lice (%)		
S Qld	60	15	25	38
New England	110	8	**14**	21
C & S Tablelands	104	21	30	40
S NSW & N Vic	115	23	31	41
Gippsland	10	7	30	65
W Vic & SE SA	289	24	29	35
S SA	51	16	27	42
KI	22	3	14	35
WA	256	24	29	35
All regions	1017	24	27	30

$\chi^2=14.88$, $p=0.0601$.
Note: percentages are adjusted for non-response bias as described in Appendix A1.6.3.

3.8.2.3 Proportion of respondents (%) reporting lice treated long wool in the last three years

Region	n	Proportion treating lice (%)		
S Qld	60	28	**40**	53
New England	110	9	**15**	23
C & S Tablelands	104	23	32	42
S NSW & N Vic	116	29	**38**	47
Gippsland	10	3	20	56
W Vic & SE SA	290	17	**22**	27
S SA	50	12	22	36
KI	21	5	19	42
WA	256	22	28	34
All regions	1017	24	26	29

$\chi^2=27.42$, $p=0.0005$.
Note: percentages are adjusted for non-response bias as described in Appendix A1.6.3.

3.8.3 *Treatment techniques used, and use of contractors*

3.8.3.1 Off-shears or short wool

Region	n	Plunge dip		Shower dip		Pour-on 'backliner'	
		% using this technique	% of these using contractor	% using this technique	% of these using contractor	% using this technique	% of these using contractor
S Qld	11	18	0	27	0	82	12
New England	27	19	43	7	0	81	8
C & S Tablelands	38	53	62	5	0	63	17
S NSW & N Vic	39	31	79	5	0	85	8
Gippsland	5	60	67	0	0	60	0
W Vic & SE SA	89	44	70	13	15	63	12
S SA	19	37	75	5	0	79	8
KI	12	33	50	8	0	75	14
WA	84	15	88	35	80	77	3
All Regions	324	32	70	16	44	73	44

Note: percentages for the three techniques may sum to more than 100 as respondents could name more than one technique.

3.8.3.2 Long wool

Region	n	Jetting		Pour-on 'backliner'	
		% using this technique	% of these using contractor	% using this technique	% of these using contractor
S Qld	6	50	0	50	33
New England	7	71	50	43	33
C & S Tablelands	14	50	14	50	14
S NSW & N Vic	9	44	50	56	20
Gippsland	2	100	0	0	NaN
W Vic & SE SA	22	55	20	45	12
S SA	3	0	0	100	0
KI	1*	–	–	–	
WA	21	62	27	52	18
All Regions	85	54	25	51	18

Note: percentages for the two techniques may sum to more than 100 as respondents could name more than one technique.
** Results are omitted to preserve confidentiality, but used in calculating totals.*

3.8.3.3 Quarantine (introduced sheep)

There were insufficient responses to this question to present a regional table. Only totals across all regions are presented below.

n	Jetting		Pour-on 'backliner'	
	% using this technique	% of these using contractor	% using this technique	% of these using contractor
19	21	25	79	9

3.8.4 *Products used*

3.8.4.1 Off-shears or short wool – plunge dip

Region	n	Proportion of respondents using products below (%)							
		Spinosad	Diazinon	Temephos	Unspecified organophosphate	Diflubenzuron	Ivermectin	Cyhalothrin	Unspecified lice treatment
S Qld	2	0	50	50	0	0	0	0	0
New England	6	0	83	17	0	0	0	0	0
C & S Tablelands	20	10	20	65	0	5	0	0	5
S NSW & N Vic	16	6	25	50	0	0	6	6	12
Gippsland	3	0	33	67	0	0	0	0	0
W Vic & SE SA	32	12	53	31	3	3	0	0	9
S SA	6	17	17	50	0	0	0	0	17
KI	2	0	50	50	0	0	0	0	0
WA	10	10	40	30	0	0	0	0	30
All Regions	97	9	39	43	1	2	1	1	10

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

3.8.4.2 Off-shears or short wool – shower dip

Region	n	Proportion of respondents using products below (%)											
		Spinosad	Diazinon	Temephos	Propetamphos	Imidacloprid	Diflubenzuron	Triflumuron	Unspecified IGR	Ivermectin	Magnesium fluorosilicate	Piperonyl butoxide	Rotenone	Unspecified lice treatment
S Qld	3	33	33	0	0	0	0	0	0	0	33	0	0	0
New England	1*	–	–	–	–	–	–	–	–	–	–	–	–	–
C & S Tablelands	3	33	0	67	0	0	0	0	0	0	0	0	0	0
S NSW & N Vic	2	50	0	0	0	0	0	50	0	0	0	0	0	0
Gippsland	0	–	–	–	–	–	–	–	–	–	–	–	–	–
W Vic & SE SA	15	13	33	13	7	0	13	13	0	7	7	0	0	7
S SA	2	0	50	0	0	50	0	0	0	0	0	50	50	0
KI	1*	–	–	–	–	–	–	–	–	–	–	–	–	–
WA	25	12	36	48	0	0	16	0	8	4	8	0	0	4
All Regions	52	15	33	33	2	2	12	6	4	4	8	2	2	4

Note: percentages may sum to more than 100 as respondents could name more than one product.
** Results are omitted to preserve confidentiality, but used in calculating totals.*

3.8.4.3 Off-shears or short wool – pour-on 'backliner'

Region	n	Proportion of respondents using products below (%)												
		Spinosad	Diazinon	Temephos	Imidacloprid	Diflubenzuron	Triflumuron	Unspecified IGR	Ivermectin	Alpha cypermethrin	Cyhalothrin	Piperonyl butoxide	Cyromazine	Unspecified lice treatment
S Qld	13	31	54	0	23	8	8	0	0	0	0	0	0	8
New England	23	17	22	0	48	17	9	0	0	4	0	0	0	4
C & S Tablelands	25	32	12	0	28	32	24	4	0	0	0	4	4	0
S NSW & N Vic	35	23	0	3	37	14	31	11	0	0	0	0	3	3
Gippsland	1	0	0	0	100	0	0	0	0	0	0	0	0	0
W Vic & SE SA	58	26	5	0	38	28	29	2	0	0	0	0	0	5
S SA	17	29	18	0	41	35	41	0	12	0	0	0	0	0
KI	9	11	11	0	0	56	44	0	0	0	0	0	0	0
WA	65	31	46	0	25	17	18	3	2	3	2	5	0	2
All Regions	246	26	21	0	33	23	24	3	1	1	0	2	1	3

Note: percentages may sum to more than 100 as respondents could name more than one product.
** Results are omitted to preserve confidentiality, but used in calculating totals.*

3.8.4.4 Long wool – jetting

Region	n	Proportion of respondents using products below (%)									
		Spinosad	Diazinon	Fenthion	Imidacloprid	Diflubenzuron	Triflumuron	Ivermectin	Alpha cypermethrin	Cyromazine	Unspecified lice treatment
S Qld	5	20	0	0	0	0	0	80	0	20	0
New England	4	25	25	0	0	0	0	50	0	0	25
C & S Tablelands	5	20	0	0	20	0	0	40	0	20	0
S NSW & N Vic	4	75	25	0	0	0	0	25	0	25	0
Gippsland	2	50	0	50	0	0	0	50	0	50	0
W Vic & SE SA	17	24	6	0	0	6	6	35	6	18	0
S SA	1*	–	–	–	–	–	–	–	–	–	–
KI	0	–	–	–	–	–	–	–	–	–	–
WA	16	31	6	0	0	6	6	56	0	6	0
All Regions	54	30	7	2	2	4	4	48	2	15	2

Note: percentages may sum to more than 100 as respondents could name more than one product.
** Results are omitted to preserve confidentiality, but used in calculating totals.*

3.8.4.5 Long wool – pour-on 'backliner'

Region	n	Proportion of respondents using products below (%)						
		Spinosad	Imidacloprid	Diflubenzuron	Triflumuron	Diclyclanil	Alpha cypermethrin	Unspecified organophosphate
S Qld	3	67	0	0	0	0	33	0
New England	4	75	0	0	25	0	0	0
C & S Tablelands	7	86	0	0	0	14	0	0
S NSW & N Vic	9	78	0	22	0	0	0	0
Gippsland	0	–	–	–	–	–	–	–
W Vic & SE SA	16	75	12	6	0	0	6	6
S SA	3	100	0	0	0	0	0	0
KI	1*	–	–	–	–	–	–	–
WA	14	64	0	0	0	7	29	0
All Regions	57	74	4	7	2	4	11	2

Note: percentages may sum to more than 100 as respondents could name more than one product.
** Results are omitted to preserve confidentiality, but used in calculating totals.*

3.8.4.6 Quarantine (introduced sheep) – jetting

There were insufficient responses to this question to present a regional table. Only totals across all regions are presented below.

n	Proportion of respondents using products below (%)		
	Spinosad	Ivermectin	Unspecified lice treatment
5	40	60	20

3.8.4.7 Quarantine (introduced sheep) – pour-on 'backliner

There were insufficient responses to this question to present a regional table. Only totals across all regions are presented below.

n	Proportion of respondents using products below (%)								
	Spinosad	Diazinon	Imidacloprid	Diflubenzuron	Triflumuron	Dicyclanil	Unspecified IGR	Alpha cypermethrin	Unspecified lice treatment
15	60	7	20	7	13	7	7	7	7

3.8.5 *Lice resistance*

3.8.5.1 Proportion of respondents (%) who had suspected lice resistance on their property

Region	n	Proportion of respondents suspecting resistance (%)		
S Qld	19	33	**58**	80
New England	53	11	21	34
C & S Tablelands	64	9	17	29
S NSW & N Vic	53	12	23	36
Gippsland	6	0	0	46
W Vic & SE SA	136	15	21	29
S SA	28	19	36	56
KI	16	15	38	65
WA	112	26	**35**	44
All regions	487	23	26	31

$\chi 2=24.00$, $p=0.0024$.

3.8.5.2 Products to which resistance may have occurred

Region	n	Proportion of respondents who suspected that resistance may have occurred to the products below (%)												
		Spinosad	Diazinon	Temephos	Imidacloprid	Diflubenzuron	Triflumuron	Dicyclanil	Unspecified IGR	Alpha cypermethrin	Deltamethrin	Unspecified synthetic pyrethroid	Magnesium fluorosilicate	Cyromazine
S Qld	12	0	18	0	0	45	55	0	0	0	0	0	0	9
New England	10	10	10	0	0	40	30	10	0	0	0	0	0	10
C & S Tablelands	10	11	11	0	0	33	44	0	0	0	0	0	0	22
S NSW & N Vic	11	10	0	10	0	10	40	0	0	0	10	10	0	20
Gippsland	0	–	–	–	–	–	–	–	–	–	–	–	–	–
W Vic & SE SA	27	5	5	0	5	27	64	0	0	9	0	0	0	5
S SA	10	10	0	0	0	40	60	0	10	0	0	0	0	0
KI	5	0	0	0	0	40	20	0	0	20	20	0	0	0
WA	36	0	6	0	0	42	45	0	16	3	0	3	3	3
All Regions	121	5	6	1	1	35	48	1	6	4	2	2	1	7

Note: percentages may sum to more than 100 as respondents could name more than one product.
** Results are omitted to preserve confidentiality, but used in calculating totals.*

3.8.5.3 Year(s) in which resistance occurred

Year	Proportion of the total number of mentions of products by respondents (%)												
	Spinosad	Diazinon	Temephos	Imidacloprid	Diflubenzuron	Triflumuron	Dicyclanil	Unspecified IGR	Alpha cypermethrin	Deltamethrin	Unspecified synthetic pyrethroid	Magnesium fluorosilicate	Cyromazine
1986	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.6
1987	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1989	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
1991	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.6
1998	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.6	0.0	0.0	0.0	1.2
1999	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
2000	0.6	0.0	0.0	0.0	0.6	1.9	0.0	0.0	0.0	0.6	0.0	0.0	1.9
2001	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2
2003	0.0	0.0	0.0	0.0	1.2	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	0.0	0.6	0.0	0.0	2.5	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	0.0	0.6	0.0	0.0	2.5	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	0.0	0.0	0.0	0.0	1.9	2.5	0.0	0.0	0.6	0.0	0.0	0.0	0.0
2007	0.0	0.0	0.0	0.0	1.9	6.2	0.0	0.0	1.2	0.0	0.0	0.0	0.0
2008	0.6	1.2	0.0	0.6	4.3	8.0	0.0	0.6	0.0	0.0	0.0	0.6	0.6
2009	0.0	1.2	0.0	0.6	5.6	7.4	0.0	0.6	0.0	0.0	0.0	0.0	0.0
2010	1.9	1.2	0.6	0.6	4.9	6.2	0.0	0.0	0.6	0.0	0.0	0.0	0.6
2011	1.2	1.2	0.0	0.6	2.5	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.6

13 different products were mentioned a total of 162 times by 121 respondents.

3.8.6 *Importance of factors contributing to recurring lice problems*

3.8.6.1 Resistance of lice to lice control products

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	13	32	62	86	5	23	54	2	15	45	0	0	25
New England	12	35	67	90	0	8	38	0	8	38	2	17	48
C & S Tablelands	19	29	53	76	6	21	46	9	**26**	51	0	0	18
S NSW & N Vic	17	33	59	82	4	18	43	1	12	36	1	12	36
Gippsland	3	1	33	91	1	33	91	0	0	71	1	**33**	91
W Vic & SE SA	36	49	67	81	8	19	36	2	8	22	1	6	19
S SA	9	30	67	93	3	22	60	0	0	34	0	11	48
KI	7	42	86	100	0	14	58	0	0	41	0	0	41
WA	58	54	67	79	14	24	37	2	7	17	0	2	9
All regions	174	57	64	71	15	21	27	6	10	15	2	5	10

$\chi 2$ =24.64, p=0.4176.

3.8.6.2 Problems with application

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	9	21	56	86	0	0	34	3	22	60	3	22	60
New England	8	16	50	84	3	25	65	0	12	53	0	12	53
C & S Tablelands	17	33	59	82	4	18	43	4	18	43	0	6	29
S NSW & N Vic	18	22	44	69	17	39	64	0	6	27	1	11	35
Gippsland	3	9	67	99	1	33	91	0	0	71	0	0	71
W Vic & SE SA	39	35	51	68	11	23	39	6	15	31	3	10	24
S SA	8	24	62	91	3	25	65	0	0	37	0	12	53
KI	6	22	67	96	4	33	78	0	0	46	0	0	46
WA	55	34	47	61	19	31	45	6	15	27	2	7	18
All regions	163	44	52	59	20	26	34	8	13	19	5	9	15

$\chi 2$ =13.23, p=0.9736.

3.8.6.3 Incomplete mustering

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	13	39	69	91	9	31	61	0	0	25	0	0	25
New England	11	31	64	89	6	27	61	0	0	28	0	9	41
C & S Tablelands	18	41	67	87	4	17	41	1	11	35	0	6	27
S NSW & N Vic	15	32	60	84	4	20	48	0	0	22	4	20	48
Gippsland	3	29	100	100	0	0	71	0	0	71	0	0	71
W Vic & SE SA	39	42	59	74	6	15	31	3	10	24	6	15	31
S SA	7	29	71	96	0	0	41	0	14	58	0	14	58
KI	6	22	67	96	0	17	64	0	0	46	0	17	64
WA	53	52	66	78	4	11	23	1	6	16	8	17	30
All regions	165	57	65	72	11	16	22	3	6	11	9	13	19

χ^2 =16.05, p=0.8978.

3.8.6.4 Introduction through fences, or purchased sheep

Region	n	Proportion of respondents (%)											
		Very important			Important			Somewhat important			Not important		
S Qld	12	74	100	100	0	0	26	0	0	26	0	0	26
New England	11	39	73	94	2	18	52	0	0	28	0	9	41
C & S Tablelands	23	72	91	99	0	4	22	0	4	22	0	0	15
S NSW & N Vic	20	56	80	94	6	20	44	0	0	17	0	0	17
Gippsland	3	29	100	100	0	0	71	0	0	71	0	0	71
W Vic & SE SA	46	66	80	91	6	15	29	0	2	12	0	2	12
S SA	12	43	75	95	5	25	57	0	0	26	0	0	26
KI	7	42	86	100	0	14	58	0	0	41	0	0	41
WA	66	72	83	91	6	14	24	0	3	11	0	0	5
All regions	200	78	84	88	9	14	19	1	2	5	0	1	4

χ^2 =18.09, p=0.7069.

3.9 General Parasite Management

3.9.1 Sheep introduction procedures and treatments

3.9.1.1 Proportion of respondents who introduced sheep to their flock in 2011

Region	n	Proportion introducing sheep (%)		
S Qld	25	31	52	72
New England	59	41	54	67
C & S Tablelands	71	36	48	60
S NSW & N Vic	64	48	61	73
Gippsland	7	18	57	90
W Vic & SE SA	141	52	61	69
S SA	27	42	63	81
KI	16	30	56	80
WA	123	48	57	66
All regions	533	53	57	61

$\chi 2=4.56$, $p=0.8076$.

3.9.1.2 Number of sheep introduced in 2011 as a proportion (%) of 2011 flock size

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	9	0	0	22	4	12	
New England	29	0	0	65	8	11	
C & S Tablelands	30	0	0	98	15	20	
S NSW & N Vic	34	0	1	167	16	23	
Gippsland	2	0	10	20	10	247	
W Vic & SE SA	74	0	6	820	22	44	
S SA	16	0	15	250	31	65	
KI	9	0	6	30	10	17	
WA	63	0	0	233	9	15	
All Regions	266	0	1	820	15	14	

Histogram class limits: 0 12.3 24.5 36.8 49 61.3 73.5 85.8 98
Anova: F=0.46, df=8, p=0.8807
***Note**: respondents where the number of sheep introduced as a proportion of flock size was more that 100%, (5) have been excluded from the histograms (and **only** from the histograms) to prevent the distribution of proportions being reduced to a single bar, due to the influence of the small number of very large proportions.*

3.9.1.3 Introduction procedures and treatments by sheep class

Procedure	Proportion of respondents (%)					
	Lambs and weaners	Maiden ewes	Adult ewes	Wethers	Rams	All sheep
Internal parasite treatment not specified	34.6	50.0	46.4	30.0	34.0	28.4
External parasite treatment 1 active	38.5	0.0	30.4	80.0	25.0	26.5
Internal parasite treatment 1 active	38.5	50.0	30.4	40.0	24.0	21.8
Unspecified external parasite treatment	11.5	25.0	23.2	0.0	20.0	16.6
Unspecified quarantine time	19.2	0.0	10.7	0.0	17.0	13.3
Internal parasite treatment 3 actives	11.5	0.0	12.5	0.0	10.0	8.5
Shear on arrival	7.7	0.0	7.1	10.0	10.0	7.1
Treatment prior to purhase by vendor	11.5	0.0	3.6	0.0	4.0	5.2
Knowledge of health status	7.7	25.0	3.6	0.0	6.0	4.7
Inspect	11.5	0.0	1.8	0.0	3.0	4.7
Trust seller	0.0	0.0	0.0	0.0	9.0	4.3
External parasite treatment post next shearing	11.5	0.0	8.9	0.0	3.0	4.3
Internal parasite treatment 2 actives	3.8	0.0	1.8	0.0	3.0	3.8
Footbath	3.8	0.0	3.6	0.0	5.0	3.8
Unspecified treatment	0.0	0.0	5.4	0.0	4.0	3.8
Internal parasite treatment 4 actives	7.7	0.0	5.4	0.0	1.0	3.3
Vaccination 6 in 1	19.2	0.0	8.9	20.0	2.0	3.3
Quarantine less than a week	7.7	0.0	5.4	0.0	4.0	3.3
Quarantine one week - two months	0.0	25.0	5.4	0.0	3.0	3.3
Quarantine until shearing	0.0	0.0	1.8	0.0	3.0	2.4
External parasite treatment 2 actives	3.8	0.0	0.0	0.0	2.0	1.9
Check for lice	3.8	0.0	1.8	0.0	0.0	1.9
Purchase shorn	0.0	0.0	3.6	0.0	1.0	1.9
Vaccination 5 in 1	7.7	0.0	1.8	0.0	0.0	1.9
Quarantine two months - one year	3.8	0.0	1.8	0.0	1.0	1.9
Internal parasite treatment twice at short interval	0.0	0.0	0.0	0.0	3.0	1.4
Vaccination not specified	0.0	25.0	0.0	0.0	0.0	1.4
Vitamin B12	7.7	0.0	0.0	20.0	0.0	1.4
Unspecified minerals	3.8	0.0	1.8	0.0	1.0	1.4
Crutch sheep	0.0	25.0	0.0	0.0	0.0	0.9
Minerals - 1 type	0.0	0.0	1.8	0.0	0.0	0.9
Faecal worm egg count	0.0	0.0	1.8	0.0	0.0	0.5
External parasite (lice) history check	0.0	0.0	0.0	0.0	1.0	0.5
Vaccination 3 in 1	0.0	0.0	0.0	0.0	0.0	0.5

(table continued on next page)

3.9.1.3 (contd) Introduction procedures and treatments by sheep class

Procedure	Proportion of respondents (%)					
	Lambs and weaners	Maiden ewes	Adult ewes	Wethers	Rams	All sheep
Vaccination erysipelas	0.0	25.0	0.0	0.0	0.0	0.5
Minerals - 3 types	0.0	0.0	1.8	0.0	0.0	0.5
Treatment for dermatitis	0.0	0.0	1.8	0.0	0.0	0.5
Antibiotic treatment	0.0	0.0	0.0	0.0	1.0	0.5
n	*29*	*4*	*65*	*11*	*135*	*233*

Note: percentages may sum to more than 100 as respondents could name more than one introduction procedure or treatment. Percentages for sheep classes may be all zero, while there is a non-zero percentage for all sheep. This is due to respondents who did not give a sheep class being included in the all sheep column but not in the columns for individual sheep classes. Percentages for individual sheep classes are number of respondents giving the procedure as a proportion of all respondents who indicated the procedure was for that class of sheep.

3.9.1.4 Types of procedures and treatments by region

Region	n	% of respondents using procedures and treatments below										
		Health status information	General health check	Internal parasite	External parasite	Vaccination	Nutritional treatment	Footbath	Dermatitis	Other disease control practice	Quarantine	Type of treatment
S Qld	11	9	0	45	45	0	0	0	0	9	0	9
New England	27	0	11	78	30	7	0	0	0	4	30	7
C & S Tablelands	28	0	0	71	39	7	0	4	0	0	50	4
S NSW & N Vic	35	14	6	49	40	3	0	3	0	6	14	9
Gippsland	3	0	0	33	33	0	0	0	0	0	0	0
W Vic & SE SA	77	4	4	61	42	4	5	4	1	3	16	1
S SA	14	7	0	79	57	21	7	0	0	0	0	0
KI	9	22	0	44	44	11	11	22	0	22	22	11
WA	53	13	4	38	49	2	2	2	0	2	17	4
All Regions	257	9	5	67	50	6	3	4	0	4	23	5

Note: percentages may sum to more than 100 as respondents could name more than one procedure or treatment.

3.9.2 Changes to parasite management in last five years

3.9.2.1 Worms and fluke

Region	n	Proportion making a change (%)		
S Qld	25	15	32	54
New England	63	29	**41**	54
C & S Tablelands	79	17	27	38
S NSW & N Vic	72	13	22	34
Gippsland	9	3	22	60
W Vic & SE SA	154	15	21	28
S SA	28	8	21	41
KI	17	4	18	43
WA	128	15	22	30
All regions	575	21	25	28

$\chi^2=12.87$, $p=0.1148$.

The types of changes made by those who reported making changes to parasite management for worms and fluke in the last five years are shown in the table below.

Region	Proportion of respondents (%)
Drench rotation	17.6
WEC	12.0
Grazing management	10.6
Using capsules	6.3
Less frequent drenching	5.6
Drench only if indicated by WEC	4.9
Grazing management, clean paddocks	4.9
Combination drench	4.2
Long acting product	4.2
Change in product used	3.5
More frequent drenching	3.5
Drench resistance testing	2.8
Grazing management, cattle	2.8
Use of monepantel	2.8
Grazing management, stubbles	2.1
Improved nutrition	2.1
Ram selection	2.1

[table continued on next page]

Type of change	Proportion of respondents (%)
Ceased drenching onto stubble	1.4
Change in drench time	1.4
Changed sheep breed	1.4
Using capsules pre-lambing	1.4
Abandoned organic methods	0.7
Adjust to seasonal conditions	0.7
Adopted organic methods	0.7
Alternative product	0.7
Ceased using product	0.7
Change sheep class drenched	0.7
Changed flock composition	0.7
Culling	0.7
Drench for fluke	0.7
Drench only if needed	0.7
Drench pre-lambing	0.7
Drench weaners only	0.7
Employ vet	0.7
Grazing management, crop	0.7
Leave 5% untreated	0.7
Long acting product pre-lambing	0.7
Monepantel in drench rotation	0.7
Using injectables	0.7
Using injectables pre-lambing	0.7
WEC pre-drenching	0.7

n=142. Note: percentages sum to more than 100 as respondents could name more than one change.

3.9.2.2 Liver fluke

Region	n	Proportion making a change (%)		
S Qld	25	0	4	20
New England	63	5	**11**	22
C & S Tablelands	79	4	**9**	17
S NSW & N Vic	72	0	1	7
Gippsland	9	0	0	34
W Vic & SE SA	154	0	2	6
S SA	28	0	0	12
KI	17	0	0	20
WA	128	0	1	4
All regions	575	2	3	5

$\chi^2=24.50$, $p=0.0073$.

The types of changes made by those who reported making changes to parasite management for liver fluke in the last five years are shown in the table below.

Region	Proportion of respondents (%)
Testing	15.0
Drench regularly	10.0
Drench rotation	10.0
Less frequent drenching	10.0
Treatments beginning and end of winter	10.0
Combination drench	5.0
Drench for fluke	5.0
Drench into fluke paddock	5.0
Drench lambs	5.0
Fence out wet areas	5.0
Grazing management	5.0
Grazing management, cattle	5.0
Grazing management, horses	5.0
WormBoss course	5.0

n=20.

3.9.2.3 Blow Fly

Region	n	Proportion making a change (%)		
S Qld	25	9	24	45
New England	63	11	21	33
C & S Tablelands	79	13	22	32
S NSW & N Vic	72	14	24	35
Gippsland	9	0	0	34
W Vic & SE SA	154	12	18	25
S SA	28	11	25	45
KI	17	0	6	29
WA	128	21	28	37
All regions	575	18	22	25

$\chi 2=9.67$, $p=0.2865$.

The types of changes made by those who reported making changes to management of blow fly strike in the last five years are shown in the table below.

Region	Proportion of respondents (%)
Increased use of dicyclanil	34.4
Routine preventative use of unspecified product	8.8
Decreased use of cyromazine	6.4
Increased jetting	4.8
Increased use of cyromazine	4.8
Culling	4.0
Adapt to season	2.4
Ceased mulesing	2.4
Increased use of unspecified product	2.4
Product rotation	2.4
Routine preventative use of dicyclanil	2.4
Breeding	1.6
Changed sheep breed	1.6
Changed time of shearing	1.6
Decreased use of diazinon	1.6
Select for low dag score	1.6
Unspecified change	1.6
Alternate between plunge dip and backline	0.8
Backline introduced sheep	0.8

[table continued on next page]

Region	Proportion of respondents (%)
Breed for conformation traits	0.8
Breeding sheep suited to region	0.8
Changed time of crutching	0.8
Changed time of joining	0.8
Changed time of treatment	0.8
Combination of products	0.8
Decreased use of spinosad	0.8
Dicyclanil on weaners	0.8
FlyBoss	0.8
Grazing management	0.8
Increased pre-summer use of dicyclanil	0.8
Increased use of diazinon	0.8
Increased use of ivermectin	0.8
Increased use of jetting	0.8
Increased use of spinosad	0.8
Increased use of triflumuron	0.8
Jetting	0.8
Jetting pre-summer	0.8
Long acting chemicals	0.8
More frequent crutching	0.8
New jetting equipment	0.8
Nutrition	0.8
Pre-summer backliner	0.8
Pre-summer jetting	0.8
Regular crutching	0.8
Routine preventative use of cyromazine	0.8
Select for bare breach	0.8
Select plain bodied sheep	0.8
Selection	0.8
Shearing time	0.8
Stopped mulesing, then started again	0.8
Unspecified chemical change	0.8
Use of blow fly traps	0.8

n=125. Note: percentages sum to more than 100 as respondents could name more than one change. Increased use includes starting use of a product, and decreased use includes ceasing use of a product.

3.9.2.4 Lice

Region	n	Proportion making a change (%)		
S Qld	25	5	16	36
New England	63	5	11	22
C & S Tablelands	79	10	18	28
S NSW & N Vic	72	14	24	35
Gippsland	9	0	11	48
W Vic & SE SA	154	15	21	28
S SA	28	4	14	33
KI	17	1	12	36
WA	128	19	27	35
All regions	575	17	20	24

$\chi 2=9.44$, $p=0.3029$.

The types of changes made by those who reported making changes to management of lice in the last five years are shown in the table below.

Region	Proportion of respondents (%)
Increased use of plunge dipping	15.7
Rotate products	14.8
Decreased use of backliner	6.1
Increased use of imidacloprid	5.2
Increased use of unspecified product	4.3
Monitoring	4.3
Increased use of spinosad	3.5
Unspecified change	3.5
Changed to cage dip	2.6
Decreased use of diflubenzuron	2.6
Decreased use of triflumuron	2.6
Improve boundary fencing	2.6
Strategic treatment	2.6
Treat off-shears	2.6
Alternate between plunge dip and backline	1.7
Changed time of shearing	1.7
Decreased use of diazinon	1.7

[table continued on next page]

Region	Proportion of respondents (%)
Detecting stray sheep	1.7
Dipping off-shears	1.7
Educate neighbours	1.7
Grazing management	1.7
Increased frequency of treatment	1.7
Increased use of backliner	1.7
Increased use of diazinon	1.7
Increased use of dipping	1.7
Increased use of jetting	1.7
Increased use of magnesium fluorosilicate	1.7
Increased use of shower dipping	1.7
Increased use of temephos	1.7
Quarantine	1.7
Shower dip	1.7
Strategic jetting	1.7
Backline off-shears	0.9
Backline treatments	0.9
Boundary fencing	0.9
Changed sheep breed	0.9
Changed time of crutching	0.9
Changed time of jetting	0.9
Decreased frequency of treatment	0.9
Decreased use of dipping	0.9
Decreased use of shower dip	0.9
Decreased use of use of backliner	0.9
Increased pressure, volume and time in shower dip	0.9
Increased use of ivermectin	0.9
Increased use of long wool treatment	0.9
Increased use of shower dip	0.9
Nutrition	0.9
Plunge dip off-shears	0.9
Routine annual treatment	0.9
Routine backliner	0.9
Routine off-shears	0.9
Single shearing	0.9
Treat all sheep and lambs	0.9
Unspecified product change	0.9
Use of pour-on	0.9

n=115. Note: percentages sum to more than 100 as respondents could name more than one change. Increased use includes starting use of a product, and decreased use includes ceasing use of a product.

3.10 Information Preferences

3.10.1 Importance of information sources for parasite control

Respondents rated a series of information sources, separately for worms, flies and lice, on a scale on one to five, where one denoted very important and five denoted not important.

Source of information	Mean importance rating (1=very important,5=not important)								
	Worms			Flies			Lice		
Respondent or member of their staff	1.5	1.6	1.7	1.5	1.6	1.7	1.5	1.6	1.7
Local vet	3.0	3.1	3.3	3.5	3.7	3.9	3.5	3.7	3.9
Private veterinary consultant	3.5	3.7	3.9	3.8	4.0	4.2	3.8	4.0	4.2
Agricultural consultant	3.5	3.7	3.9	3.7	3.8	4.0	3.6	3.8	4.0
Agriculture department officer	3.3	3.4	3.6	3.5	3.6	3.8	3.3	3.5	3.7
Rural merchandise representative	2.6	2.7	2.8	2.6	2.8	2.9	2.7	2.8	3.0
Drug company representative	3.4	3.5	3.7	3.5	3.7	3.8	3.4	3.6	3.7
Rural newspapers or magazines	3.0	3.1	3.3	3.1	3.2	3.4	3.1	3.3	3.4
WormBoss, FlyBoss, LiceBoss web sites	3.4	3.6	3.8	3.5	3.7	3.9	3.5	3.7	3.9
IPM-sheep web site	4.1	4.2	4.4	–	–	–	–	–	–
Sheep CRC web site	3.8	4.0	4.1	3.8	4.0	4.2	3.8	4.0	4.2

n=502.

3.10.2 Usefulness of web sites

3.10.2.1 WormBoss website

Region	n	Proportion of respondents (%)			
		Never heard of it	Only heard of it	Actually visited site	Used site to make changes
S Qld	16	25.0	50.0	12.5	12.5
New England	55	**27.3**	41.8	23.6	7.3
C & S Tablelands	62	40.3	37.1	19.4	3.2
S NSW & N Vic	63	**55.6**	33.3	9.5	1.6
Gippsland	8	50.0	25.0	0.0	**25.0**
W Vic & SE SA	130	37.7	42.3	16.2	3.8
S SA	28	35.7	46.4	14.3	3.6
KI	15	40.0	40.0	20.0	0.0
WA	116	46.6	31.9	16.4	5.2
All regions	493	41.0	38.1	16.2	4.7

$\chi 2$ = 30.40, p=0.1710.

3.10.2.2 FlyBoss website

Region	n	Proportion of respondents (%)			
		Never heard of it	Only heard of it	Actually visited site	Used site to make changes
S Qld	16	37.5	37.5	12.5	**12.5**
New England	55	50.9	32.7	12.7	3.6
C & S Tablelands	62	54.8	27.4	16.1	1.6
S NSW & N Vic	63	58.7	36.5	4.8	0.0
Gippsland	8	62.5	12.5	12.5	**12.5**
W Vic & SE SA	130	48.5	38.5	12.3	0.8
S SA	28	39.3	**53.6**	7.1	0.0
KI	15	46.7	40.0	13.3	0.0
WA	116	53.4	32.8	11.2	2.6
All regions	493	51.3	35.3	11.4	2.0

$\chi^2 = 29.96$, $p=0.1845$.

3.10.2.3 LiceBoss website

Region	n	Proportion of respondents (%)			
		Never heard of it	Only heard of it	Actually visited site	Used site to make changes
S Qld	16	37.5	37.5	18.8	6.2
New England	55	45.5	40.0	12.7	1.8
C & S Tablelands	62	51.6	29.0	17.7	1.6
S NSW & N Vic	63	55.6	36.5	**4.8**	3.2
Gippsland	8	75.0	**0.0**	12.5	12.5
W Vic & SE SA	130	47.7	39.2	11.5	1.5
S SA	28	35.7	53.6	10.7	0.0
KI	15	40.0	**40.0**	20.0	0.0
WA	116	52.6	28.4	14.7	4.3
All regions	493	49.3	35.3	12.8	2.6

$\chi^2 = 25.80$, $p=0.3558$.

3.10.2.4 Sheep CRC website

Region	n	Proportion of respondents (%)			
		Never heard of it	Only heard of it	Actually visited site	Used site to make changes
S Qld	16	25.0	43.8	18.8	**12.5**
New England	55	36.4	36.4	21.8	5.5
C & S Tablelands	62	38.7	38.7	21.0	1.6
S NSW & N Vic	63	50.8	33.3	12.7	3.2
Gippsland	8	62.5	25.0	0.0	12.5
W Vic & SE SA	130	46.9	34.6	17.7	0.8
S SA	28	42.9	39.3	17.9	0.0
KI	15	26.7	53.3	6.7	**13.3**
WA	116	45.7	41.4	**9.5**	3.4
All regions	493	43.6	37.7	15.4	3.2

$\chi 2 = 31.75$, $p=0.1355$.

3.10.3 Usefulness of current and/or projected extension initiatives

3.10.3.1 Regional worm control plans

Region	n	Proportion of respondents (%)			
		Very useful	Useful	Somewhat useful	Not useful
S Qld	20	45.0	**10.0**	20.0	25.0
New England	56	**53.6**	23.2	12.5	10.7
C & S Tablelands	69	36.2	33.3	17.4	13.0
S NSW & N Vic	65	32.3	**44.6**	10.8	12.3
Gippsland	9	**77.8**	22.2	0.0	0.0
W Vic & SE SA	134	32.1	29.1	19.4	19.4
S SA	28	21.4	39.3	21.4	17.9
KI	15	40.0	20.0	20.0	20.0
WA	117	**22.2**	35.0	**26.5**	16.2
All regions	513	33.7	31.8	18.7	15.8

$\chi 2 = 43.24$, $p=0.0094$.

3.10.3.2 Drench Decision Guides to help with worm problems

Region	n	Proportion of respondents (%)			
		Very useful	Useful	Somewhat useful	Not useful
S Qld	20	45.0	25.0	10.0	20.0
New England	56	46.4	39.3	**3.6**	10.7
C & S Tablelands	69	34.8	39.1	21.7	4.3
S NSW & N Vic	65	**50.8**	30.8	9.2	9.2
Gippsland	9	55.6	44.4	0.0	0.0
W Vic & SE SA	134	35.8	32.1	21.6	10.4
S SA	28	**17.9**	**17.9**	**42.9**	**21.4**
KI	15	40.0	26.7	13.3	20.0
WA	117	**25.6**	**46.2**	19.7	8.5
All regions	513	36.3	35.9	17.7	10.1

$\chi^2 = 55.50$, $p<0.00005$.

3.10.3.3 Colour codes on drenches to identify drench groups

Region	n	Proportion of respondents (%)			
		Very useful	Useful	Somewhat useful	Not useful
S Qld	20	35.0	30.0	15.0	20.0
New England	56	23.2	26.8	30.4	19.6
C & S Tablelands	69	34.8	29.0	23.2	13.0
S NSW & N Vic	65	35.4	33.8	16.9	13.8
Gippsland	9	33.3	44.4	22.2	0.0
W Vic & SE SA	134	**38.8**	29.1	15.7	16.4
S SA	28	21.4	28.6	28.6	21.4
KI	15	26.7	53.3	13.3	6.7
WA	117	26.5	40.2	17.9	15.4
All regions	513	31.8	32.9	19.7	15.6

$\chi^2 = 22.89$, $p=0.5309$.

3.10.3.4 Worm control workshops

Region	n	Proportion of respondents (%)			
		Very useful	Useful	Somewhat useful	Not useful
S Qld	20	40.0	25.0	15.0	20.0
New England	56	37.5	44.6	**8.9**	8.9
C & S Tablelands	69	31.9	34.8	26.1	7.2
S NSW & N Vic	65	**47.7**	27.7	**12.3**	12.3
Gippsland	9	44.4	44.4	0.0	11.1
W Vic & SE SA	134	27.6	34.3	25.4	12.7
S SA	28	21.4	32.1	32.1	14.3
KI	15	33.3	26.7	20.0	20.0
WA	117	**22.2**	29.1	**29.9**	18.8
All regions	513	31.2	32.9	22.4	13.5

$\chi 2 = 38.05$, $p=0.03219$.

APPENDIX A1

A1 METHODS

A1.1 Survey content

The first draft of the benchmark survey questionnaire was based on the 2004 survey and then circulated among researchers involved in the 2004 survey for comment. The second draft was then circulated to a small number of researchers in the field who had not been involved in the 2004 survey, and further adjustments made to the content.

A1.2 Sample frame

The addresses of sheep producers currently in the same postcode districts as used in the 2004 survey were provided by AWI. This address list had larger numbers of sheep producers than the address list supplied in 2004. As a result, samples of producers were drawn for the New England, Queensland and South Australia regions, whereas the whole list of producers in each of these regions was used in 2004.

Random samples were drawn in each region by assigning a random number to each address, sorting the addresses in ascending order by the random number and taking the required number of addresses from the top of the sorted list. The same sized sample of addresses as for the 2004 survey was used in each region (Table A1.0)

Table A1.0 Sample frame details.

Region	No. Mailed Out
New Eng.	728
QLD	383
NSW (rem)	1499
VIC	1500
SA	751
WA	1500
TOTAL	6361

The first surveys were sent out from February 2012 over a period of several weeks, with surveys being sent to WA addresses later in the period. Reminders were sent out approximately six weeks after the first mail out. A short one page letter and questionnaire (short survey) developed for the 2004 survey and containing a small number of key questions was mailed to remaining non-responders approximately six weeks after the reminder. This was to encourage non-responders to answer just a few questions from the main questionnaire so that it was possible to analyse the extent to which there was non-response bias in the data from the full questionnaire.

Data from the surveys received up until 13 July 2013 were included in the analysis. Figures for responses received up until this date are shown in Table A1.1.

A1.3 Coding of text answers

The full questionnaire contained 25 questions or parts of questions where the respondent could provide a text answer (rather ticking a box, or providing a numerical answer or numerical rating). In many cases, questions with tick boxes or numerical ratings of a series of items were followed by a space with "Other, please describe". This provided a check that the series of items had not omitted something that was important to respondents. Where a small number of text answers were provided, and it could be

inferred from these answers that no important item had been omitted, the test answers were used as a check on the answers to the items preceding the "Other, please describe" space.

Table A1.1. Survey response rates. Response rate is calculated as follows: the number of producers with 500+ sheep in the original mailout is estimated using the proportion of returned questionnaires with <500 sheep and 500+ sheep. The response rate is given by the number of completed questionnaires with 500+ sheep as a percentage of the estimated number of producers with 500+ sheep in the original mailout (allowing for questionnaires returned as not deliverable by Australia Post due to the addressee having left the address or not being known at the given address).

Region	No. Mailed Out	Mailed Out Less RTS	Full surveys returned 500+ sheep	Full surveys returned <500 Sheep	Short surveys returned 500+ sheep	Short surveys returned <500 sheep	Estimate of No. in Mail Out with >500 Sheep	Response Rate (full survey) (%)	Response Rate (full and short surveys) (%)
New Eng.	728	669	63	126	49	8	331	19	34
QLD	383	352	25	90	26	2	137	18	37
NSW (rem)	1499	1409	132	237	87	18	693	19	32
VIC	1500	1317	137	219	106	19	758	18	32
SA	751	692	90	112	63	6	424	21	36
WA	1500	1365	128	201	113	9	802	16	30
TOTAL	6361	5804	575	985	444	62	3144	18	32

A number of questions with text answers required analysis in their own right and coding schemes for each question were developed in close consultation with the project participants.

A1.4 Data quality control

Data was analysed using R (R Development Core Team, 2011). Frequency distributions of all variables in the dataset were examined (the dataset comprised a rectangular array of numbers with a row for each respondent and a column or columns for each question – each row is termed a case, and each column is termed a variable). Where values outside the expected range of values were encountered, the data was checked against the returned questionnaires for misreading or keystroke errors and corrections made where necessary. Where out-of-range values were not due to either misinterpretation of the question by the respondent or an error by the data entry operator, these were noted as possible outliers and given further consideration as to their inclusion or exclusion at the appropriate stage of the analysis.

A number of questions required specific quality control procedures. These are described in the subsections below.

A1.4.1 Sources of income

The percentages of various sources of income were summed and where it appeared that minor errors had been made by the respondent, the income source percentages were proportionally adjusted to sum to 100 per cent. If the failure to sum to 100 per cent was due to a major omission of the percentage for a particular income source, this was treated as missing data.

A1.4.2 Property area and land use

The percentages of the property under various land uses, viz. improved pasture, unimproved pasture , cropped and 'Other' and where necessary, the land use percentages were proportionally adjusted to sum to 100 per cent. If the failure to sum to 100 per cent was due to a major omission of the percentage for a particular land use, this was treated as missing data.

A1.5 Non-response bias

The responses to the full and short surveys were compared for the set of questions common to both surveys to assess the extent of non-response bias in the full survey responses. The rationale for this is that, if those who responded to the full survey were systematically different in some way from those who did not respond, then the generalisation of the survey results to the overall producer population will not be valid. For example, if those who do not respond tend to have smaller flocks, then the estimate of flock size calculated from the returned questionnaires will be biased upwards.

If it is assumed that those who responded to the short survey are representative of all those who did not respond to the full survey, then comparison of the responses to the full and short surveys provides an indication of the existence of non-response bias. If there are significant differences between the full and short surveys on particular questions, then the magnitude of these differences can be used to calculate weighting factors to adjust the findings from the full survey, so that the influence of non-response bias is reduced as much as possible.

The questions for which there was a significant ($p<0.01$) difference between the full and short survey responses are shown in the tables below. The tables are presented in the order in which the questions appeared in the short survey. As the weighting procedure requires that respondents be grouped according to their responses to the questions that were common to the full and short surveys, sheep numbers were used to divide respondents into quartiles. In the case of cattle numbers, slightly over 50 per cent of respondents had no cattle and the remaining respondents were divided into three approximately equal groups according their cattle numbers. In the tables below, the numbers of respondents varies from table to table as respondents can miss answering particular questions or parts of questions.

A1.5.1 Cattle numbers

Those who did not fill in the full survey, but responded to the short survey, were more likely to have cattle (Table A1.2), although there was no significant difference in the mean herd size among those who had cattle.

Table A1.2. Difference in cattle numbers between the full and short surveys. For an explanation of the bolded and underlined figures in the cells of the table, see section A1.7.2, below.

Respondents to ...	Proportion of respondents with cattle numbers in the ranges below (%)			
	No cattle	1 – 80	81 – 250	More than 250
Full survey	**66.6**	12.3	**<u>10.3</u>**	10.8
Short survey	**<u>53.4</u>**	14.9	**17.3**	14.4

Chi-squared test: $\chi 2=20.47$, d.f.=3, $p<0.0002$, n=1019.

A1.5.2 Sheep numbers

There was no significant difference between the average flock size (number of sheep typically run) of those who responded to the full survey, compared to those who responded to the short survey. The mean flock size for the former was 3,489 and for the latter, 3,495.

A1.5.3 Lice treatment

Significantly more of those responding to the short survey had used off-shears and/or short wool lice treatments between 2009 and 2011 (Table A1.3). It should be noted that the lice treatment question in the full survey was more demanding of the respondent in the amount of information requested, than the same question in the short survey. The greater number of short survey respondents providing information for this question may be a reflection of the greater ease of response.

Table A1.3. Difference in use of off-shears and/or short wool lice treatments, 2009 – 2011.

Respondents to ...	% who had treated lice off-shears or short wool, 2009 – 2011
Full survey	58.1
Short survey	78.2

Fisher's Exact Test, p<0.00005, n=1019

Significantly more of those responding to the short survey had used long wool lice treatments between 2009 and 2011 (Table A1.4). The caveat noted above with respect to the relative ease of filling in this question in full and short surveys applies here also.

Table A1.4. Difference in use of long wool lice treatments, 2009 – 2011.

Respondents to ...	% who had treated lice long wool, 2009 – 2011
Full survey	15.1
Short survey	27.3

Fisher's Exact Test, p<0.00005, n=1019

A1.5.4 Mulesing and Anti-Flystrike Clips

There was a significant difference in the incidence of various changes in practice between the full survey and short survey respondents, with a greater proportion of the former continuing to mules all or almost all replacement sheep over the period 2003 – 2011 (Table A1.5). Respondents to the short survey were more likely to have reduced the proportion of replacement sheep mulesed, or ceased mulesing altogether, although they were not using anti-flystrike skin clips. The number of respondents replacing mulesing with the use of anti-flystrike skin clips in the period 2003 – 2011 was relatively small, although this change in practice was more common among respondents to the full survey.

Table A1.5. Difference in changes in practice with mulesing of replacement sheep and use of anti-flystrike clips. For an explanation of the bolded and underlined figures in the cells of the table, see section A1.7.2, below.

Practice change	Respondents to full survey	Respondents to short survey
No change. All or almost all mulesed. No skin clips	**88.8**	**66.9**
Ceased mulesing or substantial decrease in mulesing. No skin clips.	**3.5**	**21.9**
Slight to moderate decrease in mulesing, No skin clips.	**1.5**	**6.2**
Changed from no mulesing to all or almost all mulesed. No skin clips.	1.9	1.7
Changed from mulesing some or all sheep to skin clips on all or almost all sheep.	2.7	0.8
No change. About one half of sheep mulesed. No skin clips.	0.8	2.5
Changed from about half mulesed to all mulesed. No skin clips.	0.8	0.0

Chi-squared test: $\chi 2=56.02$, $p=0.0005$, $n=502$.

A1.5.5 Frequency of monitoring worm egg counts in ewes and lambs

On average, respondents to the short survey monitored worm egg counts more frequently in 2011 than did respondents to the full survey (Table A1.6). However, it should be noted that the worm egg count monitoring question in the full survey required respondents to provide a number of details about each test carried out, whereas in the short survey respondents simply had to provide the number of tests carried out. The higher average number of times monitoring was carried out for the short survey respondents may reflect the greater ease of response.

Table A1.6. Difference in the number of times worm egg counts were monitored in 2011, and in the average number of mobs tested each time.

Respondents to ...	Average number of times in 2011 that ewe worm egg counts were monitored	Average number of times in 2011 that lamb worm egg counts were monitored	Average number of mobs tested each time
Full survey	1.76	1.53	3.84
Short survey	3.04	2.72	2.93
Anova	*F=9.4, df=1, p=0.002, n=333*	*F=18.3, df=1, p=0.00002, n=309*	*F=4.47, df=1, p=0.035, n=302*

A1.5.6 Drench resistance test

There was no significant difference between respondents to the full and short surveys in whether or not they had carried out a drench resistance test in the last five years (Table A1.7).

Table A1.7. Difference in use of drench resistance tests, 2007 – 2011.

Respondents to ...	% who had carried out one or more drench resistance tests, 2007 – 2011
Full survey	28.2
Short survey	28.4

Fisher's Exact Test, p=0.994, n=1019

Table A1.8. Difference in proportions of respondents using various drench resistance tests.

Respondents to ...	Proportion of respondents carrying out one or more drench resistance tests, 2007 – 2011 (%)			
	Faecal egg count reduction test	Laboratory larval development test	Worm egg count conducted before drenching and again within three weeks	Worm egg count conducted only within three weeks after drenching
Full survey	12.3	6.3	17.0	4.5
Short survey	9.9	7.0	16.0	6.5
Fisher's Exact Test	p=0.232, n=1019	p=0.703, n=1019	p=0.672, n=1019	p=0.165, n=1019

A1.5.7 Conclusions

Table A1.9 shows that, among the questions where there was no, or very little, difference between the full and short surveys in the amount of effort required by respondents to complete the question, there were only significant differences with respect to whether or not respondents had cattle, and with respect to some changes in the proportion of replacement sheep mulesed. The sheep number and drench resistance test questions required similar degrees of effort to complete in both questionnaires and showed no significant difference in the nature of responses between the full and short surveys.

Table A1.9. Summary of the differences between the full and short surveys.

Survey question	Difference in effort required to complete questions in full and short survey	Significant differences between full and short surveys
Number of cattle.	Very little	Short survey respondents more likely to have cattle, but no significant difference in mean herd size among those with cattle.
Number of sheep.	Very little	No significant difference in flock size.
Lice treatment.	Much more effort required for full survey.	Short survey respondents more likely to have carried out lice treatments.
Use of mulesing and skin clips	Identical question.	Short survey respondents more likely to have decreased the proportion of replacement sheep mulesed. Full survey respondents more likely not to have made any change.
Frequency of monitoring worm egg counts.	Much more effort required for full survey.	Short survey respondents monitoring more frequently.
Drench resistance tests.	Very little.	No significant difference in use of drench resistance tests.

Both questions where the short survey was much easier to provide the requested information than the full survey showed significant differences in the nature of responses between the full and short surveys. Since these differences were consistent with what might have been obtained if more respondents to the full survey were skipping the question, they should not be used in the consideration of non-response bias.

A1.6 Weighting for non-response bias

Weighting for non-response bias involves either the comparison of the survey responses with population characteristics known from other sources, or estimating the characteristics of non-responders using supplementary techniques. The first option is not feasible as data from secondary sources with the detail and geographic scope of the survey is not available. The second option can be used if it is assumed that the characteristics of the responders to the short survey are representative of the remaining nonresponders.

The preceding section has shown that nonresponders (as represented by short survey respondents) are significantly different in two respects, viz. they are more likely to have cattle and are more likely to have decreased the proportion of replacement sheep mulesed. In this case, respondents with cattle and those who had decreased the proportion of replacement sheep mulesed will be under-represented in the full survey, while respondents with no cattle and without this decrease will be over-represented. Knowing the number who responded to neither the full survey nor the short survey, it is possible to calculate case weights for the responders to the full survey, according to whether they have cattle or not, or decreased the mulesing proportion or otherwise. Application of these weights will correct the under- and over-representation described above.

However, while the use of case weights can correct biases in the estimates of means and proportions due to non-response, their use also can compromise the validity of inferential statistics. For this reason,

it is preferable, if weighting is going to be used, to ensure that its use will correct substantial biases rather than negligible biases. This can be done by comparing weighted and unweighted means and proportions for a number of key questions in the survey. Differences between weighted and unweighted estimates can be assessed simply by consideration of the magnitude of the difference in the context of the goals of the survey, or by tests of statistical significance of the differences in weighted and unweighted estimates, treated as being derived from two separate surveys with similar sized samples.

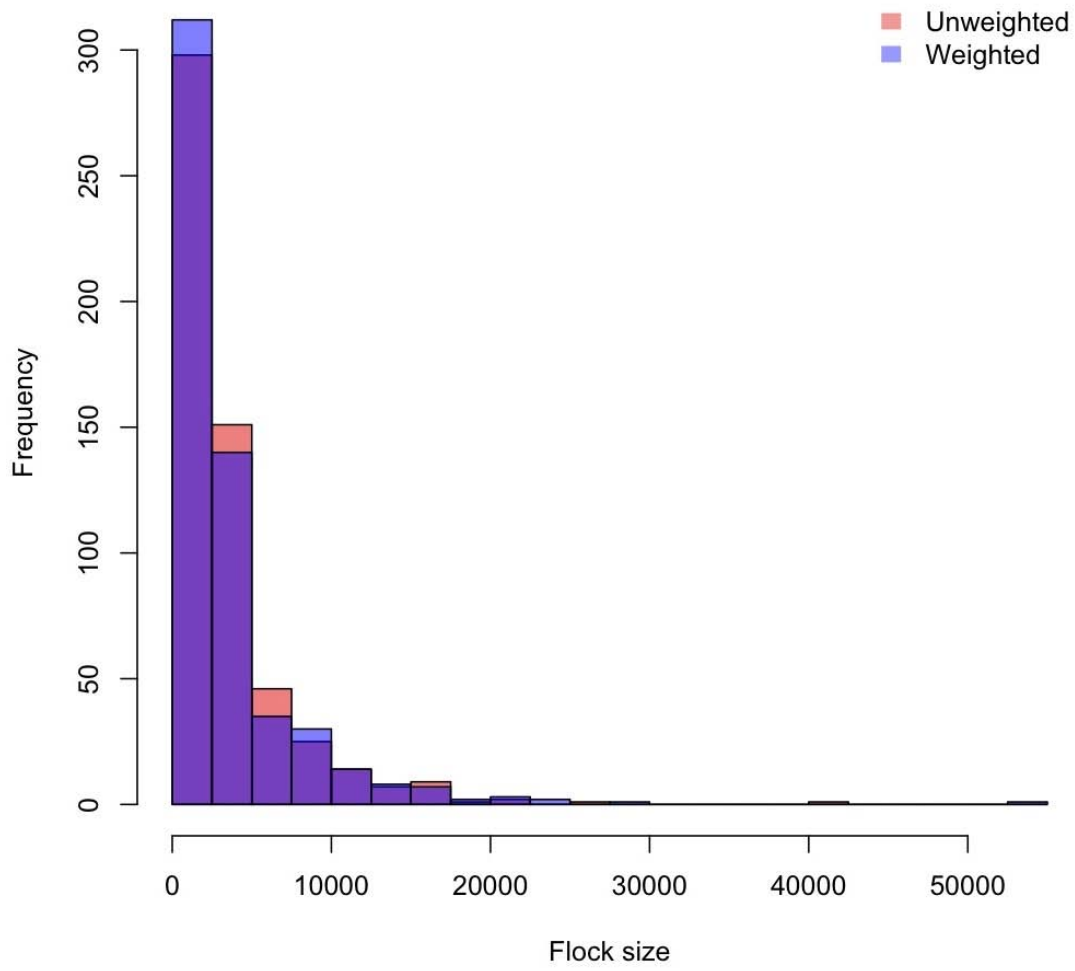
A1.6.1 Weighting by presence or absence of cattle

Table A1.10 shows that the differences between weighted and unweighted estimates for a range of producer characteristics are extremely small and, without exception, non-significant. The weighted estimate of mean flock size is 83 more than the unweighted estimate, however Figure A1.1 shows there is relatively little difference between the two flock size distributions.

Table A1.10. Comparison of unweighted and weighted distributions for the responses to a range of questions in the full survey.

Characteristic	Unweighted estimate	Weighted estimate	Test, p value, n
Mean flock size	3.489	3,572	*Anova, p=0.74, n=1110*
% who had treated lice off-shears or short wool, 2009 – 2011	58.1	57.5	*Fisher's Exact Test, p=0.86, n=1150*
% who had treated lice long wool, 2009 – 2011	15.1	14.8	*Fisher's Exact Test, p=0.93, n=1150*
No change. All or almost all mulesed. No skin clips (%)	88.8	88.2	*χ^2, p=1.00, n=521*
Ceased mulesing or substantial decrease in mulesing. No skin clips. (%)	3.5	4.1	
Slight to moderate decrease in mulesing, No skin clips. (%)	1.5	1.5	
Changed from no mulesing to all or almost all mulesed. No skin clips. (%)	1.9	1.8	
Changed from mulesing some or all sheep to skin clips on all or almost all sheep. (%)	2.7	2.4	
No change. About one half of sheep mulesed. No skin clips. (%)	0.8	1.0	
Changed from about half mulesed to all mulesed. No skin clips. (%)	0.8	1.0	
Average number of times in 2011 that ewe worm egg counts were monitored.	1.8	1.7	*Anova, p=0.91, n=304*
Average number of times in 2011 that lamb worm egg counts were monitored.	1.5	1.5	*Anova, p=0.90, n=304*
Average number of mobs tested each time.	3.8	3.9	*Anova, p=0.86, n=282*
% who had carried out one or more drench resistance tests of any type, 2007 – 2011.	28.2	29.2	*Fisher's Exact Test, p=0.74, n=1150*
% who had carried out one or more faecal egg count reduction tests, 2007 – 2011.	12.3	12.8	*Fisher's Exact Test, p=0.93, n=1150*
% who had carried out a laboratory larval development test, 2007 – 2011.	6.3	6.6	*Fisher's Exact Test, p=0.90, n=1150*
% who had a worm egg count conducted before drenching and again within three weeks, 2007 – 2011.	17.0	17.6	*Fisher's Exact Test, p=0.88, n=1150*
% who had a worm egg count conducted only within three weeks after drenching, 2007 – 2011.	4.5	5.2	*Fisher's Exact Test, p=0.68, n=1150*

Figure A1.1. Comparison of unweighted and weighted flock size distributions from the full survey (purple parts of columns denote where the two histograms overlap). $\chi 2=9.54$, p=0.82, n=1110.



A1.6.2 Weighting by change in proportion of replacement sheep mulesed

Table A1.11 shows that the differences between weighted and unweighted estimates for a range of producer characteristics are extremely small and, without exception, non-significant. It can be concluded that there would be little difference in estimates of means and proportions if the full survey data was weighted for non-response bias according to the change the proportion of replacement mulesed. A further reason for not weighting the full survey data is that one of the weights is 6.25, a figure that is unsatisfactorily large because it has the potential to amplify the idiosyncrasies of a small set of respondents to the full survey.

Table A1.11. Comparison of unweighted and weighted distributions for the responses to a range of questions in the full survey.

Characteristic	Unweighted estimate	Weighted estimate	Test, p value, n
Mean flock size	3.489	3,498	*Anova, p=0.97, n=1110*
Mean cattle herd size	110	115	*Anova, p=0.84, n=1150*
% who had treated lice off-shears or short wool, 2009 – 2011	58.1	61.3	*Fisher's Exact Test, p=0.28, n=1150*
% who had treated lice long wool, 2009 – 2011	15.1	17.1	*Fisher's Exact Test, p=0.42, n=1150*
Average number of times in 2011 that ewe worm egg counts were monitored.	1.8	1.6	*Anova, p=0.32, n=304*
Average number of times in 2011 that lamb worm egg counts were monitored.	1.5	1.5	*Anova, p=0.91, n=304*
Average number of mobs tested each time.	3.8	3.6	*Anova, p=0.68, n=282*
% who had carried out one or more drench resistance tests of any type, 2007 – 2011.	28.2	27.6	*Fisher's Exact Test, p=0.94, n=1150*
% who had carried out one or more faecal egg count reduction tests, 2007 – 2011.	12.3	12.8	*Fisher's Exact Test, p=0.86, n=1150*
% who had carried out a laboratory larval development test, 2007 – 2011.	6.3	6.4	*Fisher's Exact Test, p=1.00, n=1150*
% who had a worm egg count conducted before drenching and again within three weeks, 2007 – 2011.	17.0	16.0	*Fisher's Exact Test, p=0.69, n=1150*
% who had a worm egg count conducted only within three weeks after drenching, 2007 – 2011.	4.5	3.9	*Fisher's Exact Test, p=0.77, n=1150*

A1.6.3 Conclusions

Overall, the investigation of non-response bias suggests that there are not major and systematic differences between the full and short surveys that extend across the full range of questions common to both surveys. There appears to be some minor non-response biases with respect to particular respondent characteristics, however there are not sufficiently strong relationships between these and other characteristics to warrant universal weighting of the findings based on these biases. This is consistent with the approach taken in the 2004 survey, in which it was also found that there was little reason for weighting the data to adjust for non-response bias.

While universal weighting of the findings appears not to be warranted, there may be grounds for simple adjustment of the findings for each of the small number of questions that were asked in both the full and short surveys. Given that these questions were chosen for their central relevance to the study, it is worth using the data from the short survey to provide the best possible estimates of the producer characteristics with which these questions are concerned.

As an example of the adjustment procedure, suppose a question has a proportion of x per cent giving a certain answer in the full survey and y per cent giving the same answer in the short survey. If N respondents answered the question in the full survey and M answered the question in the short survey and P did not respond to either, then the adjusted estimate of the percentage giving the particular answer to the question, x_{adj} is:

$$x_{adj} = \frac{(x \times N) + (y \times (M + P))}{(N + M + P)}$$

This assumes that y per cent of those who did not respond to either survey would have given the particular answer if they had responded.

A1.7 Explanation of Tables

Tables presented in the main body of the report and in Appendix A2 fall into four main types. The types of statistics presented varies according to the type of table.

A1.7.1 Continuous variables

As described in the explanation of tables in section 3.1 of the main body of the report, the summary tables for continuous variables report the sample size (n), the minimum, median and maximum values, the mean and the 95% confidence interval on the estimate of the mean are provided.

A small histogram of the frequency distribution is also provided for each region in the table. Within any one table, the histograms have the same range on the horizontal axis, so that visual comparisons can be made between regions. However, the histograms are scaled to be of the same height, so that the histograms for regions with a small number of responses are not unduly small and difficult to discern. The class limits for the histogram bars are provided under each table. Histogram counts are the number of respondents with values greater than the lower class limit and less than or equal to the upper class limit. For example, for the class limits 100-260-420-580-740-900-1060-1220-1380-1540-1700, the count of respondents represented by the left-most histogram bar is the number of respondents with values greater than 100 and less than or equal to 260. The count for the next histogram bar is the number of respondents with values greater than 260 and less than or equal to 420, and so on.

Below the histogram class limits at the base of each table, basic statistics are provided for a test of whether there are significance differences in the mean between regions. The test most commonly used was analysis of variance. In a number of cases, however, the variables are strongly bi-modal, with the bulk of responses at the minimum and maximum values of the range. In these cases, the distributions depart substantially from that assumed in analysis of variance, and significance values may be in error. In particular, care should be taken in the interpretation of significance values close to 0.05 when the distributions of the variable of interest in the regions are strongly bi-modal or skewed.

Some ordinal variables were treated as continuous and had means reported for them, although they had four categories or less, which is below the threshold at which ordinal variables can be treated as continuous. This approach was followed where the variable had a relatively small number of integer values, such as the number of treatments in a year for lice control, and where a mean value would be a more convenient way of summarising the data than presenting percentages of respondents with each of the integer values. In these cases, the non-parametric Kruskal-Wallis test rather than an analysis of variance was used to test the hypothesis that there was no difference in means between regions.

For other ordinal variables, such as rankings on the importance of factors used in deciding when to drench ewes, where a mean would have relatively little meaning, the reporting format described in the next section was used.

A1.7.2 Ordinal and nominal variables from single choice questions

For tables reporting proportions for ordinal and nominal data, and where space permits, the upper and lower 95% confidence limits on the estimates of proportions are provided in greyed text to the left and right of the proportion. For questions where respondents have a binary choice, e.g. indicating whether they have cattle or not, the exact Clopper Pearson method was used to calculate confidence intervals (Clopper and Pearson, 1934; Scherer, 2013). For questions where respondents indicated one choice out of more than two possible choices, e.g. whether a factor influencing drench decisions was very important, important, somewhat important or not important, the Sison-Graz method was used (Sison and Graz, 1995; Villacorta, 2012).

Results of chi squared tests of independence of factors are shown below tabulations of ordinal and nominal variables by regions. When the number of cells with expected frequencies less than five falls below that generally regarded as acceptable for the chi squared test (about 20 per cent of cells), the p value is obtained by Monte Carlo simulation with 10,000 iterations, rather than from the chi square distribution. Tables where Monte Carlo simulation has been used can be recognised by the absence of a figure for degrees of freedom in the chi square statistics shown in the table footnote.

Where a cell in an individual region has a value significantly greater than the value for all regions taken together (as indicated by a standardised residual greater than 2.0) the figure in the cell is highlighted by bolding and underlining. Where a cell in an individual region has a value significantly less than the value for all regions taken together (as indicated by standardised residuals less than -2.0), this is denoted by bolding only.

When the chi square test of independence of factors is not significant, no figures in the table are bolded and underlined, or bolded.

Lastly, where tables for ordinal or nominal variables involved only two categories (apart from the 10 region categories), such as when the respondent indicated whether or not they had tested for drench resistance, only the percentages for one category are shown, as the percentages for the other category can readily be obtained by subtracting from 100.

A1.7.3 Nominal variables from multiple choice questions

A number of questions in the questionnaire give rise to multi-level data, i.e. data where there are several levels that could be chosen as the unit of analysis. For example, respondents reporting on their worm control practices could nominate up to twenty treatments, each of which could involve several classes of sheep and several different products Such a data structure can be analysed with respondents as the unit of analysis (and for example, aggregating products across years and practices), or with treatments as the unit of analysis (aggregating products within years or within types of practices), or with products as the unit of analysis. A further complication with this type of data structure is that the same product can be validly named several times (for example, where it is used each year for three years). In this situation, a table of proportions based on counts of respondents may have a cell in which the proportion is greater than 100 per cent. While the figure is quite correct given the structure of the data and the proportion based on counts of respondents, it is cognitively discomforting to comprehend the meaning of a statement that, for example, 125 per cent of respondents used product X. The best that can be inferred from such a statement is that a fair few people must have used product X and quite a lot probably used it several times.

To avoid this type of problem the following guidelines were followed in reporting from multiple choice and multi-level questions. Where the nature of the multiple choice question was such that the same category could not be indicated more than once by the respondent, the percentages in the table reporting on the question were expressed in terms of respondents. In this situation, no single cell can be more than 100 per cent, but the sum of a row of cells may exceed 100 per cent, due to the question allowing multiple choices. Where the latter is a possibility, this is noted in the footnote to the table.

Where the nature of the multiple choice question was such that the same category could be indicated twice (as in the example of the same lice control product used in consecutive years), the percentages in the table were expressed in terms of products, or treatments, or whatever it was that the respondent could validly name several of the same category.

Since multiple choice and multi-level data is generally ill fitted to the assumptions behind the statistical tests used on data from single choice questions, no statistics are presented in the tables from multiple choice or multi-level questions.

A1.8 Calculation of DSEs

Where stock numbers have been converted to DSEs, the conversion factors used were taken from McLaren (1997). Attwood provides conversion factors based on daily energy requirements for a number of classes of livestock at two liveweights and, in some case, at different rates of weight gain. As the survey questionnaire did not collect information on liveweight or weight gain, conversion factors in the middle of the range given by Attwood were used. The conversion factors used are shown in the table below.

Livestock type in questionnaire	Factor for conversion to DSEs
Q5 – Cows	12.0
Q5 – Heifers (weaning – 2 years)	7.0
Q5 Steers (weaning – sale)	7.0
Q5 – Bulls	12.0
Q5 – Other	Factor chosen according to description
Q6 – Merino ewes	1.2
Q6 Other ewes	1.2
Q6 – Wethers	1.0
Q6 – Merino weaners	1.3
Q6 – Other weaners	1.3
Q6 – Rams	1.0

A1.9 References

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APPENDIX A2

A2 Additional Results

A2.1 Age of Respondents

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	25	39	62	81	61	9	
New England	60	36	52	80	54	6	
C & S Tablelands	69	36	58	83	59	5	
S NSW & N Vic	66	35	57	73	56	5	
Gippsland	8	23	50	65	49	26	
W Vic & SE SA	143	22	56	86	55	4	
S SA	27	28	57	72	54	9	
KI	17	39	55	69	55	10	
WA	122	25	54	79	54	4	
All Regions	537	22	56	86	56	2	

Histogram class limits: 22 28.4 34.8 41.2 47.6 54 60.4 66.8 73.2 79.6 86
Anova: F=2.52, df=8, p=0.0107

A2.2 Cattle DSEs in 2011 Compared to a Typical Year

Region	n	Proportion of respondents (%)								
		2011 < typical			2011 = typical			2011 > typical		
S Qld	21	19	38	62	24	43	67	0	19	43
New England	55	18	31	45	40	53	67	4	16	30
C & S Tablelands	36	17	31	50	31	44	64	11	25	44
S NSW & N Vic	30	7	23	43	23	40	60	20	37	57
Gippsland	3	0	0	56	100	100	100	0	0	56
W Vic & SE SA	71	10	20	32	49	59	72	11	21	34
S SA	20	5	25	46	35	55	76	0	20	41
KI	9	22	44	84	11	33	73	0	22	62
WA	23	22	39	62	30	48	71	0	13	36
All Regions	268	22	28	35	45	51	57	15	21	28

$\chi 2 = 15.76$, $p=0.4735$

A2.3 Length of Calving Period – Cows

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	16	1.0	1.5	5.0	1.9	1.3	
New England	47	1.0	1.0	4.0	1.6	0.5	
C & S Tablelands	25	1.0	2.0	12.0	3.0	2.5	
S NSW & N Vic	24	1.0	1.0	12.0	2.7	2.7	
Gippsland	3	1.0	1.0	4.0	2.0	8.6	
W Vic & SE SA	56	1.0	2.0	12.0	2.5	1.3	
S SA	18	1.0	2.5	8.0	3.4	2.3	
KI	8	1.0	1.5	6.0	2.2	3.1	
WA	22	1.0	2.0	4.0	2.0	0.7	
All Regions	219	1.0	2.0	12.0	2.3	0.6	

Histogram class limits: 1 3.2 5.4 7.6 9.8 12
Anova: F=1.97, df=8, p=0.0515

A2.4 Length of Calving Period – Heifers

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
S Qld	5	1.0	1.0	5.0	2.4	4.8	
New England	18	1.0	1.0	12.0	1.9	2.6	
C & S Tablelands	6	1.0	2.5	8.0	3.5	5.4	
S NSW & N Vic	11	1.0	1.0	2.0	1.4	0.7	
Gippsland	2	1.0	2.5	4.0	2.5	38.1	
W Vic & SE SA	19	1.0	1.0	3.0	1.5	0.6	
S SA	8	1.0	2.0	7.0	2.5	3.3	
KI	1	2.0	2.0	2.0	2.0	–	
WA	7	1.0	2.0	3.0	1.9	1.7	
All Regions	77	1.0	1.0	12.0	2.0	0.8	

Histogram class limits: 1 3.2 5.4 7.6 9.8 12
Anova: F=1.07, df=8, p=0.3978

A2.5 Cow Calving Months with Highest Proportion(s) of Respondents

Region	n	Months in which the highest proportion(s) of respondents report cows calving
S Qld	16	December
New England	47	September
C & S Tablelands	25	August
S NSW & N Vic	24	August
Gippsland	3	July
W Vic & SE SA	56	March
S SA	18	February, March
KI	8	June
WA	22	April
All Regions	219	August

A2.6 Heifer Calving Months with Highest Proportion(s) of Respondents

Region	n	Months in which the highest proportion(s) of respondents report cows calving
S Qld	5	October, December
New England	18	August
C & S Tablelands	6	July, August, September
S NSW & N Vic	11	August
Gippsland	2	July
W Vic & SE SA	19	February, March, April
S SA	8	April
KI	1	September, October
WA	7	April, May
All Regions	77	August

A2.7 Sheep DSEs in 2011 Compared to a Typical Year

Region	n	Proportion of respondents (%)								
		2011 < typical			2011 = typical			2011 > typical		
S Qld	25	20	36	59	8	**24**	47	24	40	63
New England	61	10	21	34	48	**59**	72	8	20	33
C & S Tablelands	76	24	34	47	32	42	55	13	24	37
S NSW & N Vic	70	14	26	39	30	41	55	21	33	46
Gippsland	9	22	44	84	11	33	73	0	22	62
W Vic & SE SA	140	9	**17**	26	39	48	57	26	35	44
S SA	27	0	**7**	29	30	44	66	33	**48**	70
KI	17	0	12	40	24	41	69	29	47	75
WA	120	28	38	48	28	38	48	16	25	35
All Regions	545	22	26	31	39	43	48	26	30	35

$\chi^2 = 38.24$, $p = 0.0012$.

A2.8 Proportion of Respondents (%) Shearing and Crutching Ewes Each Month

A2.8.1 Shearing Ewes

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	22	29	24	18	6	0	0	24	0	6	0	0	0
New England	59	5	19	31	29	10	2	12	5	3	3	0	2
C & S Tablelands	71	11	10	17	10	13	13	13	8	10	13	10	4
S NSW & N Vic	67	3	15	27	10	5	3	3	10	11	19	8	2
Gippsland	9	0	0	22	33	11	11	11	0	0	22	0	11
W Vic & SE SA	148	3	8	25	22	8	8	6	7	8	16	8	8
S SA	25	4	21	33	38	12	8	4	8	25	21	0	4
KI	17	0	0	6	41	12	12	6	0	24	18	24	0
WA	120	0	5	19	19	9	4	4	17	25	14	7	0
All regions	538	5	10	23	20	9	6	7	9	13	14	7	4

Note: percentages may sum to more than 100 as respondents could give more than one month.

A2.8.2 Crutching Ewes

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
SW & S Qld	17	29	24	18	6	0	0	24	0	6	0	0	0
New England	58	5	19	31	29	10	2	12	5	3	3	0	2
C & S Tablelands	71	11	10	17	10	13	13	13	8	10	13	10	4
S NSW & N Vic	62	3	15	27	10	5	3	3	10	11	19	8	2
Gippsland	9	0	0	22	33	11	11	11	0	0	22	0	11
W Vic & SE SA	143	3	8	25	22	8	8	6	7	8	16	8	8
S SA	24	4	21	33	38	12	8	4	8	25	21	0	4
KI	17	0	0	6	41	12	12	6	0	24	18	24	0
WA	107	0	5	19	19	9	4	4	17	25	14	7	0
All regions	508	5	10	23	20	9	6	7	9	13	14	7	4

Note: percentages may sum to more than 100 as respondents could give more than one month.

A2.9 Proportion of Respondents (%) Shearing and Crutching Wethers Each Month

A2.9.1 Shearing Wethers

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	13	0	0	0	8	23	8	38	15	15	0	0	15
New England	37	5	0	0	3	3	0	8	19	30	24	11	0
C & S Tablelands	49	4	10	2	2	4	4	8	14	16	16	16	6
S NSW & N Vic	18	0	6	6	22	0	0	0	0	44	22	0	6
Gippsland	6	0	0	33	0	17	0	0	33	0	0	17	0
W Vic & SE SA	68	4	7	4	12	6	4	7	10	21	18	24	6
S SA	10	0	0	10	10	0	0	0	20	0	30	40	0
KI	11	18	0	9	9	0	0	0	0	9	9	36	9
WA	57	9	14	4	7	2	2	4	19	21	18	9	2
All regions	269	5	7	4	8	4	3	7	14	21	17	16	4

Note: percentages may sum to more than 100 as respondents could give more than one month.

A2.9.2 Crutching Wethers

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	11	18	18	27	9	9	0	9	9	0	0	9	0
New England	35	0	11	26	20	23	9	14	9	6	0	0	0
C & S Tablelands	47	9	9	17	9	13	11	4	6	15	9	15	4
S NSW & N Vic	15	0	7	40	13	0	0	0	0	13	13	7	7
Gippsland	6	0	17	17	0	0	17	0	17	0	17	0	17
W Vic & SE SA	68	6	7	24	13	10	7	6	10	10	4	7	12
S SA	9	0	0	22	33	11	11	11	0	22	0	0	11
KI	11	0	0	0	36	9	0	0	0	18	36	27	0
WA	54	0	7	20	31	9	2	2	15	11	11	4	2
All regions	256	4	8	22	18	11	6	5	9	11	8	7	5

Note: percentages may sum to more than 100 as respondents could give more than one month.

A2.10 Proportion of Respondents (%) Shearing and Crutching Weaners (Less than 12 Months) Each Month

A2.10.1 Shearing Weaners

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	17	6	6	12	18	29	12	29	12	6	0	6	6
New England	49	2	4	4	4	6	2	8	24	31	20	12	2
C & S Tablelands	59	10	8	14	10	8	10	14	15	14	22	14	3
S NSW & N Vic	50	18	16	10	16	4	2	4	4	10	18	12	18
Gippsland	9	0	0	22	11	11	0	11	11	11	22	0	0
W Vic & SE SA	110	10	8	7	6	6	4	3	4	7	11	30	13
S SA	17	6	6	12	6	0	6	0	0	6	47	24	6
KI	12	0	0	17	8	0	8	0	0	8	17	33	8
WA	105	11	13	6	10	2	2	3	11	19	25	12	5
All regions	428	10	9	9	9	6	4	6	10	14	19	18	8

Note: percentages may sum to more than 100 as respondents could give more than one month.

A2.10.2 Crutching Weaners

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	14	21	29	21	7	0	0	7	7	0	0	0	7
New England	42	5	19	24	26	21	5	5	14	5	0	0	2
C & S Tablelands	55	15	15	18	9	11	11	5	5	9	5	7	9
S NSW & N Vic	35	6	6	20	9	6	3	3	6	11	17	14	9
Gippsland	8	0	12	12	25	0	12	0	12	12	12	0	25
W Vic & SE SA	90	6	9	20	17	10	7	6	7	8	17	8	10
S SA	13	0	8	0	15	15	23	0	8	23	8	8	8
KI	11	0	9	0	36	18	0	9	9	27	9	9	0
WA	68	3	9	19	22	9	3	4	13	16	9	1	6
All regions	336	7	12	18	17	11	6	5	9	11	10	6	8

Note: percentages may sum to more than 100 as respondents could give more than one month.

A2.11 Proportion of respondents (%) putting rams with ewes each month of the year in 2003

A2.11.1 Merino mated to Merino rams

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	16	6	12	12	56	6	0	0	0	0	0	6	0
New England	35	0	3	6	43	43	3	0	3	0	0	0	0
C & S Tablelands	50	12	22	28	24	2	0	0	0	0	2	8	2
S NSW & N Vic	28	14	25	7	0	0	0	0	4	0	7	7	36
Gippsland	7	0	14	14	43	0	0	0	0	14	0	0	14
W Vic & SE SA	62	5	16	15	23	2	0	0	0	0	3	11	26
S SA	13	31	8	0	0	0	0	0	0	0	23	8	31
KI	11	45	27	0	0	0	0	0	0	0	0	0	27
WA	83	35	17	1	0	0	0	0	0	0	5	14	28
All regions	305	17	16	10	17	6	0	0	1	0	4	9	19

$\chi 2$ =329.65, p=0.0001.

A2.11.2 Merino mated to Meat breed rams

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	6	0	0	33	50	17	0	0	0	0	0	0	0
New England	29	0	3	14	59	17	3	0	0	0	0	0	3
C & S Tablelands	37	22	41	14	8	0	0	0	0	0	0	8	8
S NSW & N Vic	28	11	18	18	0	0	4	0	0	0	11	14	25
Gippsland	3	0	33	0	0	0	0	0	0	0	0	33	33
W Vic & SE SA	71	7	13	13	4	1	0	0	0	0	3	17	42
S SA	17	18	0	0	0	0	0	0	0	0	24	24	35
KI	9	44	22	11	0	0	0	0	0	0	0	0	22
WA	51	35	12	2	2	0	2	0	0	0	10	18	20
All regions	251	16	16	11	11	3	1	0	0	0	6	13	24

χ^2 =229.23, p=0.0001.

A2.11.3 Cross-bred ewes

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	3	0	0	0	0	33	33	0	0	33	0	0	0
New England	20	0	0	35	50	10	5	0	0	0	0	0	0
C & S Tablelands	25	32	24	0	8	0	0	0	0	0	8	12	16
S NSW & N Vic	29	14	21	10	0	0	0	0	0	0	14	28	14
Gippsland	1*	-	-	-	-	-	-	-	-	-	-	-	-
W Vic & SE SA	83	17	12	6	2	0	0	0	0	0	6	12	45
S SA	9	33	22	11	0	0	0	0	0	0	0	33	0
KI	11	36	27	0	0	0	0	0	0	9	0	9	18
WA	16	31	19	0	0	0	6	0	0	0	0	19	25
All regions	197	19	15	8	8	2	2	0	0	1	6	14	26

χ^2 =246.28, p=0.0004.

** Figures for this single respondent have been omitted for confidentiality reasons. The respondent's data is included in the figures for all regions and the anova statistics.*

A2.12 Marking percentages in 2011 compared to a typical year

A2.12.1 Merino ewes mated to Merino rams

Region	n	Proportion of respondents (%)								
		2011 < typical			2011 = typical			2011 > typical		
S Qld	15	67	**80**	100	0	7	28	0	**13**	34
New England	34	3	18	37	24	38	58	29	44	63
C & S Tablelands	45	22	36	53	11	24	41	27	40	57
S NSW & N Vic	22	0	14	33	0	14	33	59	**73**	92
Gippsland	5	0	0	51	40	60	100	20	40	91
W Vic & SE SA	48	8	21	37	15	27	43	40	52	68
S SA	14	0	7	29	0	14	36	64	**79**	100
KI	8	0	0	33	12	38	71	38	62	96
WA	75	32	**43**	56	12	23	36	24	**35**	48
All Regions	266	24	30	37	18	25	31	39	45	52

$\chi 2 = 51.44$, $p = 0.0001$

A2.12.2 Merino ewes mated to meat breed rams

Region	n	Proportion of respondents (%)								
		2011 < typical			2011 = typical			2011 > typical		
S Qld	8	38	**62**	96	0	12	46	0	25	58
New England	26	0	8	28	46	**62**	82	15	31	51
C & S Tablelands	28	4	21	41	29	46	66	14	32	51
S NSW & N Vic	21	0	10	27	0	**14**	32	62	**76**	94
Gippsland	3	0	0	35	0	33	69	33	67	100
W Vic & SE SA	64	5	16	30	25	36	50	38	48	62
S SA	15	0	20	42	0	13	35	47	67	89
KI	6	0	17	66	17	33	83	33	50	100
WA	47	19	**32**	49	17	30	47	26	38	55
All Regions	218	13	20	27	28	34	42	39	45	53

$\chi 2 = 37.32$, $p = 0.0018$.

A2.12.3 Cross-bred ewes

Region	n	Proportion of respondents (%)								
		2011 < typical			2011 = typical			2011 > typical		
S Qld	2	50	50	100	50	50	100	0	0	96
New England	13	0	15	43	31	54	81	8	31	58
C & S Tablelands	17	12	29	58	24	41	70	12	29	58
S NSW & N Vic	21	10	29	51	0	19	41	33	52	75
Gippsland	1*	-	-	-	-	-	-	-	-	-
W Vic & SE SA	67	6	18	31	25	37	50	33	45	58
S SA	9	0	22	59	0	22	59	33	56	93
KI	8	0	25	58	0	12	46	38	62	96
WA	12	0	17	44	8	33	61	25	50	78
All Regions	150	13	21	30	26	34	43	37	45	54

$\chi 2 = 12.28$, $p = 0.7648$.

** Figures for this single respondent have been omitted for confidentiality reasons. The respondent's data is included in the figures for all regions and the anova statistics.*

A2.13 Proportion of respondents (%) weaning lambs each month of the year in 2011

A2.13.1 Merino mated to Merino rams

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	15	20	20	27	13	7	0	0	0	0	0	7	7
New England	38	45	18	13	8	3	0	0	0	0	0	3	11
C & S Tablelands	49	20	4	4	0	0	0	2	0	4	16	24	24
S NSW & N Vic	30	0	0	0	0	0	3	13	17	13	7	40	7
Gippsland	7	0	14	14	0	0	0	14	0	0	14	29	14
W Vic & SE SA	69	9	3	0	0	0	1	6	9	16	14	26	16
S SA	13	0	0	0	8	8	0	8	15	31	23	8	0
KI	9	0	0	0	0	0	0	0	0	11	44	44	0
WA	83	1	0	0	0	0	1	2	11	25	30	18	11
All regions	313	12	5	4	2	1	1	4	7	14	17	21	13

$\chi = 268.26$, $p = 0.0001$.

A2.13.2 Merino mated to Meat breed rams

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	8	12	25	25	12	0	0	0	0	0	0	0	25
New England	30	43	23	7	3	0	0	0	3	0	0	3	17
C & S Tablelands	35	6	3	3	0	0	0	3	3	6	31	17	29
S NSW & N Vic	26	4	0	0	0	0	0	15	12	4	15	35	15
Gippsland	3	0	0	0	0	0	0	0	0	0	67	33	0
W Vic & SE SA	80	5	0	1	0	0	0	1	9	14	19	32	19
S SA	15	0	7	0	0	0	0	13	27	13	27	13	0
KI	6	0	0	0	0	0	0	0	0	17	33	50	0
WA	56	0	0	0	0	0	0	4	9	25	32	20	11
All regions	259	8	4	2	1	0	0	4	8	12	22	23	16

$\chi 2$ =220.11, p=0.0003.

A2.13.3 Cross-bred ewes

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	3	33	33	0	0	33	0	0	0	0	0	0	0
New England	32	25	34	13	0	0	0	0	0	3	0	3	22
C & S Tablelands	43	9	0	0	0	0	0	2	5	7	16	26	35
S NSW & N Vic	42	2	0	0	2	0	2	10	10	19	24	26	5
Gippsland	5	0	0	0	20	0	0	0	0	0	20	20	40
W Vic & SE SA	119	5	1	0	0	0	1	4	7	6	16	36	24
S SA	18	0	0	0	0	0	0	0	11	44	28	17	0
KI	8	0	0	0	0	0	0	0	0	38	50	13	0
WA	12	0	0	0	0	0	0	0	0	17	33	17	33
All regions	283	7	5	1	1	0	1	4	6	11	18	26	21

$\chi 2$ =384.27, p=0.0001.

A2.14 Worm Control, 2011

A2.14.1 Proportion of treatments (%) of lambs and/or weaners in each month of the year

Region	n*	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	61	16	13	15	3	5	2	11	8	2	5	7	13
New England	255	16	13	9	10	5	4	4	10	5	4	9	12
C & S Tablelands	176	7	9	6	5	9	8	7	10	6	9	15	11
S NSW & N Vic	113	19	10	8	2	4	4	9	4	11	4	20	6
Gippsland	15	7	33	7	0	13	7	7	13	0	7	0	7
W Vic & SE SA	288	9	12	7	8	6	8	8	7	8	7	9	11
S SA	31	10	10	10	10	6	0	6	3	10	3	13	19
KI	33	9	12	0	12	12	0	12	9	6	9	9	9
WA	151	8	7	7	11	3	3	6	5	5	11	14	19
All regions	1123	12	11	8	7	6	5	7	8	6	7	11	12

** number of treatments.*

A2.14.2 Anthelmintics used – lambs and/or weaners

Anthelmintic: Class and/or active constituent	Proportion of treatments (%)
Alternative	1.5
BZ Albendazole	15.5
BZ Fenbendazole	7.3
BZ Oxfendazole	7.4
BZ unspecified	2.7
Closantel	6.1
Levamisole	35.4
ML Moxidectin LA	2.7
ML Abamectin	25.2
ML Ivermectin	6.1
ML Moxidectin	25.0
ML unspecified	2.9
Monepantel	3.4
OP Naphthalophos	7.2
Organophosphate unspecified	0.1
Praziquantel	5.4
OP Pyraclofos	0.6
Triclabendazole	1.4
Unspecified drench	5.9

417 respondents, 1074 treatments. Percentages add to more that 100% as treatments could involve more that one anthelmintic. Anthelmintic class abbreviations – ML: Macrocyclic lactone, BZ: Benzimidazole, and OP:Organophosphate.

A2.14.3 Proportion of treatments (%) of maiden ewes in each month of the year

Region	n*	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	3	33	0	0	33	0	0	0	0	0	0	0	33
New England	13	15	8	15	23	8	0	0	8	0	8	8	8
C & S Tablelands	8	12	12	0	0	12	25	12	0	12	12	0	0
S NSW & N Vic	3	0	0	0	0	0	0	0	0	100	0	0	0
Gippsland	2	0	100	0	0	0	0	0	0	0	0	0	0
W Vic & SE SA	13	8	0	8	0	0	23	15	0	23	0	15	8
S SA	1	–	–	–	–	–	–	–	–	–	–	–	–
KI	2	0	0	0	50	0	0	0	50	0	0	0	0
WA	6	0	0	33	0	0	17	17	0	0	17	0	17
All regions	51	10	8	10	10	4	12	10	4	14	6	6	8

** number of treatments. When sample size = 1, results are omitted to preserve confidentiality, but used in calculating totals.*

A2.14.4 Anthelmintics used – maiden ewes

Anthelmintic: Class and/or active constituent	Proportion of treatments (%)
BZ Albendazole	20.8
BZ Fenbendazole	11.3
BZ Oxfendazole	3.8
BZ unspecified	1.9
Closantel	11.3
Levamisole	43.4
ML - Moxidectin LA	5.7
ML Abamectin	26.4
ML Ivermectin	5.7
ML Moxidectin	18.9
ML unspecified	1.9
Monepantel	3.8
OP Naphthalophos	7.5
OP Pyraclofos	1.9
Unspecified drench	5.7

31 respondents, 53 treatments. Percentages add to more that 100% as treatments could involve more that one anthelmintic. Anthelmintic class abbreviations – ML: Macrocyclic lactone, BZ: Benzimidazole, and OP:Organophosphate.

A2.14.5 Proportion of treatments (%) of adult ewes in each month of the year

Region	n*	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	72	19	15	7	4	7	1	11	4	3	6	11	11
New England	258	19	10	9	7	7	7	4	7	7	5	10	8
C & S Tablelands	171	13	10	8	5	9	8	4	6	6	8	13	9
S NSW & N Vic	118	17	11	8	7	5	4	8	4	9	7	14	6
Gippsland	14	0	21	7	0	7	14	7	29	0	7	7	0
W Vic & SE SA	328	10	10	8	9	8	5	10	6	5	6	9	14
S SA	51	2	8	6	16	4	4	6	8	10	6	10	22
KI	32	12	16	0	28	6	0	6	9	3	9	6	3
WA	170	9	9	8	9	3	6	6	4	8	13	12	12
All regions	1214	13	11	8	8	6	5	7	6	6	7	11	11

** number of treatments. When sample size = 1, results are omitted to preserve confidentiality, but used in calculating totals.*

A2.14.6 Anthelmintics used –adult ewes

Anthelmintic: Class and/or active constituent	Proportion of treatments (%)
Alternative	2.1
BZ Albendazole	20.0
BZ Fenbendazole	8.1
BZ Oxfendazole	5.9
BZ unspecified	4.0
Closantel	7.5
Levamisole	35.4
ML Abamectin	22.6
ML Ivermectin	7.0
ML Moxidectin	23.5
ML Moxidectin LA	3.0
ML unspecified	2.8
Monepantel	2.9
OP Naphthalophos	9.6
Organophosphate unspecified	0.5
Praziquantel	0.6
OP Pyraclofos	3.9
Triclabendazole	2.4
Unspecified drench	5.9

440 respondents, 1114 treatments. Percentages add to more that 100% as treatments could involve more that one anthelmintic. Anthelmintic class abbreviations – ML: Macrocyclic lactone, BZ: Benzimidazole, and OP:Organophosphate.

A2.14.7 Proportion of treatments (%) of wethers in each month of the year

Region	n*	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	12	25	8	0	8	8	0	0	8	0	0	17	25
New England	87	15	14	6	7	3	5	2	9	8	5	10	16
C & S Tablelands	54	13	6	6	7	6	4	6	6	6	13	19	11
S NSW & N Vic	46	13	13	7	4	7	11	4	2	2	7	22	9
Gippsland	8	0	12	0	0	12	12	12	25	0	0	12	12
W Vic & SE SA	87	7	11	6	8	6	5	7	7	9	8	14	13
S SA	8	0	0	0	12	12	12	0	12	0	0	25	25
KI	5	20	0	0	0	20	0	20	0	20	20	0	0
WA	27	4	11	0	7	0	11	7	11	7	15	11	15
All regions	334	11	11	5	7	5	6	5	7	7	8	15	13

** number of treatments. When sample size = 1, results are omitted to preserve confidentiality, but used in calculating totals.*

A2.14.8 Anthelmintics used – wethers

Anthelmintic: Class and/or active constituent	Proportion of treatments (%)
Alternative	0.7
BZ Albendazole	18.0
BZ Fenbendazole	10.2
BZ Oxfendazole	6.9
BZ unspecified	3.3
Closantel	7.5
Levamisole	40.3
ML Abamectin	23.6
ML Ivermectin	3.9
ML Moxidectin	18.7
ML Moxidectin LA	1.6
ML unspecified	2.6
Monepantel	3.3
OP Naphthalophos	14.4
Praziquantel	1.0
OP Pyraclofos	0.7
Triclabendazole	2.6
Unspecified drench	11.1

142 respondents, 305 treatments. Percentages add to more that 100% as treatments could involve more that one anthelmintic. Anthelmintic class abbreviations – ML: Macrocyclic lactone, BZ: Benzimidazole, and OP:Organophosphate.

A2.14.9 Frequency of use of combinations of anthelmintics

Combination of anthelmintics	Proportion of sheep class treatments using combinations of anthelmintics (%)
BZ Fenbendazole + Levamisole	11.19
BZ Oxfendazole + Levamisole + ML Abamectin	10.88
BZ Albendazole + Levamisole + ML Abamectin	7.77
Levamisole + OP Naphthalophos	5.83
BZ Albendazole + Closantel + Levamisole	5.59
BZ Albendazole + Levamisole + ML Ivermectin	3.65
BZ Fenbendazole + Levamisole + OP Naphthalophos	3.65
Closantel + ML Abamectin	3.65
BZ Fenbendazole + Levamisole + ML Abamectin	3.42
BZ Albendazole + ML Moxidectin + OP Pyraclofos	3.26
BZ Albendazole + Levamisole	3.03
Unspecified drench + Unspecified drench + Unspecified drench	2.80
ML Abamectin + Praziquantel	2.72
BZ Albendazole + OP Naphthalophos	2.56
BZ Oxfendazole + Levamisole	2.56
BZ Albendazole + Closantel	2.41
BZ unspecified + Levamisole	2.18
BZ unspecified + OP Naphthalophos	1.94
Levamisole + Praziquantel	1.48
ML Moxidectin + Praziquantel	1.09
ML unspecified + OP Naphthalophos	1.09
BZ Albendazole + ML Abamectin	1.01
ML Abamectin + OP Naphthalophos	0.85
Alternative + ML Moxidectin	0.78
BZ Albendazole + OP Pyraclofos	0.70
BZ unspecified + Monepantel	0.70
BZ Albendazole + Closantel + Levamisole + ML Moxidectin	0.54
ML Moxidectin + OP Naphthalophos	0.54
ML Moxidectin + Triclabendazole	0.54
Unspecified drench + Unspecified drench	0.54
BZ Fenbendazole + BZ unspecified + Levamisole	0.47
BZ unspecified + OP Naphthalophos + Triclabendazole	0.47
Closantel + ML Moxidectin	0.47
Levamisole + ML Moxidectin	0.47
BZ Albendazole + Closantel + Levamisole + ML Abamectin	0.39
Closantel + Levamisole	0.39
Levamisole + ML Moxidectin LA	0.39
ML Abamectin + Triclabendazole	0.39
OP Naphthalophos + Unspecified drench	0.39
Alternative + Levamisole	0.31
BZ Albendazole + Closantel + Levamisole + Unspecified drench	0.31
BZ unspecified + ML Ivermectin	0.31
Closantel + ML Abamectin + ML Moxidectin	0.31
Levamisole + ML unspecified	0.31
Levamisole + Triclabendazole	0.31
Alternative + BZ Albendazole	0.23
Alternative + ML Abamectin	0.23
BZ Albendazole + BZ Oxfendazole + Levamisole + ML Abamectin	0.23

(table continued on next page)

A2.14.9 (contd) Frequency of use of combinations of anthelmintics

Combination of anthelmintics	Proportion of sheep class treatments using combinations of anthelmintics (%)
BZ Albendazole + Levamisole + OP Naphthalophos	0.23
BZ Albendazole + OP Naphthalophos + Triclabendazole	0.23
BZ unspecified + Levamisole + OP Naphthalophos	0.23
BZ unspecified + Organophosphate unspecified	0.23
ML Abamectin + ML Moxidectin	0.23
ML Abamectin + Monepantel	0.23
BZ Albendazole + Levamisole + ML Abamectin + Praziquantel	0.16
BZ Oxfendazole + Levamisole + Monepantel	0.16
BZ Oxfendazole + ML Abamectin	0.16
BZ Oxfendazole + Triclabendazole	0.16
BZ unspecified + Levamisole + ML unspecified	0.16
ML Abamectin + OP Naphthalophos + Praziquantel	0.16
ML Abamectin + Unspecified drench	0.16
ML unspecified + OP Naphthalophos + Triclabendazole	0.16
OP Naphthalophos + Triclabendazole	0.16
Alternative + BZ Fenbendazole + Levamisole + ML Abamectin	0.08
Alternative + BZ Oxfendazole + Levamisole + ML Abamectin	0.08
Alternative + Closantel	0.08
Alternative + Levamisole + OP Naphthalophos + Triclabendazole	0.08
Alternative + Triclabendazole	0.08
Alternative + Unspecified drench + Unspecified drench	0.08
BZ Albendazole + BZ Albendazole + Levamisole + ML Abamectin + ML Ivermectin	0.08
BZ Albendazole + BZ unspecified + OP Naphthalophos	0.08
BZ Albendazole + Levamisole + ML Abamectin + ML Moxidectin	0.08
BZ Albendazole + Levamisole + ML Abamectin + ML unspecified	0.08
BZ Albendazole + Levamisole + OP Pyraclofos	0.08
BZ Albendazole + ML Abamectin + Praziquantel	0.08
BZ Albendazole + Unspecified drench	0.08
BZ Fenbendazole + Levamisole + ML Ivermectin	0.08
BZ Oxfendazole + Levamisole + Triclabendazole	0.08
BZ Oxfendazole + OP Naphthalophos	0.08
BZ unspecified + Levamisole + ML Ivermectin	0.08
Levamisole + ML Ivermectin	0.08
Levamisole + ML Ivermectin + OP Naphthalophos	0.08
Levamisole + ML Moxidectin + ML Moxidectin	0.08
ML Abamectin + OP Naphthalophos + Triclabendazole	0.08
ML Moxidectin + OP Pyraclofos	0.08
ML unspecified + Monepantel	0.08
Monepantel + Triclabendazole	0.08

The unit of analysis in this table is sheep class treatments that involved a combination of anthelmintics, either contained within a single product, or within several products, n=1287. Anthelmintic class abbreviations – ML: Macrocyclic lactone, BZ: Benzimidazole, and OP:Organophosphate.

A2.15 Blow Fly Control

A2.15.1 Usual chemical treatments for fly strike

Treat routinely with preventative chemicals every year

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	25	15	0	8	0	**8**	0	**8**	8	15	8	23	8
New England	63	21	7	3	0	0	0	0	3	3	17	24	21
C & S Tablelands	79	11	4	2	0	0	0	0	0	4	33	24	20
S NSW & N Vic	72	0	8	0	0	0	0	0	0	10	36	**38**	8
Gippsland	9	17	0	0	0	0	0	0	0	0	17	17	**50**
W Vic & SE SA	154	**23**	0	2	0	0	0	2	0	**3**	21	31	18
S SA	28	0	11	0	0	0	0	0	11	11	22	0	**44**
KI	17	0	0	0	0	0	0	**17**	0	17	17	17	33
WA	128	**2**	0	0	0	0	**2**	0	**14**	**38**	31	**12**	**0**
All regions	575	12	3	2	0	0	0	1	4	12	26	25	16

$\chi 2 = 166.31$, $p=0.0003$. Note: Months with zero respondents are excluded from the $\chi 2$ test.

Treat with preventative chemicals only risk of fly strike is high

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	25	18	9	9	0	0	0	0	9	0	18	27	9
New England	63	17	4	4	0	4	0	0	0	9	4	22	35
C & S Tablelands	79	14	19	10	0	0	**5**	0	0	10	10	14	19
S NSW & N Vic	72	29	6	6	0	6	0	0	0	6	6	6	35
Gippsland	9	33	0	0	0	0	0	0	0	0	0	33	33
W Vic & SE SA	154	27	27	0	0	0	0	0	0	**0**	8	16	22
S SA	28	20	20	0	0	0	0	0	0	20	0	20	20
KI	17	0	0	**33**	0	0	0	0	0	0	0	0	67
WA	128	**0**	**0**	0	0	0	0	0	**9**	**34**	**31**	22	**3**
All regions	575	17	12	4	0	1	1	0	3	11	12	18	21

$\chi 2 = 110.82$, $p=0.0279$. Note: Months with zero respondents are excluded from the $\chi 2$ test.

Treat whole mob once fly strike is detected

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	5	20	0	0	**20**	0	0	0	0	0	20	40	0
New England	5	0	20	20	**20**	0	0	0	0	0	40	0	0
C & S Tablelands	12	8	17	8	0	0	0	0	0	0	0	17	**50**
S NSW & N Vic	8	0	12	12	0	0	0	0	0	0	0	38	38
Gippsland	2	0	0	0	0	0	0	0	0	0	0	0	**100**
W Vic & SE SA	19	21	16	**26**	0	0	0	0	0	0	11	11	16
S SA	3	33	33	0	0	0	0	0	0	0	0	33	0
KI	0												
WA	16	0	6	0	0	6	0	0	0	**19**	**38**	25	6
All regions	70	10	13	11	3	1	0	0	0	4	16	20	21

$\chi 2 = 75.18$, $p=0.0682$. Note: Months and regions with zero respondents are excluded from the $\chi 2$ test.

Only treat individually struck sheep

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
S Qld	2	50	0	**50**	0	0	0	0	0	0	0	0	0
New England	4	0	50	0	0	**25**	0	0	0	0	0	0	25
C & S Tablelands	3	0	33	0	0	0	0	0	0	0	33	33	0
S NSW & N Vic	7	0	**43**	0	0	0	0	0	0	0	14	29	14
Gippsland	0	–	–	–	–	–	–	–	–	–	–	–	–
W Vic & SE SA	**17**	35	24	12	6	0	0	0	0	6	0	6	12
S SA	5	40	0	20	0	0	0	0	0	20	20	0	0
KI	3	0	0	0	0	0	0	0	0	0	0	**67**	33
WA	22	5	**0**	5	0	0	0	9	0	**36**	23	18	5
All regions	63	16	16	8	2	2	0	3	0	16	13	16	10

$\chi 2 = 82.64$, $p=0.0870$. Note: Months and regions with zero respondents are excluded from the $\chi 2$ test.

APPENDIX A3

Benchmarking Australian Sheep Parasite Control
A National Survey

Dear Sheep Producer,

We invite you to participate in a national survey on control of sheep parasites. This survey will evaluate change in parasite control practices between 2003 and 2011 and set a new benchmark of current practices against which to measure future change.

This survey builds on a similar major survey of sheep producers in 2004 (Integrated Parasite Management in Sheep project: Benchmark Survey). The detailed report from that survey is available for download from AWI's website at:http://www.wool.com. Just put IPM-s in the Search box on this page and you will be taken to where the report can be downloaded.

Since that survey there have been a number of major initiatives in parasite control including the Integrated Parasite Management in Sheep project and the development of the WormBoss, FlyBoss and LiceBoss initiatives. This period has also seen consumer pressure on blowfly control options and an increase in drench resistance. It is vital for a profitable sheep industry that we continue to optimize our parasite control methods to reduce production loss, reduce chemical residues in our products and slow the development of resistance to the chemicals used for parasite control.

There is very little writing required to fill in the survey, it is mainly just ticking boxes to indicate your answer. It will take approximately 30 minutes to complete the survey. We hope you will consider being involved. A reply-paid envelope is provided for the return of your questionnaire. The information to be gathered in this survey will, of course, remain confidential, and all respondents will remain anonymous.

More information on the project and the survey is provided on the back of this letter, or you can phone or email either of the UNE staff listed below.

Thank you for your cooperation.

Yours faithfully,

Steve Walkden-Brown (Research team leader)
Animal Science, UNE. (02) 6773 5152 swalkden@une.edu.au

Ian Reeve (Survey team leader)
Institute for Rural Futures, UNE. (02) 6773 5145
ireeve@une.edu.au

University of New England

AWI Australian Wool Innovation Limited

MEAT & LIVESTOCK AUSTRALIA

Information Sheet for Participants

About the project

The survey is the second national benchmark survey of sheep producers, following the first survey in 2004. The survey will evaluate change in parasite control practices between 2003 and 2011 and set a new benchmark of current practices. The aim of this survey is to find out what parasite control methods are currently being used for the control of internal and external parasites in sheep to make sure that research meets the needs of sheep producers.

How your address was selected

Your address was provided to us by AWI. The number on the front of the survey is for mailing purposes only – this will ensure that you will not be sent any unnecessary reminders. We will not be using your address for any purposes other than this survey.

Filling in the survey

Your participation is entirely voluntary and you can fill in as little or much of the survey as you can spare time for. We appreciate it is hard for producers to find time to fill in surveys and have made every effort to make the questions as short and easy to answer as possible. It is not necessary to consult your farm records, unless you prefer to. Answering from memory is all that is required. If you mislay the envelope you can return the questionnaire to Reply Paid 61883, University of New England, Armidale, NSW 2351.

Security of your information

Your name is not required on the questionnaire. The information you provide is accessible only to the research team at UNE, and will be held in secure storage at UNE. Your completed questionnaire will be destroyed after five years, while the data will be held on a secure server to be used in future national benchmark surveys. Information on individual farms will not be made available to other organisations or published.

Withdrawing from the study

Posting the completed questionnaire to the University signifies that you have given your consent for the information you have supplied to be used in this study. You are free to withdraw this consent at any time without prejudice. Simply mail a note to this effect to Reply Paid 61883, University of New England, Armidale, NSW 2351, and your completed questionnaire will be destroyed and the data from it will be removed from the study.

This project has been approved by the Human Research Ethics Committee of the University of New England (Approval No. HE11-211 Valid to 18/11/2012) Should you have any complaints concerning the manner in which this research is conducted, please contact the Research Ethics Officer at the following address: Research Services, University of New England, Armidale, NSW 2351. Telephone: (02) 6773 3449 Facsimile: (02) 6773 3543 Email: Ethics@une.edu.au

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Benchmarking Australian Sheep Parasite Control
A National Survey

Reminder:

If you have already returned the survey, please ignore this letter. Thank you for helping with this project.

Dear Sheep Producer,

We recently sent you a survey form for the national survey on the control of sheep parasites. We have had a good response in some regions of Australia, but in other regions the survey has coincided with a busy time of year.

We just wanted to let you know that if you haven't had a chance to fill in the form, there is still time to do so. If you are able to find the time to complete the form in the next two or three weeks, the information you provide will help give a better picture of sheep parasite control right across Australia. This will enable research and extension to be better focused on the needs of sheep producers in all areas.

There is very little writing required to fill in the survey, it is mainly just ticking boxes to indicate your answer. It will take approximately 30 minutes to complete the survey. We hope you will consider being involved. A reply-paid envelope is provided for the return of your questionnaire. The information to be gathered in this survey will, of course, remain confidential, and all respondents will remain anonymous.

More information on the project and the survey is provided on the back of this letter, or you can phone or email either of the UNE staff listed below.

Thank you for your cooperation.

Yours faithfully,

Steve Walkden-Brown (Research team leader)
Animal Science, UNE. (02) 6773 5152 swalkden@une.edu.au

Ian Reeve (Survey team leader)
Institute for Rural Futures, UNE. (02) 6773 5145
ireeve@une.edu.au

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How your address was selected

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Filling in the survey

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Benchmarking Australian Sheep Parasite Control

A National Survey

Dear Sheep Producer,

A few weeks ago we sent you a survey about what parasite control methods you are using. **If you have already returned this survey, please ignore this letter and take this as our sincere thanks for your help.**

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 can make sure that this project is of maximum benefit to all sheep producers, we need at least a small amount of information from producers such as yourself.

We appreciate that it can be hard to find the time to respond to the many surveys that primary producers receive. The few questions below will take only two minutes of your time to answer.

Your cooperation in this important project for the sheep industry is greatly appreciated.

Yours faithfully

Steve Walkden-Brown and Ian Reeve, UNE
Ph:02 6773 5152 Ph:02 67735145

Two minutes of your time .... **Helps us develop new and better ways to control parasites that will benefit you and other sheep producers**

1 How many cattle and sheep do you run in a typical year?

_____ cattle

_____ sheep

2 Have you undertaken any of the following lice treatments in the last 3 years? *(please tick any that apply)*

Lice treated off-shears	❒
Lice treated short wool (1 day to 6 weeks)	❒
Lice treated long wool (over 6 weeks)	❒

3 If you used mulesing or Anti-Flystrike Clips in 2011, please give an estimate of the percentage of your replacement sheep treated in 2003 and 2011.

Percentage mulesed 2003	_____%
Percentage mulesed 2011	_____%
Percentage skin clipped 2011	_____%

4 If you monitored worm egg counts in 2011, how many times did you do this?

For ewes _____

For lambs _____

Average number of mobs tested each time?_____

5 Please indicate the number of drench resistance tests used in the last 5 years.

No tests done	❒
FECRT (formal on-farm faecal egg count reduction test)	____
DrenchRite (laboratory larval development test)	____
Worm egg count conducted before drenching and again within 3 weeks after drenching	____
Worm egg count conducted only within 3 weeks after drenching	____

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Your name is not required on the questionnaire. The information you provide is accessible only to the research team at UNE, and will be held in secure storage at UNE. Your completed questionnaire will be destroyed after five years, while the data will be held on a secure server to be used in future national benchmark surveys. Information on individual farms will not be made available to other organisations or published.

Withdrawing from the study

Posting the completed questionnaire to the University signifies that you have given your consent for the information you have supplied to be used in this study. You are free to withdraw this consent at any time without prejudice. Simply mail a note to this effect to Reply Paid 61883, University of New England, Armidale, NSW 2351, and your completed questionnaire will be destroyed and the data from it will be removed from the study.

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This project has been approved by the Human Research Ethics Committee of the University of New England (Approval No. HE11-211 Valid to 18/11/2012) Should you have any complaints concerning the manner in which this research is conducted, please contact the Research Ethics Officer at the following address: Research Services, University of New England, Armidale, NSW 2351. Telephone: (02) 6773 3449 Facsimile: (02) 6773 3543 Email: Ethics@une.edu.au

une University of New England

awi Australian Wool Innovation Limited

mla MEAT & LIVESTOCK AUSTRALIA

PARASITE MANAGEMENT IN THE SHEEP INDUSTRY – 2011

❒ Yes ❒ No

If 'Yes', please continue to fill in the survey. Thank you for your help.

If 'No', please send this blank survey back in the envelope provided, so that you do not receive any unnecessary reminders

Guide and Definitions

1 The best person to fill in the survey is the person who makes the major decisions about the management of livestock on the property.

2 Please fill in the questions for the property on which you reside or spend the most time.

3 If there is insufficient space for your answers to any of the questions, please feel free to put them on a separate sheet of paper and enclose it with the survey form.

4 If a word in the survey is underlined like this, you will find a definition on this page.

WEC	Faecal worm egg count (sometimes called FEC).
Marking %:	(Lambs marked / Ewes joined) x 100
Sheep classes	
Adult ewes	Have lambed previously
Maiden ewes	Ewes being bred for the first time
Lambs or weaners	Milk teeth, less than12 months
Hoggets	2-tooth, 12-18 months)
Intensive rotational grazing	Short graze periods of 1-4 days in summer, up to 8 days in winter.
Smart Grazing	Method of using sheep in the preparation of low worm risk paddocks. Drench sheep with known effective chemical, place in intended low risk paddock for a month or less (ideally less than 3 weeks) then remove sheep. When the pasture has recovered the paddock is low risk.
ASBV	Australian Sheep Breeding Value provided by LAMBPLAN or MERINOSELECT. A measure of the genetic merit of an animal for a range of traits.
Drench group	A drench group indicates a different chemical group, e.g. benzimidazole (BZ), levamisole (LEV), organophosphate (OP) macrocyclic lactone ML, "mectins") or monepantel. Typically resistance to one drench within a group results in side resistance to others in the group, but does not lead to resistance to other groups.

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Section A: Your Farm

Please provide information from 2011, unless otherwise specified

1. How much rainfall did you receive in 2011?

Rainfall received on your farm - 2011
_____ mm OR _____ inches

2. What was the estimated percentage of income from each enterprise in 2011?

Enterprise type	**Income (%)**
Wool sales	_____
Sheep sales (stores, culls & cast for age, boat wethers)	_____
Sheep sales (First cross ewe sales for breeding)	_____
Sheep sales (1st or 2nd cross prime or store lambs)	_____
Beef cattle	_____
Cropping	_____
Other *(please specify)* _____	_____
	TOTAL: 100%

3. Property size and land uses in 2011.

Total property area	_____ hectares OR _____ acres
Number of paddocks	_____
Percentage improved pasture	_____ %
Percentage unimproved pasture	_____ %
Percentage cropped	_____ %
Other *(please specify)* _____	_____ %
	TOTAL: 100%

4. How many cattle did you have in 2011? Please also indicate the number you typically run (if this is different to the number run in 2011) and the usual month(s) of calving.

No cattle ❒	**Number 2011**	**Number typically run**	**Month(s) of calving**
Cows	_____	_____	_____
Heifers (weaning – first calf)	_____	_____	_____
Steers (weaning – sale)	_____	_____	
Bulls	_____	_____	
Other *(please specify)* _____	_____	_____	_____

5. How many sheep did you have at the main weaning time in 2011, or November 2011 if you have an all wether flock? Indicate the number you typically run if different to the number you had in 2011.

	Breed	**Number 2011**	**Number typically run**
Merino ewes		_____	_____
Other ewes	_____	_____	_____
Wethers	_____	_____	_____
Merino weaners		_____	_____
Other weaners	_____	_____	_____
Rams	_____	_____	_____

6. In which month(s) did you shear and crutch in 2011?

Sheep class	**Month(s) shorn**	**Month(s) crutched**
Ewes (older than 12 months)	_____	_____
Wethers (older than 12 months)	_____	_____
Weaners (less than 12 months)	_____	_____
Rams	_____	_____

7. If you have ewes, please provide details about their breeding programme:

	Merino ewes mated to Merino rams	**Merino ewes mated to Meat-breed rams**	**Cross-bred ewes**	**Other ewes** *(specify)* _____
Month rams put in with ewes in 2011	_____	_____	_____	_____
Time rams left with ewes in 2011	_____	_____	_____	_____
Marking % in 2011 (adults ewes only)	_____	_____	_____	_____
Typical marking % (adult ewes only)	_____	_____	_____	_____
Month lambs weaned in 2011	_____	_____	_____	_____

8. How important to you are each of the following key objectives when determining your overall grazing strategy?
(please rate on a scale of 1 to 5, where 1 = 'very important', and 5 = 'not important')

Objective	**Rating**
Ease of management	_____
Improved pasture productivity	_____
Improved pasture persistence/sustainability/weed control	_____
Improved animal productivity	_____
Parasite control	_____
Utilise crops and stubbles	_____
Other *(please specify)*_____	_____

9. Have you changed your grazing strategy in recent years?

Yes ❒ No ❒

If so, why?

_____

_____

_____

Section B: Worm Control

10. Please show the number and type of chemical worm treatments given to each class of sheep in 2011. If several different classes of sheep were treated in the same month, please use a separate line for each class.

Month of treatment in 2011	**Sheep class**	**Product category**			**Product names** *If two products used at the same time indicate with a "+" between them. If unsure of product name, write "unknown".*
		Drench	**Capsule**	**Injectable**	
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_____
_____	_____	❒	❒	❒	_

11. If you monitored worm egg counts in 2011, please fill in the table below, otherwise skip to question 13.

Month of monitoring in 2011	Sheep class	Number of mobs in class	Numbered of mobs monitored on this date	Monitor type (if known)	
				Individual mob animal WEC	Bulk WEC
_____	_____	_____	_____	❒	❒
_____	_____	_____	_____	❒	❒
_____	_____	_____	_____	❒	❒
_____	_____	_____	_____	❒	❒
_____	_____	_____	_____	❒	❒
_____	_____	_____	_____	❒	❒
_____	_____	_____	_____	❒	❒
_____	_____	_____	_____	❒	❒
_____	_____	_____	_____	❒	❒
_____	_____	_____	_____	❒	❒

12. **Who carried out the worm egg counts you have listed in the table above?**

Self ❒ Govt lab ❒ Private lab ❒ Your vet or consultant ❒ Other _____

13. **Please provide details in the table below of any drench resistance tests you have undertaken between 2006 and 2011.** *(please tick all that apply)*

	2006	2007	2008	2009	2010	2011
No drench resistance tests undertaken	❒	❒	❒	❒	❒	❒
FECRT (on-farm faecal egg count reduction test)	❒	❒	❒	❒	❒	❒
DrenchRite (laboratory larval development test)	❒	❒	❒	❒	❒	❒
Worm egg count conducted before drenching and again within 3 weeks after drenching	❒	❒	❒	❒	❒	❒
Worm egg count conducted only within 3 weeks after drenching	❒	❒	❒	❒	❒	❒
Other *(please specify)*_____	❒	❒	❒	❒	❒	❒

14. **If you did undertake any drench resistance testing, who assisted with the testing?**

Vet or consulant ❒ Govt or LHPA advisor ❒ Drug company rep ❒ Other _____

15. How would you rate the drench resistance status of the following drench groups for the main worm species on your property? Efficacy is measured as % reduction in WEC following treatment and during the claimed efficacy period. Exclude efficacy of capsule preparations.

Drench Group	**Major resistance** (less than 80% reduction in WEC)	**Moderate resistance** (80-95% reduction in WEC)	**No resistance** (over 95% reduction in WEC)	**Don't know**
BZ (white drenches) e.g. Oxfen®, Alben®, Valbazen®, Panacur®, Fenbendazole® Extender capsules®	❒	❒	❒	❒
Levamisole (Clear drench) e.g. Nilverm® Ripercol®, Rycozole®	❒	❒	❒	❒
Organophosphate e.g. Rametin®, Combat®	❒	❒	❒	❒
Ivermectin e.g. Ivomec®, Ausmectin® Imax® Noromectin®, Paramax®, Genesis®	❒	❒	❒	❒
Abamectin e.g. Ovimectin®, Rycomectin®, Virbamec®, Abamax®, Zoomec®, Genesis injection ABamectin® Vetmec®,	❒	❒	❒	❒
Moxidectin e.g. Cydectin®	❒	❒	❒	❒
Closantel e.g. Seponver®, Closamax®, Closicare®, Sustain®	❒	❒	❒	❒
Triclabendazole (for fluke) e.g. Fasinex®, Exifluke®, Flukare®, Trickla®, Tremacide®	❒	❒	❒	❒
Monepantel e.g. Zolvix®	❒	❒	❒	❒
Others *(please specify)* _____ _____	❒	❒	❒	❒

16. **Please rank how important the following factors are when deciding whether to drench ewes and weaners.** *(please tick one per line for ewes (PART A) and weaners (PART B))*

PART A: Ewes

	Very important	Important	Somewhat important	Not important
Results from faecal worm egg count	❒	❒	❒	❒
Condition score of sheep	❒	❒	❒	❒
Time of year	❒	❒	❒	❒
Seasonal weather conditions	❒	❒	❒	❒
Availability of pasture	❒	❒	❒	❒
Quality of pasture	❒	❒	❒	❒
Presence of daggy sheep in mob	❒	❒	❒	❒
Weak sheep when driven (poor exercise tolerance)	❒	❒	❒	❒
Convenience, e.g. when sheep are yarded for other purposes	❒	❒	❒	❒
Appearance of sheep	❒	❒	❒	❒
Other *(please specify)*_____	❒	❒	❒	❒

PART B: Weaners

	Very important	Important	Somewhat important	Not important
Results from faecal worm egg count	❒	❒	❒	❒
Condition score of sheep	❒	❒	❒	❒
Time of year	❒	❒	❒	❒
Seasonal weather conditions	❒	❒	❒	❒
Availability of pasture	❒	❒	❒	❒
Quality of pasture	❒	❒	❒	❒
Presence of daggy sheep in mob	❒	❒	❒	❒
Weak sheep when driven (poor exercise tolerance)	❒	❒	❒	❒
Convenience, e.g. when sheep are yarded for other purposes	❒	❒	❒	❒
Convenience	❒	❒	❒	❒
Appearance of sheep	❒	❒	❒	❒
Other *(please specify)*_____	❒	❒	❒	❒

17. Which of the following treatments or techniques do you use for sheep worm control? *(please tick strategies used)*

		Description/Comment
Treating for worms (drenching, injection, capsule)	❒	_____
Prepare clean pastures by spelling/resting paddock ('long spelling')	❒	_____ _____
Prepare clean pastures by cropping paddock	❒	_____
Prepare clean pastures by cattle/sheep alternation	❒	_____
Prepare clean pastures by intensive rotational grazing	❒	_____
Prepare clean pastures using 'Smart Grazing' techniques	❒	_____
Leave some sheep un-drenched	❒	Show % left un-drenched: _____ %
Feeding strategy	❒	_____
Use rams selected for resistance to worms *(please describe)* _____	❒	With ASBV for WEC? Yes ❒ No ❒
Other *(please specify)* _____	❒	_____

Section C: Blowfly Control

18. **If you had blowfly strike on your property during 2011, please provide details below.**

Type of Strike	Percentage Ewes affected	Percentage Wethers affected	Percentage Weaners affected	Percentage Rams affected
Breech strike	_____ %	_____ %	_____ %	_____ %
Body strike	_____ %	_____ %	_____ %	_____ %
Pizzle strike		_____ %	_____ %	_____ %
Poll strike	_____ %	_____ %	_____ %	_____ %
Wound strike	_____ %	_____ %	_____ %	_____ %
Other *(please specify)*_____	_____ %	_____ %	_____ %	_____ %

19. Please provide details on your chemical treatments for blowfly strike in the table below.

	I usually do this	Month I did this in 2011	Chemical used in 2011
Treat your sheep routinely with preventive chemicals for flystrike every year	❒	_____	_____
Treat your sheep with preventive chemicals only when the risk of flystrike is high	❒	_____	_____
Treat the whole mob of sheep once flystrike is detected	❒	_____	_____
Only treat individually struck sheep	❒	_____	_____
Other *(please specify)*_____	❒	_____	_____

20. **Did you use mulesing or Leader Products Anti-Flystrike Clips to control blowfly strike in 2011?** *(Please tick the ones you used)*

Mulesing ❒

Leader Products Anti-Flystrike Clips ❒ *(if you ticked neither box, please skip to Question 24)*

21. **If you used mulesing or Anti-Flystrike Clips to control breech strike in 2011, who performed the mules operation or breech clipping on your sheep?**

Mulesing				Leader Products Anti-Flystrike Clips
Operator	***Accredited?***			***Operator***
Self ❒	Yes ❒	No ❒	Unsure ❒	Self ❒
Farm staff ❒	Yes ❒	No ❒	Unsure ❒	Farm staff ❒
Contractor ❒	Yes ❒	No ❒	Unsure ❒	Contractor ❒

22. If you used mulesing or Anti-Flystrike Clips in 2011, please provide details in the table below.

	Replacement ewe lambs	**Wethers**	**Other** *(specify)* _____
Age at mulesing/alternative (months)	_____	_____	_____
Percentage of mob treated:			
Mules	_____%	_____%	_____%
Clips	_____%	_____%	_____%
Pain relief provided after mulesing (eg Trisolfen®)	Yes ❒ No ❒	Yes ❒ No ❒	Yes ❒ No ❒
Some wool left on tail	Yes ❒ No ❒	Yes ❒ No ❒	Yes ❒ No ❒

23. **If you used mulesing or Anti-Flystrike Clips in 2011, please give an estimate of the percentage of your replacement sheep treated in 2003 and 2011.**

Proportion mulesed 2003 _____ % Proportion mulesed 2011 _____ %

Proportion skin clipped 2011 _____ %

24. **At what length do you dock lambs' tails?** *(please tick all that apply)*

Tail length		**Type(s) of sheep**
Much shorter than tip of vulva in ewes ('butted tail')	❒	_____
Just shorter than tip of vulva ('short tail')	❒	_____
Equal to the tip of the vulva	❒	_____
Longer than the tip of the vulva	❒	_____
Other *(please specify)*_____	❒	_____

25. **If you used *genetic selection* to assist with blowfly strike control in 2011, please indicate which genetic selection method/s you used.** *(please tick all that apply)*

Method	Ewes		Rams	
	Visual	***ASBV***	***Visual***	***ASBV***
Cull sheep with fleece rot	❒		❒	
Cull sheep with body strike	❒		❒	
Cull sheep with breech strike	❒		❒	
Select for plain bodied sheep	❒		❒	
Select for low breech wrinkle	❒	❒	❒	❒
Select for bare breech area	❒	❒	❒	❒
Select for low CV of fibre diameter	❒	❒	❒	❒
Select for low dag score	❒	❒	❒	❒
Other *(please specify)*_____	❒	❒	❒	❒

26. Did you use any of the following methods to assist with blowfly control in 2011? *(please tick all the methods that you used)*

Method		Details on how method used (if applicable)
Timing of shearing	❒	_____
Timing of crutching	❒	_____
Trapping flies (e.g. Lucitrap)	❒	_____
Destroy maggots from treated sheep clippings	❒	_____
Other method *(please specify)* _____	❒	_____

Section D: Lice Control

27. **Please summarise your lice detection and treatment methods between 2006 and 2011?** *(please tick all that apply)*

	2006	2007	2008	2009	2010	2011
Lice detection						
No evidence of lice seen	❒	❒	❒	❒	❒	❒
Sheep seen rubbing	❒	❒	❒	❒	❒	❒
Live lice seen	❒	❒	❒	❒	❒	❒
Lice detected by ELISA (Lab test)	❒	❒	❒	❒	❒	❒
Lice treatment						
No lice treatment	❒	❒	❒	❒	❒	❒
Lice treated off-shears	❒	❒	❒	❒	❒	❒
Lice treated short wool (1 day to 6 weeks)	❒	❒	❒	❒	❒	❒
Lice treated long wool (over 6 weeks)	❒	❒	❒	❒	❒	❒

28. **Please indicate below which of the following lice control techniques and products you have used in the past three years (2009-2011).**

		Year/s used	Contractor used	Product/s used
Off-shears or short wool	Plunge dip	_____	Yes ❒ No ❒	_____
	Shower dip	_____	Yes ❒ No ❒	_____
	Pour-on 'backliner'	_____	Yes ❒ No ❒	_____
	Other *(please specify)* _____	_____	Yes ❒ No ❒	_____
Long wool	Jetting	_____	Yes ❒ No ❒	_____
	Pour-on 'backliner'	_____	Yes ❒ No ❒	_____
	Other *(please specify)* _____	_____	Yes ❒ No ❒	_____
Quarantine (introduced sheep)	Jetting	_____	Yes ❒ No ❒	_____
	Pour-on 'backliner'	_____	Yes ❒ No ❒	_____
Other *(please specify)*	_____	_____	Yes ❒ No ❒	_____

29. **Have you ever suspected resistance to a lice product on your property?**

No	❒	*Go to question 31, below.*	
Yes	❒	**Product lice resistant to** _____ _____ _____	**Year resistance occurred** _____ _____ _____

30. **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	❒	❒	❒	❒
Other *(please specify)*_____	❒	❒	❒	❒

Section E: General Parasite Management

31. Did you introduce any sheep to the flock in 2011?

No	❒	*Skip to question 32, below*
Yes	❒	*If yes, please describe below any procedures or treatments on the introduced sheep for worms, lice and flies. If any chemicals were used please specify those used and the method(s) of administration.*
Sheep class	**No of sheep**	**Procedure or treatment**
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

32. **How important are the following sources of information for parasite control on your property?** *(for each parasite category, please rate on a scale of 1 to 5, where 1 = 'very important', and 5 = 'not important')*

	Worms	Flies	Lice
Me or member of my staff	_____	_____	_____
Local vet	_____	_____	_____
Private veterinary consultant	_____	_____	_____
Ag consultant	_____	_____	_____
Ag Department officer	_____	_____	_____
Rural merchandise representative	_____	_____	_____
Drug company representative	_____	_____	_____
Rural newspapers/magazines	_____	_____	_____
WormBoss/FlyBoss/LiceBoss web sites	_____	_____	_____
IPM-sheep web site	_____		
Sheep CRC web site	_____	_____	_____
Other web site *(please specify)*_____	_____	_____	_____
Other source *(please specify)*_____	_____	_____	_____

33. If you have changed your parasite management in the last five years, please describe the change you regard as the most important?

Worms and fluke:_____

Liver fluke:_____

Blowfly:_____

Lice:_____

Finally, we just need a little information about you and your views

34. **What is the post code for your property?**

_____

35. **In what year were you born?** 19 _____

36. **How useful are each of the following web sites 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	❒	❒	❒	❒
Sheep CRC web site	❒	❒	❒	❒
Other web site *(please specify)* _____	❒	❒	❒	❒

37. **Updated worm control advice is being made available to producers. How useful would each of the following be to you?**

	Very useful	Useful	Somewhat useful	Not useful
Regional worm control plans	❒	❒	❒	❒
Drench Decision Guides to help you tackle your current worm problem	❒	❒	❒	❒
Colour codes on drenches to indicate drench group	❒	❒	❒	❒
Worm control workshops	❒	❒	❒	❒
Other *(please specify)*_____	❒	❒	❒	❒

If you have any additional comments, please write them in the space below, or include a separate piece of paper if you need more room.

THANK YOU FOR YOUR PARTICIPATION

I would like to be contacted about further developments in IPM-s, including workshops or field days. ❒

I would like to be sent a summary of the findings from this survey. ❒