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Appendix A Kelly's Role Repertory Grid

The original version of Kelly's repertory grid was called the 'Role Construct Repertory Test' (Rep Test), where 'role' refers to role titles of important or influential people in the client's life (relevant to the clinical setting). The role titles are design to cover six groupings, including self, situational, values, family, valencies, intimates and authorities (Fransella *et al.* 2004). Kelly's Rep Test originally, comprised 24 role title, including:

a. A teacher you liked (or the teacher of a subject you liked);

b. A teacher you disliked (or the teacher of a subject you disliked);

c. Your wife or present girlfriend;

d. (for women) your husband or present boyfriend;

e. an employer, supervisor or officer under whom you worked or served and whom you liked (or someone under whom you worked in a situation you liked);

f. your mother (or the person who has played the part of a mother in you life);

g. your father (or the person who has played the part of a father in your life);

h. your brother who is nearest your age (or the person who has been most like a brother);

i. your sister who is nearest your age (or the person who has been most like a sister);

j. a person with whom you have worked who was easy to get along with;

k. a person with whom you worked who was hard to understand;

l. a neighbour with whom you get along well;

m. a neighbour whom you find hard to understand;

n. a boy you got along well with when you were in high school (or when you were 16 years old);

o. a girl you got along well with when you were in high school (or when you were 16 years old);

p. a boy you did not like when you were in high school (or when you were 16 years old);

q. a girl you did not like when you were in high school (or when you were 16 years old);

r. a person of your own sex whom you would enjoy having as a companion on a trip;

s. a person of your own sex whom you would dislike having as a companion on a trip;

t. a person with whom you have been closely associated recently who appears to dislike you;

u. the person whom you would most like to be of help to (or whom you feel most sorry for);

v. the most intelligent person whom you know personally;

w. the most successful person whom you know personally;

x. the most interesting person whom you know personally.

Appendix B Focus Group Reports

Winchelsea Focus Group Report

7 June 2006, 10:00am, Winchelsea Hotel, Winchelsea, Victoria

This focus group was a formal Best Wool group that had only been together for about one year, so most participants knew each other. The focus group followed a group session they had had that morning on monitoring. There were 12 people present. The area was formerly a dairy area, but was now predominantly sheep. There were, according to one participant, now "only about 90 cows left in the area." The group was friendly, but a little uncomfortable about the focus group setting as indicated by a lack of commenting and verbal participation. Often comments were not said directly, but more in an offhand manner. This made recording difficult at times.

Q. What tools and methods do you use to control parasites on your farm?

This was a written exercise of about five minutes duration where people could quietly write down methods of parasite control, either by themselves or in consultation with a friend. No questions were asked about the types of information required at this stage. This exercise resulted in about 55 responses representing 20 different categories of control relating to worms, flies and lice. A summary list is provided below:

Knowledge/Skill/Practice	Times mentioned
Grass management	2
Monitoring of stock movements off farm purchases etc	1
Feeding	1
Grazing management (stubbles)	1
Time of drenching (1-2 summer)	1
Vets	1
Rotational graze/paddock rotation/rotate mobs	3
"Safe" paddock	1
Fly traps	1

Crutching	5
Mulesing	8
Back Line	2
Jetting (Click)	5
Dipping	1
Maintaining boundary fences	1
Running a closed flock	1
Drenching & capsuling	1
Drenching	7
FEC/Worm test/WEC	9
Drench resistance tests (2-3 years)	3

Q. How should we categorise the list of parasite control methods?

Response sheets were collected and placed up on a wall for all to see so that the group could run through a categorisation exercise of placing like things together. The items were broken down into lists under parasite type, including worms, flies and lice. Participants were asked during the process to verify the categories for accuracy.

Q. Which items on your list are also on the researchers' list?

Participants were haded a list containing 20 items nominated by the IPM-s researchers as being most important to integrated parasite management and parasite management in general. Participants were asked to look at the list in their own time and to independently mark off things on the list that they believed they had mentioned. The group then ran through the list and probed about items that may not have been mentioned or which required more clarification to assess whether items mentioned by the group were similar to the researchers' list despite typically being less descriptively written.

For instance, Researcher list item number 18: Only drench when monitoring or planning indicates a real need. The group was asked whether this was an important part of drenching and at least three participants indicated that monitoring helped them determine when to drench. When asked about farm management plan, one respondent stated:

"We do have a plan, you don't want to put another mob in the paddock if it is not clean"

This was indicative of the general feeling that written or formal plans did not exist for most people and that management was more intuitive or based on knowing in their head what has happened on the farm. This was indicated also for maintaining written paddock histories.

Scouring was a confusing issue, with some participants unsure and mocking how this could be done. One participant however indicated: "you can stop it by keeping them healthy" when another person questioned how you would stop scouring. The use of cattle was not mentioned by the group and this is indicative of the lack of and dislike for cattle in the region. A list of the items not mentioned by the group is provided below:

Management tool not mentioned by group	**Comments**
19. Make sure parasite management activities are part of overall Farm Management Plan	1 & 2 closely related
20. Understand how and when parasites develop etc	
16. Use insecticide appropriately etc	
10. Monitor ewe condition scores etc	
7. Use breeding strategy to produce worm resistant sheep etc	
5. Keep history of worm egg counts etc	
14. Management to minimise scouring	
9. Use sheep/cattle interchange	

Upon seeing the list of items on the Researchers' list, one participant felt the need to defend his and the group's knowledge by stating:

"all the things you have listed up hers, I was thinking physical things, such as mulesing...I wasn't thinking about pasture management. I would say that the majority of the things up there, we all do."

Q. How would you prioritise the list of parasite management tools?

This exercise gave the participants a chance to indicate what was important to them in terms of parasite management, using both their own and the Researchers' list. This went a way to alleviating somewhat the feeling that the participants were not knowledgeable sheep managers because they had not mentioned all the things on the Researchers' list in the same way.

Worms

There was some debate about whether, with regards to worm management, monitoring came first or drenching. Grazing management was placed high on the list after theser two, despite one participant asking the person who nominated "how do you use it? What do you actually do?". The participants also used this section to ask each other and their group leader about some of the management techniques, such as "Once you drench the mob, should they go on a different paddock every time?"

Participants repeatedly indicated that season was a big impact on management practices for worms. All participants indicated that they had conducted a drench resistance test, though it was not asked whether these were formal or informal.Supplementary feeding was indicated as being very important by one person, and was related to 'nutritional needs' of the sheep rather than part of a grazing management plan. There was a mix of how important vets were to decision making, with some people indicating they always used an advisor and others stating they made decisions themselves.

The list form worm control was prioritised in the following order and was verified with the group at the time:

Priority	**Worm management practice or tool**
1	FEC testing & Vet advice
2	Drench resistance tests & Rotation grazing
3	Drenching
4	Grazing management & Mob rotation (clean paddocks)
5	Nutrition - supplements

Flies

There was unanimous agreement that mulesing was the main strategy for control of flies, despite issues relating to animal welfare activists. Genetics was proposed as being important by one participant was not placed on the list at the time. Discussion of genetics was taken up again at the end of the prioritisation for flies, with one participant very keen to have it on

the list specifically for flies, stating: "it's something that always comes to mind when you are buying sheep." This same participant indicated that they use EBVs when purchasing sheep – typically EBVs are related to the heritability of worm resistance, not flies. Inclusion here indicates a potential misunderstanding about what EBVs are used for, however it could also indicate the persons concern that we hadn't talked about genetics in the context of worms earlier. Another participant stated: "there's more so in the bloodline rather than EBVs", indicating a perception that EBVs do not capture all elements of genetics for some producers as well as the understanding that bloodlines, including traits such as wrinkly or smooth skin, can be an important consideration for fly control, since sheep with wrinkly skin seem to be more likely to get flyblown due to the moisture getting trapped in the skin folds.

Crutching was a key practice, and one participant wondered if drenching should also be on the list (though this practice typically relates to worms). Back-lining was considered a 'costly' control method, with most indicating their preference for jetting instead. One person indicated that they also use flytraps. The list was verified during the session.

The priority list for fly control was:

Priority	**Fly management practice or tool**
1	Mulesing
2	Crutching
3	Jetting
4	Click
5	Back-lining
6	Drenching
7	Fly traps - monitoring
8	Genetics (back of mind consideration)

Lice

Lice was a fairly easy category, with the methods seemingly cut and dry. The discussion lasted about five minutes in total. Fencing was seen as important and related to this were neighbours, with one participant stating "Choosing your neighbours" as being an advantage to lice management. The resulting prioritised list was:

Priority	Lice management practice or tool
1	Back-line
2	Dipping
3	Fencing management - boundaries
4	Quarantine
5	Closed flock

Q. What are the positive and negative aspects of these management practices?

At this point participants were again asked to write down on different coloured sheets of paper the positive and negative aspects of each management practice. Each practice was run through sequentially, starting with FEC testing. When all practices were completed, these were complied and participants given the opportunity to comment. The most common factors affecting management practices for all tools were cost and time. Although mulesing attracted a comment also about negative perceptions from animal activists. The social perception of this practice was also acknowledged however as being positive as it has led to the development of new technologies for combating fly strike.

Q. How would you prioritise the leftover researchers' list?

Participants ranked "Parasite management as an overall farm management plan' as the most important on the researcher list. The producers in the group did not mention having a farm management approach on their list, but as pointed out by one participant earlier, the group was more likely thinking of practical tools and ideas. However, IF a management plan was a frequently used tool, I suspect someone would have mentioned it.

Second ranked was 'Understanding how the parasite works', which is again something that was not mentioned by producers. 3. Monitor use of insecticide, followed by 4. Using insecticide appropriately. There some some discussion about which of the latter two should come first and a vote was taken in favour of monitoring. Having a breeding strategy was agreed at number 5, this was something producers had mentioned in their own way,

Rotation using cattle or other (such as stubble) was nominated as number six (despite one producer indicating earlier on that there were not many cattle in the district), but relegated to last after participants decided that keeping a history of FEC was more important. Management to minimise scouring ranked as number 7.

Q. What are the positives and negatives for the leftover items?

- In discussing having a FMPlan comments included:

'most important tool for maintaining animal health', and

'prevention rather than cure',

'Knowing which drench to use'.

The comments indicate a seemingly strategic approach was favoured by some of the participants, even though having a plan was not mentioned in their list.

- Comments made about understanding parasite biology and epidemiology included:

'knowing when to drench',

'knowing how long they (worms) stay in the ground', and

'grazing management'.

So even though this was another piece of management not mentioned by the producers, they did have a good understanding of how such knowledge was useful.

- Comments on positives and negatives for Monitoring use of insecticides included:

'Protecting your markets'

'making sure that its always there',

'Checking to see if it works'.

A negative mentioned was time.

- Monitoring ewe condition scores etc, received the following positives:

'Knowing what to feed',

Better lambs',

'More lambs',

'likely to survive parasites',

'better control'.

Negatives included: *'trying to find the sheep',*

- Comments on Using Breeding Strategie:

'Availability of genetic information'.

- Comments on Keeping a record of FEC:

'More book work'.

The latter comment was typical of anything involving record keeping that was not 'in the head'.

- Comments on Management to minimise scouring included:

'Clean sheep, less crutching' (Positive)

'Need to find cause of scouring' (Negative)

- Comments on Use of sheep/cattle interchange include:

'Clean paddocks',

'Get to feed them grass. If you were rotating crops, you can give them better grass.'

'Got to run cattle' (Negative)

'Got to feed cattle'

'Need bigger fences' (because of cattle)

Someone asked whether other were using wethers instead of cattle.

Dunkeld Focus Group Report

8 June 2006, Royal Mail Hotel, Dunkeld, Victoria

This was a Best Wool group again, with the difference that it had been together for about 10 years in various forms. This group have participated in several courses, such as Risk Assessment and ProGraze. Participants are well known to each other and were very open about some antagonisms amongst members approach to sheep production.

Q. What tools and methods do you use to control parasites on your farm?

This was a written exercise of about five minutes duration where people could quietly write down methods of parasite control, either by themselves or in consultation with a friend. No questions were asked about the types of information required at this stage. This exercise resulted in about 93 responses representing 74 different categories of control relating to worms, flies and lice. A summary list is provided below:

Knowledge/Skill/Practice	Times mentioned
Drench into clean paddocks if possible	1
New products and advice from Vet	1
stray stock, fencing etc	1
paddock history	2
weather conditions	1
Class of stock - ewes with lambs	1
High copper mineral supplement ad-lib for sheep	1
Contract sheep dipping when the neighbours give us lice	1
Double fenced nearly all boundaries	1
FEC before drenching sheep	1
FEC weaners when required past autumn (June/July)	1
Clean paddocks through capsules	1
Clean paddocks past hay making (weaners)	1
Follow dry stock with weaners or lambing ewes	1
Breeding large % prime lambs so that they don't stay past 6-8 months old	1
Time of drenching	2
Capsules for vulnerable sheep - weaners & lambing ewes in winter - if necessary	1
Capsules pre-lambing in Xbred ewes in April	1
Drench into new paddock	1
Drench merino ewes at weaning	1
Drenching plan - early summer drench and pre-winter drench	1

Leave some 'good condition' (CS 4+) sheep in mob undrenched at the summer drench	1
White and clear drenches	1
Rotational grazing to break worm cycle	1
Set paddocks in a rotation used by only one class of sheep	1
Drench/ capsule for worms	2
Use drench found to be suitable after drench resistance test (every 2 years)	3
Personally monitor egg counts in mobs - drench when count above 200	1
Drench based on faecal egg counts	3
Strategically monitor WEC - let some young sheep get exposure to build immunity	1
Worm counts	3
Scouring	1
Loosing condition	1
Worm counts, use during winter to help sheep condition	1
Stock rotation, especially for weaner management	1
Use stubbles over summer	1
Use cattle to help clean up worms	3
Mulesing and click at lamb marking	1
Extinosat for fly strike - not an organophosphate so less dangerous for oeprators	1
Don't put unnecessary pressure on the worm population to develop resistance - only drench when necessary	1
Visual assessment/observation of sheep for drenching (rubby, dirty sheep)	2
Rotate drench types	2
Wean lambs into hay paddocks if possible or else cleanest possible	1
Don't drench all the sheep in a mob	1
Capsules as a last resort when alternating drench types	1
Assess stock condition to measure vulnerability to worms	1
Drench pre-summer	1
Crutch sheep prior to november for fly control	1
Apply Click to mulesed lambs (flys)	1
Mules lambs (flys)	1
Dock tails on sheep (Flys)	1
Run more Xbred sheep (flys)	1
Keep sheep out of long grass (flys)	1
Shear in January (flies)	1
Jet rams in November and February (Flies)	1
Paddock topography	1
Drench resistance tests	1
Graze paddocks heavily pre-summer to reduce shelter for worms	1
Rotate dry stock after ewes to consume worms	1
Drench sheep November and February with option of mid-year	1
Prevent stray sheep from entering property - adequate fencing	3
Prevent stray sheep - close gates	1
prevent stray sheep - capture strays on road	1
Dip with diajina if lice present	1
Purchase lice free sheep	1
Lice control - monitor for rubbing sheep	1
Lice - dip or Backline if required	2
Flies - shear	2
Flies - crutch	2
Flies - lamb marking	1

Flies- Dressing (Click)	1
Apply Extinosad to fly blown sheep	2
Dip sheep for lice when required - about every 4 years	1
Extinsoad at lamb marking	1

Q. How should we categorise the list of parasite control methods?

This was performed by Lyndal on the computer into Worms, Lice and Flies and participants were asked if they agreed at the time.

Q. How would you prioritise the list of your parasite management tools?

This exercise gave the participants a chance to indicate what was important to them in terms of parasite management, using both their own and the Researchers' list. This went a way to alleviating somewhat the feeling that the participants were not knowledgeable sheep managers because they had not mentioned all the things on the Researchers' list in the same way.

Worms

There was a lot of chatter in the first few minutes about whether drenching or drench resistance testing or cleaning paddocks was the number one priority. It was eventually decided on 'just drenching' because 'there's no point doing FEC if you can't drench'. Everybody then agreed that number two should be FEC. DRT was listed as third behind FEC, followed by 'something about paddocks' (Cleaning paddocks). Although most agreed on cleaning paddocks being important, there was one dissenter who stated 'There's no such thing as a clean paddock'. Visual assessment was rated at 5. When questioned about rotation grazing, this sparked a conversation about being able to clean paddocks again, with one person indicating they have no spare paddocks for this and another saying they didn't clean and that it should be rated low. Drench planning was rated next and then finally rotation grazing.

Some people indicated they rotated sheep and cattle, and this seemed to be more common and accepted within this group as compared to the Winchelsea group.

The list form worm control was prioritised in the following order and was verified with the group at the time:

Priority	Worm management practice or tool
1	Drenching
2	Drench on FEC
3	Drench resistance tests
4	Clean paddocks
5	Rotate drench types
6	Visual assessment before drenching
7	Rotate dry stock before ewes
8	Use capsules 9for cleaning paddocks)
9	Drenching plan (summer)
10	Worm control paddock history
11	Rotation graze (spell paddocks)
12	Wean lambs into hay/Use of crop & sheep/cattle rotation (clean paddocks)
13	High copper mineral supplement
14	Don't drench all sheep at once

Lice

Dipping was suggested as number one, isolation fencing was suggested as number 2, but following some discussion this was swapped. There was some dissent about the benefit of fencing if you already have lice. Shearing was thought to be very important by some, but ended up at the bottom of the list.

Priority	Lice management practice or tool
1	Fencing
2	Dipping
3	Purchasing lice-free sheep
4	Jetting and backliner
5	Shearing

Flies

Mulesing was suggested as top for flies, followed by crutching and lamb marking and breeding. Someone suggested paddock selection, and in particular having long grass that 'the breeze can't get through', as being important to flies. Effective chemical control was also mentioned for this group.

The priority list for fly control was:

Priority	Fly management practice or tool
1	Mulesing/Shearing/Crutching
2	Lamb marking
3	Jetting
4	Breeding/Genetics
5	Foot health
6	Paddock selection
7	Drenching (daggy sheep)
8	Effective chemicals

Q. Which items on your list are also on the researchers' list?

There was some discussion about the use of plans, some people indicated that 'the vet does it for you', while others said the drench plan was 'on the drench' and another stated 'we know what works.' So there are a variety of approaches to planning. When questioned about worm life cyles, initially someone indicated they had a good idea and in terms of drenching 'that's why we say January', however upon further explanation of knowing about the worm lifecycle, and then asked are they conscious of these thing, the same person answered:

'I think not so conscious of it.'

Another however stated 'The eggs that are dropped in August/September are the ones that will hit you in April/May.' It was not specifically mentioned, and most did not obviously use such knowledge in management (as indicated by the comments relating to worm management planning), so understanding of the worm lifecycle was left on the researchers' list.

Number	Knowledge/skill/practice
1	Use various methods to maintain the effectiveness of drenches
6	Minismise sheep deaths and weight loss through acceptable drenching program e.g. consult Drench Decision Aid, WormBoss etc.
8	Use breeding strategy to produce worm resistance sheep and reduce scouring
10	Monitor ewe condition scores at lambing as well as weaner body weights. Have set targets for these
11	Have a plan for using feed supplements to maintain sheep health and bodyweight when needed
12	Quarantine new or sick sheep
14	Management to minimise scouring
20	Understand how and when parasites develop and when they are most vulnerable and most active. Use this information actively to make parasite management decisions

Q. What are the positive and negative aspects of these management practices?

Below is a list of the positives and negatives about the management practices listed by the producers:

List of things they do or need to know to control parasites	Positive	Negative
Drenching	kills worms	handling stock
	assess condition through handling	labour intensive
		expensive
drench resistance tests	not drenching unnecessarily	getting samples, complicated - understanding resistance issues,
	effective drenches	
	save money	
	save work long term	
	prolonging use of drenches	
drench based on FEC	reduce need to drench	getting samples
	saving money	time consuming
	prolong effectiveness of drenches	cost of sending off and analysis
	labour saving	waiting time for results
	learn about whats going on - effects of clean and dirty paddocks	
	vulnerability	
	awareness increases	
rotate drench types	prolonging use	price increases for new type and combination
rotate sheep and cattle	cheap	need to have cattle - or have a lot of cattle
	complimentary	pugging the ground
		destroy dams
		dirty the water
		end up feeding cattle as well as sheep (e.g. grain)
		need facilities to handle cattle
visual assessment before drenching (experience - based???)	more accurate	could be other causes
	pre-warning foe need to FEC	only see part of the story
	most important tool	
don't drench all sheep at once	leave non-resistant worms in mob	not getting total kill
rotation grazing (spell paddocks)	grow more grass	infrastructure
	Cleaner paddocks	sheep become disoriented
use capsules (for cleaning)	100-day worm control, cleaner paddocks	worms go mad after 100-days
	Cleaner paddocks	expensive
	peace of mind	may promote resistance through trialing

	less labour	application is time consuming and frustrating
	less crutching	long-term sheep health
	more lambs	capsule remains inside sheep
	more wool	
	better return	
	save drenching	
	better prime lambs and weaning weights	
	later drenching of lambs	
drenching plan (summer)	it works	requires flexibility
	don't have to make decision yourself	action may not be necessary
use of crop rotation to clean paddocks	reduces need to drench	expensive
	reduces exposure to drenches	ploughing the paddock
	cash crop	must be part of a pasture management plan
wean lambs into hay (clean paddocks)	Lamb health - better growth rate - reach target weights	could still be wormy
	reduces need to drench	need to test to see if wormy
	reduces exposure to drenches	
	cash crop	
high copper mineral supplement	maintain health	another job!
		Benefits not proven
worm control paddock history	saves drenching	record keeping
	better knowledge of what's happening with stock & paddocks	
	put sheep in 'right' paddock	
rotate dry stock before ewes	saves drenching	maintaining quarantining periods
	better knowledge of what's happening with stock & paddocks	dry does not mean clean - need FEC to tell
	put sheep in 'right' paddock	feed consumption when needed for ewes
clean paddocks (some disagree)	saves drenching (all of above)	achieving it!
	better knowledge of what's happening with stock & paddocks	
	put sheep in 'right' paddock	

There was a discussion about the benefit of visual assessment, with one of the older group members stating that he thought it was more accurate. This was a brave statement as he was concerned that other group members were going to 'jump on him' for saying it. He did however think that FEC was inaccurate. The wife of a family who did the FEC at home indicated that she thought FEC testing was 'deceptive' but did not wish to further this statement. The general gist was however that there were issues with low egg counts saying the sheep were OK, but then the same mob having trouble not too long afterwards.

Eventually most people did agree that there was not much negative about visual assessment, but that it could be that the sheep sometimes looked 'crook' due to something other than worms.

There was debate about the practice of not drenching all the sheep at once and leaving some 'well conditioned' sheep un-drenched. Some did not understand the argument for this and it was agreed that the 'jury is still out' on this practice.

The use of capsules also rated a mention, with one producer stating that they were good for cleaning paddocks because of a 100 day control period, while another stated that the 100 days was negative because 'the worms go mad' after 100 days.

Another found many good points, but yet another stated that the 'application time is consuming and frustrating'. Another negative related to concern over the sheep ingesting the capsule and it being plastic and not breaking down.

An interesting comment made about the positives of drench planning was '*it means you don't have to make the decision yourself*', which was not an uncommon feeling about some of the more prescriptive practices.

Others though however that a plan meant you might be drenching when in fact it was 'not necessary'.

Crop rotation also produced polar comments, with one supporter stating the benefits were:

'reducing the necessity to drench, therefore reducing exposure to drench, reducing resistance'. While another countered with:

'its irrelevant. It doesn't reduce worms'. This is typical of the polarised opinion as to whether cleaning paddocks is something you can actually do.

There was also debate about the usefulness of using supplements.

People saw paddock rotation as expensive (due to infrastructure and having to keep sheep off some paddocks). This also related back to the cleaning paddocks debate, with the group members quite comfortable with the level of dissention within the group.

Q. How would you prioritise the leftover researchers' list?

Q. What are the positives and negatives for the leftover items?

These last two were not completed due to the length of previous discussions.

Glen Innes Focus Group Report

11 July 2006, 10:00am, Glen Innes Ex-Serviceman's Club, Glen Innes, NSW

This focus group was very small, but producers present held a wide variety of views and had a variety of experience. There was a father-son team in this group. One of the participant had been in farming a very long time and had recently sold-up but felt he had much to offer in the way of perspective.

Q. What tools and methods do you use to control parasites on your farm?

This was a written exercise of about five minutes duration where people could quietly write down methods of parasite control, either by themselves or in consultation with a friend. No questions were asked about the types of information required at this stage. This exercise resulted in about responses representing different categories of control relating to worms, flies and lice. A summary list is provided below:

Times mentioned	Knowledge/Skills/Practice
3	Rotational grazing - clean paddocks
3	Rotation with cattle - clean paddocks
1	Capsules
1	Drench strategy
1	Adequate and good feed
1	Good nutrition
2	drench resistance testing
2	Worm monitoring (FEC)
1	Quarantine new sheep
2	smaller paddocks
1	Adequate supply of good quality water
2	Ram selection (EBV, natural resistance)
1	Mob size
1	Length of joining
1	Keep sheep in medium condition (not below score 3)
2	mulesing
1	crutching
1	Fly treatment as lambs
2	culling
1	Only use chemicals as last resort (flys) (except at mulesing)

l	Treat only as required (cattle lice)
l	Dipping (only when lice imported)
	Paddock history - planning
l	Have a Quarantine strategy -
l	Appropriate and strategic use of insecticide – monitoring, observe witholding periods, resistance management etc
l	Visual Assessment
l	Wean early (?) 12-14 weeks requires planning for clean paddocks and feed etc
l	Have a lice biosecurity plan – regular monitoring, quarantining, fence maintenance etc.

- Rotational grazing was mentioned as a 'very effective weapon', while another producer indicated that keeping sheep in medium condition mean 'they're not being challenged, that's a minimum.'

Chris noted that the categories were very broad and attempted to 'extract a bit more information' to narrow them down somewhat.

- There was some conversation about monitoring, with one producers indicating he did it all the time, and another stating:

"We have in the past, but it sort of fell by the wayside due to other pressures."

One producer indicated that the RLPB had been doing FEC tests on their sheep for a few years, And in terms of frequency, another, younger producer, indicated that they FEC tested about 6 weeks after every drench treatment. And that this was done six weeks regardless. This producer did his own testing and only sent the samples away if there was a problem.

- On the issue of drench resistance, one producer indicated that they had resistance on their property and therefore tested every year, the fellow who had the RLPB board doing FEC indicated that they also did DRT. The older producer in the group, Paul, indicated that he had never done a DRT and that he believed rotation grazing:

"was the most effective method of beating drench resistance"

His full speech is below:

"I have never tested for drench resistance. I have done some monitoring. Personally I think that the most effective method of beating drench resistance worms is by a planned system of rotation. Drench you sheep with the most effective drench, put them in a paddock that has been filled for six weeks to two months. Depending on rainfall. We might hammer it hard to knock the feed down. Like put 200 cows or calves in a paddock for two weeks, just to knock it down. I think rotation grazing is the most effective long-term method that we will have. It requires a little bit of planning, you have to get out your pencil and paper and get down your paddock and work out what you have. What you can do, what you think you can carry. And for people that can do that, they will be surprised that they have more feed than what they thought they had. Because if you put sheep in a paddock and there's heaps of feed, they will sit in the corner and eat that out. But if you put a thousand sheep in a paddock you are forcing them to eat it. We have to change the way we run stock. We have to change our mindset. That's far more effective than any other thing that I can think of, that includes monitoring them."

Mark, who used to farm in southern Queensland until 5 years ago, indicated that paddock rotation was vital due to the seasonal conditions out west where flooding meant there was a need for clean paddocks where the sheep wouldn't fill-up with worms. In drought years it also meant you had some green pick if you had spelled paddocks.

- One producer thought ram selection and, in particular, where they come from is very important. He stated:

"P10 - I think the ram selection is an important one. I think where the ram comes from is very important.

We basically won't buy a ram that is a big negative ram, but any improvement we can get without comprising the other selection criteria.

Lyndal - What are some of the other selection criteria.

P10 - *Basically, density, nourishment,*

Lyndal - *So nutrition is very important. Do people see that nutrition is a good worm management control.*

P11 - *That's number 1. A healthy sheep won't attract parasites."*

There was strong support for genetics being a key issue with more research needed, such as they believed had occurred in the cattle industry. There was general consensus that resistance was heritable, although one producer indicated his confusion with it:

"That's beyond us, quite frankly. You go to a bull sale and you get a print out that is the size of a book. A lot of it, we are confused now. You used to look at a bull and think that was a good looking bull."

- Given the good understanding and general acceptance of the benefits of testing, the group was asked about visual assessment as a technique for worm control.

One producer stated:

"once the sheep are showing signs, it's past. If the sheep are healthy, that doesn't say to me that they are not carrying worms"

This was a comment that occurred several times in focus groups and later in interviews.

Q. How should we categorise the list of parasite control methods?

Response sheets were collected and placed up on a wall for all to see so that the group could run through a categorisation exercise of placing like things together. The items were broken down into lists under parasite type, including worms, flies and lice. Participants were asked during the process to verify the categories for accuracy.

Q. Which items on your list are also on the researchers' list?

No.	Practices/Skills/Knowledge
1	Use various methods to maintain the effectiveness of drenches
6	Minismise sheep deaths and weight loss through acceptable drenching program e.g. consult Drench Decision Aid, WormBoss etc.
8	Use breeding strategy to produce worm resistance sheep and reduce scouring
10	Monitor ewe condition scores at lambing as well as weaner body weights. Have set targets for these
11	Have a plan for using feed supplements to maintain sheep health and bodyweight when needed
12	Quarantine new or sick sheep
14	Management to minimise scouring
20	Understand how and when parasites develop and when they are most vulnerable and most active. Use this information actively to make parasite management decisions

The following comments were also recorded.

Paul was quite happy with the researchers' list, stating:

"I couldn't object to any of those, quite frankly. But as I've said before, I think that rotational grazing as the most effective long-term measure. And the fringe benefit is that you have a better control over your feed. You know how much feed you have several months ahead."

He also talked about the need to wean lambs early as they pick up worms from mum. The other benefit that the mother's resistance builds up more quickly since:

"*everyone knows that when a ewe is looking after a lamb their worm resistance drops to zero.*"

There was general agreement about the early weaning, with one other producer noting that they had noticed this at Cobar.

- None of the producers had a worm management plan, though one producer had a vet advising him. Most indicated that they had an understanding of the worm lifecycle, but still used heuristics such as '*there is a rule out west that you drench within three weeks of rain*' etc.

Most did not agree with using a plan such as wormkill, due to seasonal conditions, reliance on rotation grazing (Paul), with Paul stating:

"*I rely on my own judgement. I've been around for a while.*"

- Participants were asked about weighing, and one indicated that he didn't need to because he could assess condition visually. He also indicated he scanned ewes for twinning, and separated out any such ewes. This practice was also carried out by at least one other participant.
- Participants were also in favour of rotating sheep with cattle.
- Every participant indicated that they quarantine new sheep, or used cydectin and a follow-up to kill anything new sheep had inside.
- In conversation about **fly** management, nobody had a set strategy (except one had a set plan for lambs). Another indicated that they bought only Merryville stock since they are a plainer skinned sheep.
- Shearing was viewed as an important strategy for blowfly control.
- The need to know about withholding periods was answered with respect to having to fill in forms when selling sheep at the saleyards and the need to keep chemicals out of the wool.
- In conversation about **lice**, one producer stated:

"*Getting rid of lice is not an issue, it's about being reinfested. We only treat for lice if we import them. We're pretty lucky here because there aren't too many people running sheep. The resistance to lice is just as great as resistance to worms.*"

Another producer agreed that neighbours' stray infested sheep were a big problem.

There was some discussion about whether parasite management or nutrition was the number one priority in sheep management. The conversation ran as follows:

"*P58 - Parasite management is number 1. You don't go along and put these sheep here. You say that you are going to do this.*

P59 - I tend to disagree. I say number one is nutrition, and concentrate on pasture improvement and winter cropping. And that tends to correct your nutrition problems and that will bring about parasite control. And other parasite control will follow on from that."

- When questioned about understanding of the worm life cycle, participants generally believed everyone would know about it because of access to information. Some comments included:

"*Chris - Do you have a reasonable understanding of the life cycle of the parasite.*

P64 - The department has promoted it over the years and I believe that there is a good understanding out there.

Chris - That's were you need a good understanding for your rotational grazing.

P65 - There is a lot of access of information to that. The departments, the Unis have a lot of information."

Q. How important is are cost and time to management choices?

A general question was asked at the end about how important time and cost were to management. The following comments were received, indicating that market return in particular was the issue rather than costs in one sense. That is, they weren't necessarily concerned that some of the things they needed to do were expensive, more that there was not enough return in the industry to be able to afford some of these things:

"P68 - I could answer that by saying that if we were getting more out of the industry we could afford to do it. The ways things have been, economic pressures on us we can only do so much. We can't do all the things the greenies think we should be doing because there is not a sufficient return on the industry. "

Lyndal - With testing, I know that you said you had the Board doing it for you. If the Board didn't do it would you say that time and cost has stopped you fro doing it.

P69 - *Yes, we did the best we could. We knew that we couldn't afford more people to do these things.*

P70- *I've got to go, but my parting shot is to say that I agree with everything said in that regard, but because of worms, what you essentially do is you fence up while it will cost you money, it can also produce a greater return simply because you have to manage your properties better. Technically, it should put more money in your pocket.*

P71 - *I've got two years wool in my shearing shed. We've got cows and calves and that pays my grocery bill. Everyone who runs sheep will tell you the same thing, you can never leave the bastards alone. If you're not shearing them, you're drenching them, if you're not drenching them, you're marking them, if you're not marking them, you're treating them for fly strike, the cycle is never ending. We put cows and calves in the paddock and we brand them and that's it.*"

Walcha Focus Group Report

14 July 2006, 10:00am, Walcha Ex-Serviceman's Club, Walcha, NSW

This focus group was comprised mainly of younger farmers, many of whom were very focussed on genetics and new technology. There was an older famer there who seemed quite interested in what the younger group had to say, and also offered a different perspective to theirs on the situation, past and present.

Q. What tools and methods do you use to control parasites on your farm?

This was a written exercise of about five minutes duration where people could quietly write down methods of parasite control, either by themselves or in consultation with a friend. No questions were asked about the types of information required at this stage. This exercise resulted in 47 responses representing 25 different categories of control relating to worms, flies and lice. A summary list is provided below:

Times mentioned	Practices
1	Drench for fluke in April and spring
1	Check for lice at shearing
6	Worm egg counts (FEC)
2	Drench resistance testing
4	Rotate drenches
2	Cull sheep with body strike
1	Mules as lambs
4	Paddock rotation/rotational grazing
4	Rotate sheep and cattle
1	spell paddocks
2	genetics/breeding for resistance
1	mix drenches
1	pasture length
2	crutching
1	short wool thru summer
1	click
2	jet lambs
1	capsules
1	injectible drenches
1	Drench young sheep into spelled paddock

3	dipping
1	breeding away from flies
2	nutrition management
1	cell grazing
1	Backline after shearing

- While discussing FEC testing one producer indicated that there was no set routine, the strategy was mainly seasonal and impacted by visual assessment to some degree.
- One person indicated that they had not done a DRT for 5 or 6 years. There was some confusion between FEC testing and DRT, with a couple of producers using them interchangeable and one producer indicating that they did their DRT at home – indicating the use of informal DRT rather than a formal test such as drench rite. On average it seemed that the producers checked their drenches in some way every 4-6 years.
- There was a discussion about the efficacy of the different drench types, with Levamisole considered useless and Rametin highly regarded. One producer indicated that he believed that if you did not use a drench for a while "they'll go back up again" in terms of percentage efficacy.

One of the younger producers indicated in a discussion on grazing management systems, that stock management was definitely an issue and indicated that "you have to break the worm lifecycle." His comments included the following:

"*You need to break the worm cycle. Worms can't live on the ground forever and a day, they need to be inside the sheep. So if you can spell the paddock for a certain time frame then it's a good idea. The younger sheep are more susceptible than the older sheep, so if you can rotate from lambs, to lambing ewes, to wethers so not having a set pattern. Using cattle on the place for a while.*"

Some producers indicated they used cattle in their rotations. But mainly for spelling the paddock, with cattle on one year and sheep the next. Their rotation was based on their own experience with no consultant advice. One older producer commented about consultants in the following way:

"*I agree with the boys. You can talk about consultants if you want to, but I find that we've used one or two, but an old friend said that the best consultant is to find someone who is doing well and look over the fence.*"

- During a discussion about selective breeding and genetics, some producers indicated that they were considering it, but one producer stated:

"*I don't think there's enough information to say that one breed is better than another.*"

Another indicated that he was selectively breeding in a 'roundabout fashion' by putting rams that did not perform as well 'in the cool room.'

Genetics and selective breeding was also considered important to flystrike, with one producer stating:

"*With all our sheep anything that gets body struck is automatically culled.*"

Another indicated that there was a focus on bad shoulders and breeches, stating:

"*...then you're breeding away from an area that is going to attract flies.*"

- With regards to nutrition and supplementary feeding, one producer commented:

"*I know if you want to feed them extra protein you're going to kill out a lot of the worms. It's not something that we aim for.*"

Others indicated that they aimed to keep sheep in a certain condition, with another specifically indicating a weight range of about 45-50kgs. Producers indicated that they saw a relation between sheep in good condition and parasite problems, with one producer stating:

"*Apparently there's a bit of research coming out that meatier sheep, those carrying more meat, actually have a better ability to resist worms as well. I think it might flow through by default. If you*

grow sheep for better wool, then they are meatier and then they will be more resistant to worms. If they have more protein in the system, they will be able to fight worms. It's only just come out."

Q. How should we categorise the list of parasite control methods?

Response sheets were collected and placed up on a wall for all to see so that the group could run through a categorisation exercise of placing like things together. The items were broken down into lists under parasite type, including worms, flies and lice. Participants were asked during the process to verify the categories for accuracy.

Q. Which items on your list are also on the researchers' list?

The list of items remaining included the following:

List No.	IPM-s Practices
1	Have a planned strategy for maintaining drench efficacy on farm using various techniques (manage drench resistance)
2	Test regularly for drench resistance (every 3 years)
4	Use WEC to determine drench strategy
5	Use WEC history of paddocks for setting weaning and lambing paddocks
6	Minismise sheep deaths and weight loss through acceptable drenching program e.g. consult Drench Decision Aid, WormBoss etc.
7	Have breeding strategy for worm resistant sheep and less scouring
10	Set targets and monitor for ewe condition scores at lambing and weaner bodyweights
11	Nutrition - Able to identify supplementation strategies
14	Management to minimise scouring
16	Appropriate and strategic use of insecticide – monitoring, observe witholding periods, resistance management etc
17	Have a lice biosecurity plan – regular monitoring, quarantining, fence maintenance etc.
18	Treat for parasites only when monitoring and/or planning indicates a genuine need
19	Ability to integrate parasite control into farm management program
20	Sufficient knowledge of parasite biology to make considered management decisions/choices

- In talking about use of a drench plan, all producers indicated that they did not. One producer stated that he used to, another was concerned about how well they worked for his region stating:

"*One of the biggest problems is that if you do use a program that's been designed in Western Australia and it's too good you build the resistance up a lot faster. So you don't want one that's too good.*"

This indicates an issue with knowledge about what drench plans are available for NSW through the Department of Agriculture, since there are plans designed specifically for each sheep growing region in NSW.

- On the topic of keeping written paddock histories, most producers present indicated that they 'have a mental note' about what has occurred in their paddocks. One producer stated:

"*I'm quite sure that if you had a hell of a lot of country, you'd tend to write it down.*"

- With regards to having a breeding strategy, this came back to culling poorly performing animals, with one producer stating:

"*No. …. Those sheep that have shares in the Ivomec factory, you'd just cull them. That's what you mean.*" And other stated:

"P23- "We don't have a …. We're not actually going out and sourcing rams.

P24 - But Ross, you're not breeding from the ewe …. You will have one that is never any good, you don't breed from them.

P23 - No that's right. But as far as going the other way and actually looking for rams…"

- Producers indicated that they did not have set targets for weights and condition scores.
- Producers indicated that they tended to quarantine drench new sheep with cydectin, while another indicated that they quarantined by not buying in any stock.

With regards to sheep quarantine and lice, one producer brought up the issue of neighbours having infested sheep.

- Culling was used for blowfly strike. While another indicated that they used to mules for flystrike but try not to any more. No one used fly traps. Shearing was used to help with flystrike also.
- One person mentioned they did pregnancy scanning.
- One the topic of opportunity drenching, producers indicated that they "did a bit of both" (ie visual assessment , FEC testing and opportunity drenching).

- One producer indicated that he used capsules every year on lambs only. There was non concern about sheep health due to the capsules not breaking down as there was in Dunkeld.
- When asked about integrating parasite management into farm management, one producer stated:

"*Aren't we already doing that with putting cattle in with the sheep to try and clean up a paddock*?"

Another said:

"*In a good season you can do a lot of things. These couple of seasons we've had you've just got to get through it the best you can.*"

Another, older producer indicated that they had moved from more piecemeal management to strategic management:

"*...we came here in '72, those days you got your sheep, you drenched them and then you sheared them. If you didn't do it, they died. Now, we are doing things a little more strategically. We know how the parasites work, we've talked about Ivomec drenches, your clears and your whites. We all know how they work.*"

- On the topic of doing FEC, producers indicated that it was "Better doing that, then drenching a mob of sheep."

This comment was to indicate that cost was not an issue. Though the producer making this comment did his FEC at home and was one of the younger producers who had been to university. The older farmer in the group questioned him about being able to do cultures at home and the cost compared to using a vet. The older producer indicated his testing cost him $65 a throw, and when the younger indicated it cost him only 20 cents, the older producer stated:

"*We might have to look into that. We've done that, we've drenched with Cydectin and put them back in the paddock and got a faecal egg count and it's come back zero, zero, zero. So you know that that drench is still working.*"

When asked about whether they found FEC results deceptive, the younger, university-educated producer stated:

"*The only time that will happen is that in the middle of summer and barber's pole is about to take off, and you're picking up a lot of immature worms that are just being picked up, but they are not producing eggs, but if you relate all your egg counts to what the seasons like, what the sheep are like and what the conditions are like, once you get a figure, if it's potentially slightly higher, but they've got lots of feed in front of them, you might say you will let them go a little longer. But if it's a little lower than when you normally drench them, but coming into winter you might be inclined to drench them. You don't just take them on the reading.*"

- There was some discussion about the benefit of breeding resistance and EBVs, with some concerned about the tradeoffs between the resistance trait and other traits, with one producer stating

"*Depends on what the trade off is. Generally those sheep with a lower egg count, generally have a trade off with lower production because they divert protein from going into production to fighting worms. There can be a trade off for the two. I'm hoping that there's a couple of new drenches on the horizon being developed for cattle and what not that will eventually come back to sheep. The drenches we've got at the moment if they're used wisely with rotation will last us quite OK. Even if they don't we'll go back to copper sulphate.*"

- When asked about how long they think drenches might last, producers indicated that they had no idea, but maybe about ten years. Another indicated that the issue was 'always at the back of his mind'. One producer was not willing to say he believed that

the industry was losing drenches, but indicated he thought that you could prolong them.

Q. How would you prioritise the list of parasite management tools?

This exercise gave the participants a chance to indicate what was important to them in terms of parasite management, using both their own and the Researchers' list. This went a way to alleviating somewhat the feeling that the participants were not knowledgeable sheep managers because they had not mentioned all the things on the Researchers' list in the same way.

Worms

Priority	Worm management practice or tool
1	FEC testing & Vet advice
2	Drench resistance tests & Rotation grazing
3	Drenching
4	Grazing management & Mob rotation (clean paddocks)
5	Nutrition - supplements

Flies

The priority list for fly control was:

Priority	Fly management practice or tool
1	Mulesing
2	Crutching
3	Jetting
4	Click
5	Back-lining
6	Drenching
7	Fly traps - monitoring
8	Genetics (back of mind consideration)

Lice

Priority	Lice management practice or tool
1	Back-line
2	Dipping
3	Fencing management - boundaries
4	Quarantine
5	Closed flock

The final 3 questions were not addressed due to time constraints.

Appendix C Full list of 86 Delphi Responses

1 A basic understanding of the parasite life cycle
2 A basic understanding of the parasite epidemiology
3 Ability to interpret information sources on parasite control
4 Understanding of farm worm history - property specifics
5 Understanding of when a sheep is susceptible to parasite infection
6 Understanding of seasonal patterns of worm infection in the region
7 Good knowledge of the core or basic worm control program appropriate to the region
8 Knowledge of clinical signs of worm parasitism
9 Knowledge of clinical signs that may be confused with those indicating anaemia
10 Knowledge of the drench groups
11 Knowledge of current effectiveness of drenches on farm
12 Knowledge of drench capsules and newer long-acting products
13 Knowledge of correct drench technique for different drenches (oral liquid, capsule, injection)
14 Understand correct choice of anthelmintics for specific treatment situations
15 Basic understanding of how to rotate drenches
16 Know what is an acceptable number of annual drenches
17 Understand witholding periods & ESIs for drenches and lice/ fly chemicals used (meat and wool)
18 Minismise sheep deaths and weight loss through acceptable drenching program
19 Understand basics of drench resistance (genetic selection of resistant worms, risks of frequent drenching)
20 More advanced knowledge of drench resistance - principles of "refugia" & risks of low refugia, when this is likely to occur
21 Knowledge of the methods available to test for drench resistance
22 Knowledge of the role of worm egg count monitoring
23 Basic interpretation of WECs
24 Nutrition - know target condition scores for breeding ewes
25 Understand the concept of estimated breeding values (EBV) particularly as applied to worm resistance
26 Understand difference between Nemesis FEC EBVs and other EBVs
27 Principles of weaner management - time of weaning, preparation of weaning paddocks, target weights, monitoring weight & FEC of weaners
28 Understanding of parasite control strategies other than drenching
29 Understand principles of Grazing management -(role of)- for worm control
30 Understand how to do Smart Grazing (Vic) or rotation grazing (NSW)
31 Grazing management - understand principles of sheep/ cattle interchange for worm control
32 Breeding for resistance - principles of how to go about it (ram breeder)
33 Breeding for resistance- understand relationship/ balance with production traits
34 Breeding for resistance- interpret EBVs for resistance purposes (commercial producers)
35 Ram breeders- how parasite control fits in with breeding objectives
36 Knowledge of groups of chemicals available (lice and blowflies), advantages & disadvantages of these
37 Knowledge of chemical products available - pros and cons
38 Know chemcial application techniques and suitability for different chemicals (lice

and blowflies)
39 Undertand the main OH&S issues associated with parasiticide use
40 Knowledge of effectiveness of backliners
41 Know lice status of sheep on their property
42 Understanding of when appropriate to apply chemicals (e.g. timing, withholding periods)
43 Flystrike management: understanding of strategic and non-strategic jetting
44 Awareness of emerging backliner resistance issue
45 Consider implications of residues in meat and wool from using chemicals
46 Understand principles of blowfly strike prevention - making sheep less susceptible (mulesing, selecting against fleece rot etc),
47 How to prevent infestation (care with purchased and neighbouring sheep & Management of stray sheep)
48 How to control/ eradicate lice infestations
49 Understand the key IPMs strategies available for each of the parasites of concern (eg. grazing management, use of alternative hosts, use of host nutrition, biological control methods etc)
50 Understanding of how time of lambing dictates feed demand of flock, how this interacts with parasitism
51 Good working knowledge of practical sheep nutrition
52 Ability to undertake strategic drenching for worm control
53 Ability to determine timing of non-strategic drenching
54 Able to use drench equipment correctly (for all types)
55 Able to calibrate drench-gun
56 Able to weigh sheep correctly
57 Able to assess sheep condition scores
58 Able to record sheep weights and condition scores
59 Maintain records of annual drench program and sheep deaths and weight losses
60 Carry out regular WEC
61 Monitor WEC results
62 Know how to collect samples for WEC monitoring and how to appropriately package and transport samples
63 Breeding for resistance - Able to source resistant rams
64 Ability to carry out pasture assessments (availability/Quality)
65 Management of introduced sheep - able to quarantine/or quarantine drench
66 Able to apply chemicals/insecticides using correct method
68 Be able to tell if sheep is anaemic
69 Ability to recognise struck sheep
70 Maintain records of flystrike
71 Cull animals with flystrike
72 Able to detect fleece rot
73 Use of suppression methods e.g. Luci traps
74 Ability to properly mules sheep
75 Ability and knowledge to dock sheeps tails to correct length
76 Ability to recognise lice
77 Ability to recognise infested sheep
78 Regular monitoring/inspection of sheep for lice
79 Maintain fences
80 Good record keeping - management and financial
81 Computer/spreadsheeting/internet skills (help but not essential)
82 Pregnancy scanning if multiple births exceed 10%
83 Have a single shearing time (NSW)

84 Sheep selection/classing skills
85 Avoid summer drenching (WA)
86 Organise for drench resistance testing

Appendix D Interview information sheet and invitation

UNE
THE UNIVERSITY OF NEW ENGLAND

INSTITUTE FOR Rural Futures

Got Worms?

Worms and other parasites are a huge cost to the Australian sheep industry. Every year Australian producers spend millions of dollars trying to control parasites, with much of this money going on chemical drenches that are starting to fail.

·Do you have a problem with drench resistance on your farm?

·Are you interested in finding out ways to reduce your worm burden and better manage worms despite resistance problems?

·Would you be willing to help researchers and industry understand how you deal with worm problems on your farm?

If the answer is YES to any of these questions then please participate in an interview process being carried out through Australian Wool Innovation's Integrated Parasite Management in sheep (IPM-s) project.

Your views are important

Help us to understand what you think about the various methods for managing worms.

Your experience is vital

Sharing how you approach worm management can help develop research and management programs that better meet the real world operation of your property.

Get the information you want

A better understanding of your needs means you only get the information you really want. Information overload is a common problem for producers, but helping researchers understand what's important to you can help them make sure the most relevant information is provided through field days, leaflets, courses and websites.

We appreciate your help

Your name was selected from amongst the thousands of sheep producers registered with Australian Wool Innovation Ltd. Your participation in this study is entirely voluntary. However, your assistance in this important research will be greatly appreciated.

We know it is hard to find the time to participate in research, and the interview process is designed to take as little of your time as possible. Your participation is anonymous and your interview will be ***totally confidential.*** The number on the top of this letter is for mailing purposes only and ensures you do not receive any unwanted calls or other communication. Should you have any complaints concerning the manner in which this research is conducted, please contact the Research Ethics Officer at: Research Services, University of New England, Armidale, NSW 2351, Telephone: (02) 6773 3449, Fax: (02) 6773 3543 or email: ethics@une.edu.au.

How to participate

If you can spare about 45 minutes to share your views and experiences of worm control, please contact Lyndal Thompson at the Institute for Rural Futures, University of New England to register your interest. Lyndal will be interviewing late September and October. She will be contacting invitees shortly to check if they can participate and to set a date and time that suits best.

Contact Details

Lyndal Thompson
Institute for Rural Futures,
University of New England,
Armidale, NSW 2351
Telephone: 1800 652 592
Fax: (02) 6773 3245
Email: lredman@une.edu.au

iPM-sheep
integrated parasite management

another australian wool innovation limited

Invitation for New England producers

UNE
THE UNIVERSITY
OF NEW ENGLAND

INSTITUTE FOR Rural Futures

Got Worms?

Worms and other parasites are a huge cost to the Australian sheep industry. Every year Australian producers spend millions of dollars trying to control parasites, with much of this money going on chemical drenches that are starting to fail.

·Do you have a problem with drench resistance on your farm?

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Your views are important

Help us to understand what you think about the various methods for managing worms.

Your experience is vital

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A better understanding of your needs means you only get the information you really want. Information overload is a common problem for producers, but helping researchers understand what's important to you can help them make sure the most relevant information is provided through field days, leaflets, courses and websites.

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We know it is hard to find the time to participate in research, and the interview process is designed to take as little of your time as possible. Your participation is anonymous and your interview will be ***totally confidential.*** The number on the top of this letter is for mailing purposes only, and ensures you do not receive any unwanted calls or other communication. Should you have any complaints concerning the manner in which this research is conducted, please contact the Research Ethics Officer at: Research Services, University of New England, Armidale, NSW 2351, Telephone: (02) 6773 3449, Fax: (02) 6773 3543 or email: ethics@une.edu.au.

How to participate

If you can spare about 45 minutes to share your views and experiences of worm control, please contact Lyndal Thompson at the Institute for Rural Futures, University of New England to register your interest. Lyndal will be interviewing in Victoria during late September and October. She will be contacting invitees shortly to check if they can participate and to set a date and time that suits best.

Contact Details

Lyndal Thompson
Institute for Rural Futures,
University of New England,
Armidale, NSW 2351
Telephone: 1800 652 592
Fax: (02) 6773 3245
Email: lredman@une.edu.au

iPM-sheep
integrated parasite management

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australian wool
limited

Invitation for Victorian interviews

«ID»

«Address_Line_1»
«Address_Line_2»
«Address_Line_3»
«Town_Name»
«State_Code» «Postcode»

INSTITUTE FOR **Rural Futures**

Dear Mr or Mrs «Family_Name_1»

My name is Lyndal Thompson and I am a researcher at the Institute for Rural Futures at the University of New England in Armidale, NSW.

I am involved in a project about Integrated Parasite Management in sheep (IPM-s) funded by Australian Wool Innovation Ltd and I would like to invite you to participate in a personal interview about worm management. Whilst I am based in New South Wales, IPM-s has a project team based in the Mackinnon Project at LaTrobe University, as well as 5 demonstration farms across Victoria.

As you would be aware drenches are losing their effectiveness and the IPM-s project is looking at different methods that can work alongside chemicals to control parasites such worms.

I am inviting a small group of people in your area to participate in personal interviews about the types of things you do to control worms and how you make decisions about which methods to try. The information you give us will be used to design extension material for the project that is relevant to producers as well as understand other aspects of worm management that the project might need to consider.

I have enclosed an information sheet about the proposed interview. I will contact you again in the next week or two to confirm whether or not you are interested in being interviewed. I am happy to visit your property, or we can arrange an alternative location if desired. I will be in the Ballarat area from Monday 16th October through to 30th October and Hamilton from 31st October through to 7 November 2006. You can also call me to indicate whether or not you are interested. I can be contacted on: 1800 652 592 (please leave a message if unanswered, the mailbox defaults to Cathy Coleman who is our administrative officer) or phone my mobile on 0407 557 488.

I thank you for your time and look forward to talking with you shortly.

Regards,
Lyndal Thompson
PhD Researcher
Institute for Rural Futures
Enclosure (1)

Institute for Rural Futures
University of New England
Armidale NSW 2351

Telephone 02 6773 2220
Facsimile 02 6773 3245
Email irf@une.edu.au
Internet www.ruralfutures.une.edu.au

... learn from the past, try to understand the present, and feel inspired to help plan a better future for all Australians.
Herb Wharton, retired Aboriginal drover and author

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The University of NEW ENGLAND

Personal interview cover letter

Appendix E Full survey report

Copies of the IPM-s benchmark survey, the full report and its associated appendices can be found on the attached CD-ROM.

The following tables have been extracted from the 2004 Benchmark Survey (Reeve and Thompson 2005) for convenience as they are referred to in Chapter 7.

Table 7.1 Proportion of respondents who use supplementary feeds

Region	n	Proportion using feeds (%)		
SW & S Qld	57	34	**47**	60
GB & DD	16	32	56	81
New England	170	67	74	80
C & S Tablelands	179	75	81	87
SW NSW & NE Vic	168	83	88	93
Gippsland	12	40	67	93
W Vic & SE SA	369	75	79	84
S SA	69	62	72	83
KI	41	68	80	93
WA	204	93	**96**	99
All regions	1285	78	80	83

$\chi 2$ =93.32, d.f. = 9, $p < 0.0005$. 2 cells (10.0%) have expected counts less than 5.

Table 7.2 Proportion of survey respondents feeding ewes and lambs by region

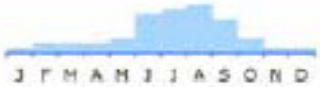
Region	n	Proportion of respondents feeding ewes	n	Proportion of respondents feeding weaners
SW & S Qld	20		12	
GB & DD	8		5	
New England	110		69	
C & S Tablelands	123		103	
S NSW & N Vic	132		94	
Gippsland	5		6	
W Vic & SE SA	248		187	
S SA	43		20	
KI	32		27	
WA	186		159	
All Regions	907		682	

Table 7.3 Grazing strategies used in 2003

Region	n	Proportion with grazing strategy below (%)						
		Set stocked	Set stocked at lambing only	Alternating between sheep and cattle	Alternating between sheep and crop stubble	Alternating between sheep and forage crop	Cell grazing	Rotational grazing
SW & S Qld	94	52	17	42	16	15	4	41
GB & DD	32	72	10	40	1	9	9	18
New England	280	57	34	32	3	8	11	33
C & S Tablelands	310	54	30	18	34	11	4	38
S NSW & N Vic	307	40	41	25	47	11	3	44
Gippsland	21	48	41	33	10	2	10	39
W Vic & SE SA	598	55	30	24	30	11	6	39
S SA	110	17	46	27	31	5	4	71
KI	55	44	49	23	39	0	4	40
WA	436	41	26	7	60	6	6	30
All Regions	2243	48	31	22	36	9	6	38

Note 1: percentages may sum to more than 100 as respondents could give more than one strategy.
Note 2: percentages are adjusted for non-response bias as described in Appendix 1.10.

Table 7.4 Key objectives in using grazing strategies

Region	n	Proportion with key objective below (%							
		Parasite control	Pasture mgt	Animal mgt	Sustain-ability	Ease	Use of crops and stubbles	Maximise or increase productivity or production	Other
SW & S Qld	55	27	31	27	7	7	4	5	35
GB & DD	19	16	47	21	5	16	0	11	21
New England	146	36	47	33	5	13	1	9	17
C & S Tablelands	150	21	47	44	2	13	7	3	15
S NSW & N Vic	129	18	38	46	2	11	15	8	18
Gippsland	8	38	38	63	0	13	0	0	13
W Vic & SE SA	307	21	40	37	2	14	5	5	19
S SA	63	32	35	35	0	13	27	5	13
KI	36	22	44	31	3	19	0	11	14
WA	159	14	48	36	3	13	15	11	17
All Regions	1072	23	42	37	3	13	8	7	18

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

Table 7.5 Proportion of respondents drenching newly introduced sheep

Region	n	Proportion drenching sheep on arrival (%)		
SW & S Qld	46	54	67	81
GB & DD	20	85	95	105
New England	100	89	94	99
C & S Tablelands	102	84	90	96
SW NSW & NE Vic	104	72	80	88
Gippsland	7	60	86	112
W Vic & SE SA	227	82	86	91
S SA	38	63	76	90
KI	26	71	85	98
WA	97	60	69	78
All regions	767	81	83	86

χ^2 =40.01, d.f. = 9, p <0.0005.

Table 7.6 Respondents using WEC

Region	n	Proportion of respondents monitoring worm egg counts (%)		
SW & S Qld	63	42	54	66
GB & DD	24	43	63	82
New England	173	52	**59**	66
C & S Tablelands	179	41	49	56
SW NSW & NE Vic	168	32	39	47
Gippsland	12	40	67	93
W Vic & SE SA	368	35	40	45
S SA	70	26	37	48
KI	42	23	38	53
WA	206	26	33	39
All regions	1305	41	44	46

χ^2 =42.22, d.f. = 9, p <0.0005.

Table 7.7 Number of times worm egg counts typically monitored – wethers

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	19	1	2	12	3.1	1.3	
GB & DD	13	1	5	25	5.7	3.7	
New England	61	1	3	12	3.0	0.6	
C & S Tablelands	42	1	2	13	2.4	0.7	
S NSW & N Vic	27	1	1	24	2.4	1.8	
Gippsland	5	1	1	3	1.6	1.1	
W Vic & SE SA	73	1	2	12	2.4	0.5	
S SA	5	1	2	5	2.4	2.1	
KI	11	1	2	5	2.5	0.8	
WA	23	1	2	4	2.0	0.4	
All Regions	279	1	2	25	2.7	0.3	

Histogram class limits: 1.0-1.9-2.8-3.7-4.6-5.5-6.4-7.3-8.2-9.1-10.0.
Kruskal-Wallis: $\chi 2=28.34$, d.f.=9, p=0.001.
***Note:** respondents monitoring more than 10 times (6) have been excluded from the histograms (and **only** from the histograms) to prevent the size distribution being reduced to a single bar, due to the influence of the small number of respondents monitoring very frequently.*

Table 7.8 Number of times worm egg counts typically monitored – adult ewes

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	24	1	2	12	3.1	1.0	
GB & DD	7	2	3	7	3.7	1.9	
New England	94	1	3	15	3.4	0.6	
C & S Tablelands	76	1	2	17	2.7	0.5	
S NSW & N Vic	51	1	1	6	1.6	0.3	
Gippsland	8	1	2	3	1.8	0.6	
W Vic & SE SA	131	1	2	12	2.5	0.3	
S SA	24	1	2	7	1.9	0.6	
KI	14	1	3	5	2.9	0.8	
WA	57	1	1	6	1.8	0.3	
All Regions	486	1	2	17	2.6	0.2	

Histogram class limits: 1.0-1.9-2.8-3.7-4.6-5.5-6.4-7.3-8.2-9.1-10.0.
Kruskal-Wallis: $\chi 2=56.07$, d.f.=9, p<0.0005.
***Note:** respondents monitoring more than 10 times (6) have been excluded from the histograms (and **only** from the histograms) to prevent the size distribution being reduced to a single bar, due to the influence of the small number of respondents monitoring very frequently.*

Table 7.9 Number of times worm egg counts typically monitored – weaners

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	22	1	2	7	2.3	0.7	
GB & DD	3	2	3	6	3.7	5.2	
New England	87	1	3	43	4.3	1.1	
C & S Tablelands	77	1	2	26	3.4	0.8	
S NSW & N Vic	53	1	2	12	2.2	0.5	
Gippsland	6	1	2	3	2.0	0.7	
W Vic & SE SA	127	1	2	12	2.8	0.3	
S SA	21	1	2	12	3.1	1.5	
KI	14	1	3	10	3.4	1.4	
WA	61	1	2	8	2.1	0.4	
All Regions	471	1	2	43	3.0	0.3	

Histogram class limits: 1.0-1.9-2.8-3.7-4.6-5.5-6.4-7.3-8.2-9.1-10.0.
Kruskal-Wallis: $\chi 2=37.29$, d.f.=9, $p<0.0005$.
Note: respondents monitoring more than 10 times (12) have been excluded from the histograms (and only from the histograms) to prevent the size distribution being reduced to a single bar, due to the influence of the small number of respondents monitoring very frequently.

Table 7.10 Proportion of respondent indicating they had conducted a drench resistance test

Region	n	Proportion of respondents who have tested for drench resistance (%)		
SW & S Qld	101	19	**28**	37
GB & DD	33	42	59	76
New England	276	51	**57**	63
C & S Tablelands	314	39	44	50
SW NSW & NE Vic	310	40	45	51
Gippsland	21	44	65	85
W Vic & SE SA	606	44	48	52
S SA	108	38	47	57
KI	54	44	57	70
WA	438	46	51	56
All regions	2261	46	48	50

$\chi 2$ =35.96, d.f. = 9, p <0.0005.

Table 7.11 Year of Most Recent DRT

Year of most recent drench resistance test	Proportion of respondents (%)		
1980	0.0	0.4	0.9
1982	0.0	0.2	0.6
1986	0.0	0.2	0.6
1989	0.0	0.6	1.3
1990	2.3	3.9	5.5
1991	0.0	0.4	0.9
1992	0.3	1.3	2.3
1993	0.0	0.7	1.4
1994	1.3	2.6	3.9
1995	2.7	4.5	6.3
1996	0.8	2.0	3.2
1997	1.6	3.0	4.4
1998	5.0	7.2	9.4
1999	5.0	7.2	9.4
2000	10.3	13.2	16.1
2001	9.2	11.9	14.6
2002	14.6	17.8	21.0
2003	11.7	14.7	17.7
2004	6.0	8.3	10.6

n=539

Table 7.12 Type of drench resistance test used

Region	n	Proportion of respondents using tests below (%)											
		DrenchRite			FECR			DrenchRite or FECR*			Other**		
SW & S Qld	7	0	0	0	6	43	80	0	14	40	6	43	80
GB & DD	6	0	0	0	0	0	0	0	17	46	54	83	113
New England	55	0	4	9	22	35	47	0	7	14	41	55	68
C & S Tablelands	45	5	16	26	2	11	20	1	9	17	50	64	78
SW NSW & NE Vic	30	0	7	16	0	3	10	0	10	21	66	80	94
Gippsland	5	0	40	83	0	20	55	0	0	0	0	40	83
W Vic & SE SA	88	3	9	15	6	14	21	2	7	12	61	70	80
S SA	17	0	6	17	0	12	27	0	6	17	56	76	97
KI	11	0	0	0	0	18	41	0	18	41	35	64	92
WA	53	0	4	9	4	13	22	4	13	22	57	70	82
All regions	317	5	8	10	12	16	20	6	9	12	62	67	72

$\chi 2$ =42.84, d.f. = 27, p = 0.027. 26 cells (65.0%) have expected counts less than 5.

** Sufficient information given to identify test as DrenchRite or FECR test, but not sufficient to determine which of the two.*

*** Tests other than DrenchRite and FECR tests, or cases where information given was only sufficient to identify that some form of drench resistance testing had been carried out by the respondent.*

Table 7.13 Proportion of respondents using particular worm control techniques

Region	n	Proportion of respondents using technique below (%)							
		Smart grazing	Other grazing	Sheep un-drenched	Feeding	Rams	Organic	Drenching	Other
SW & S Qld	54	19	28	2	11	13	4	80	15
GB & DD	24	4	21	0	8	8	0	96	8
New England	176	29	47	2	13	24	1	89	10
C & S Tablelands	184	34	33	5	21	8	3	89	11
S NSW & N Vic	164	30	35	3	21	5	2	84	15
Gippsland	12	25	25	0	33	17	8	100	17
W Vic & SE SA	363	33	34	3	23	10	3	91	10
S SA	70	40	30	3	26	19	1	84	16
KI	42	31	48	14	36	21	5	86	5
WA	200	23	23	18	19	21	1	89	18
All regions	1289	30	33	6	20	14	3	89	12

Note: percentages may sum to more than 100 as respondents could give more than one strategy.
"Sheep un-drenched" = Leave some sheep un-drenched at summer treatments. "Feeding" = Feeding strategy.
"Rams" = Use rams selected for resistance to worms. "Organic" = Organic methods.

Table 7.14 Reasons for using 'Other' Grazing techniques

Prepare pastures by other grazing techniques – all regions

Explanatory description	Proportion of respondents (%)
Provide or move treated sheep to clean/ low risk pastures	9.8
Graze high risk pastures with dry sheep	2.0
Graze first/ in rotation/ alternate with cattle	25.5
Graze first with cattle & provide clean pastures	2.0
Graze first with cattle & provide crop stubbles	2.0
Graze first with cattle &/ or dry sheep	9.8
Graze cattle & sheep together	2.0
Graze first with dry sheep	13.7
Paddocks grazed by sheep given a capsule	2.0
Use rotational grazing incl. cell grazing	5.9
Spell pasture/ paddock	9.8
Change pasture/ paddock after treatment	2.0
Shift after treatment onto crop stubbles	3.9
Use/ shift after treatment onto fodder or standing crop	2.0
Avoid drenching onto crop stubbles	2.0
Use hay paddock	2.0
Avoid high stocking rate/ use low stocking rate	2.0
Use native pasture	2.0

n=51

Table 7.15 Reasons for using any grazing strategy – All regions

Feeding strategy – all regions

Explanatory description	Proportion of respondents (%)
Graze first/ in rotation/ alternate with cattle	7.7
Change pasture/ paddock after treatment	7.7
Shift after treatment onto crop stubbles	7.7
Keep feed availability high	7.7
Maintain condition score	38.5
Supplementary feed/ start feeding early	15.4
Feed in troughs	7.7
Nutrition/ grazing management/ good quality pasture	7.7
Graze first/ in rotation/ alternate with cattle	7.7
Change pasture/ paddock after treatment	7.7

n=13

Table 7.16 Reasons for using treatments and techniques other than grazing (part (a))

Other treatments and techniques - all regions

Explanatory description	Proportion of respondents (%)
Provide or move treated sheep to clean/ low risk pastures	7.7
Graze first/ in rotation/ alternate with cattle	4.5
Graze first with cattle & provide crop stubbles	1.3
Graze first with dry sheep	0.6
Paddocks grazed by sheep given a capsule	1.9
Use rotational grazing incl. cell grazing	1.9
Spell pasture/ paddock	8.4
Spell lambing paddock	0.6
Change pasture/ paddock after treatment	0.6
Shift after treatment onto crop stubbles	13.5
Use/ shift after treatment onto fodder or standing crop	0.6
Use hay paddock	0.6
Graze crop stubbles	9.0
Avoid high stocking rate/ use low stocking rate	3.9
Use high stocking rate	0.6
Nutrition/ grazing management/ good quality pasture	5.2
Use minerals	8.4
Nutrition - especially vitamins	0.6

continued on next page

Table 7.17 Other techniques and treatments (part (b))

Other treatments and techniques - all regions (contd)

Explanatory description	Proportion of respondents (%)
Nutrition - organic	1.9
Monitor BWt	0.6
Use strategic/ summer drenches	2.6
Leave some sheep untreated at summer drench	0.6
Don't summer drench	0.6
Give pre-lambing drench	1.3
Use 'smart drenching' (~12 hrs off feed)	1.3
Rotate chemicals	3.2
Monitor egg counts before drench	1.9
Assess when to drench visually (appearance of the sheep)	1.9
Only drench tail of mob	0.6
Don't drench much/ worms not a problem	2.6
Only drench weaners or lambs/ don't drench adult sheep	2.6
Use some form of genetic strategy	1.9
Cull daggy sheep	0.6
Select low worm count sheep	0.6
Flock structure limits other control measures	1.3
Disaster & chaos - no other control possible	3.2

n=153

Table 7.18 Other Factors regarded as important by respondents when deciding to drench ewes

Factor	Proportion of respondents (%)		
Death of sheep	1	3	5
Signs of disease, ill thrift or weakness	28	35	42
Routine practice	51	58	65
Weaning	1	4	7

n=179

Table 7.19 Other factors regarded as important by respondents when deciding to drench weaners

Factor	Proportion of respondents (%)		
Death of sheep	2	8	14
Signs of disease, ill thrift or weakness	29	40	51
Routine practice	22	32	42
Weaning	12	21	29

n=179

Table 7.20 Main advisor for worm control

Region	n	Proportion of respondents using source of advice below (%)							
		Self or staff	Local vet	Pvte vet consult't	Ag consult't	Ag dept officer	Rural mer'se rep	Drug co. rep	Other
SW & S Qld	61	89	0	0	0	12	0	0	0
GB & DD	24	96	0	4	0	0	0	0	0
New England	177	76	3	12	1	0	6	1	1
C & S Tablelands	180	76	9	2	1	1	6	2	4
S NSW & N Vic	170	74	4	8	4	2	4	3	1
Gippsland	12	83	0	0	0	8	0	8	0
W Vic & SE SA	375	75	8	7	2	2	4	1	1
S SA	70	77	11	6	1	0	4	0	0
KI	42	71	19	10	0	0	0	0	0
WA	202	74	12	5	5	2	1	2	0
All regions	1313	76	8	7	2	2	4	1	1

$\chi 2$ =159.12, d.f. = 27, $p < 0.0005$. 51 cells (63.8%) have expected counts less than 5.
"Pvte vet consult't" = Private veterinary consultant. "Ag consult't" = Ag consultant. "Ag dept officer" = Ag department officer. "Rural mer'se rep" = Rural merchandise representative. "Drug co. rep" = Drug company representative.

Please feel free to add comments in the space below or on a separate piece of paper if you require more room.

THANK YOU FOR YOUR PARTICIPATION.

If you would like to be contacted about further developments in IPM-s, including workshops or field days, please indicate your preferences above and send this survey form back or e-mail Lyndal Redman-Thompson lredman@pobox.une.edu.au.

If you lose the return envelope, please send the survey to U.N.E. Reply Paid 61883, NSW 2351.

This project has been approved by the Human Research Ethics Committee of the University of New England (Appr. No. HE04/015, valid to 31/12/06. 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. Phone: (02) 6773 3449; Fax (02) 6773 3543; Email: Ethics@metz.une.edu.au.

Rural Futures

australian wool innovation limited

Integrated Parasite Management in the Sheep Industry
A National Survey

Dear Sheep Producer,

We are seeking your help with a national survey investigating integrated parasite management in sheep (IPM-s). Many parasites have developed resistance to chemical controls and it is vital for a profitable sheep industry that we have other methods to work alongside chemicals. There is also a need to ensure low chemical residues in wool and meat in order to maintain our success in overseas markets as well as to reduce staff exposure to chemicals in our industry.

This research is supported by Australian Wool Innovation (AWI) and research partners listed below. The Institute for Rural Futures has been employed to carry out this survey .on behalf of these organisations. The project is looking at new parasite control methods to reduce reliance on chemicals, and parasite resistance to chemicals, while maintaining or improving production. 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 the research meets the needs of sheep producers such as you.

Your address is one of a small sample of AWI levy-paying wool producers selected who may wish to assist in our survey. The number appearing at the top right-hand corner of this page is for mailing purposes only – this will ensure that you will not be sent any unnecessary reminders. Your name is not required on the survey, so your responses will be strictly confidential.

You do not have to fill out this survey; however your assistance in this important research will be very much appreciated. I know it is hard for producers to find time to fill in surveys and I have made every effort to make the questions as short and easy to answer as possible. I would be grateful if you could take the twenty minutes needed to fill in the form. A reply-paid envelope is provided for the return of your questionnaire. If you would like to know more about the project, please call me on (02) 6773 5144.

Many Thanks,

Lyndal Redman-Thompson, Institute for Rural Futures.

UNE The University of New England · The MacKinnon Project · The University of Melbourne · Department of Agriculture Government of Western Australia · Queensland Government Department of Primary Industries and Fisheries

PARASITE MANAGEMENT IN THE SHEEP INDUSTRY

Survey Instructions:

1. Do you own or manage 500 or more sheep? ☐ YES ☐ NO
   If NO, please send this blank survey back in the envelope provided.
2. The best person to complete this survey is the person who makes the major decisions about the management of livestock on the property.
3. Please complete the questions for the property on which you reside or spend the most time.
4. Most of the information requested for this survey is for 2003. However, for some districts this was a time of drought and you may have adopted practices different to your usual program. If this is the case for you, please provide information about the usual management practices on your property where asked.

SECTION A: PROPERTY AND OPERATION DETAILS

Please provide information from 2003, unless otherwise specified.

Q1. What rainfall did you receive in 2003?

…… mm OR …… inches (1 inch = 25.4 mm)

Q2. What is the average annual rainfall for your area?

…… mm OR …… inches (1 inch = 25.4 mm)

Q3. What was the estimated percentage of income from each enterprise?

	Income (%)
Wool sales	
Wool sheep sales (stores, culls & cast for age, boat wethers)	
First cross ewe sales for breeding	
Meat sheep (1st or 2nd cross prime or store lambs)	
Beef cattle	
Cropping	
Other (*Please specify)*	
TOTAL	100%

Q29. Please indicate below which of the following lice control techniques you have used in the past three (3) years (2001-2003) and show also what product(s) you used.

		Year/s Used	Product/s Used
Off-shears	Mobile dipping contractor		
	Plunge dip		
	Shower dip		
	Pour-on 'backliner'		
	Other (*Please specify*) ……		
Long wool	Hand jetting		
	Pour-on 'backliner'		
	Other (*Please specify*) ……		
No lice treatments used ☐			

Q30. Have you ever suspected resistance to a lice product on your farm?

Please tick one only

YES	☐	*Go to 30A below.*
NO	☐	*SKIP to last section About You.*

Q30A. Please indicate to which product you think the resistance might have occurred.

……

Finally, we just need a little information about yourself

Q31. What is the postcode for the area in which your property is located?

……

Q32. Are you Male? ☐ Female? ☐

Q33. In what year were you born? 19……..

Q24. At what length do you dock lambs' tails?

Please tick one only

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*) ……	☐

SECTION D: LICE CONTROL

Q25. How often do you *typically* treat sheep for lice on your property?

……...

Q26. Were any of your sheep lousy when they were last shorn?

Yes ☐ **No** ☐ **Not Sure** ☐

Q27. How many years in the last ten years have your sheep been infested with lice?

…….. years

Q28. If your sheep had lice, what do you believe was the cause/s?

Please tick any applicable

Poor muster	☐
Infected neighbours	☐
Stray sheep	☐
Purchased sheep	☐
Treatment failure	☐
Other (*Please specify)* ……	☐

Q4. What areas of your property are used for the following?

	Area	
	Ha	Ac
Area grazed		
Area cropped		
Cropping area grazed as stubble		
Cropping area grazed as green		
Other *(Please specify)*		
Total property area		
Number of paddocks		
Percentage Grazed Improved		**%**
Percentage Grazed unimproved		**%**

Q5. How many cattle did you have in 2003? Please indicate the number you typically run if this is different than the number for 2003, as well as the usual month of calving.

	Number 2003	Number typically run	Month(s) of calving
Cows			
Heifers (weaning – 2 years)			
Steers (weaning – sale)			
Bulls			
Other (*Please specify*)			

Q6. How many sheep did you have at the main weaning time in 2003, or November 2003 if you have an all wether flock? Indicate the number you typically run if different than the number you had in 2003.

	Breed	Number in 2003	Number typically run
Merino ewes	Merino		
Other ewes (*Please specify breed*)			
Wethers			
Merino weaners	Merino		
Other weaners (*Please specify*)			
Rams			

Q7. In which month(s) do you shear and crutch?

	Month(s) shorn	Month(s) crutched
Ewes (older than 12 months)		
Wethers (older than 12 months)		
Weaners (less than 12 months)		

Q8. Please give details of the 2003 wool clip for your main breed of sheep:

Breed? ……..……..	Wool shorn from: Adult breeding ewes	Adults - dry ewes & wethers	Weaners (Less than 12 months)
Number of sheep shorn			
Total quantity of wool shorn or wool cut per head (kg)	…… (kg)	……..…… (kg)	……..……..…… (kg)
Fibre diameter of main line (microns)			

Q9. If you have ewes, please provide details about their breeding program:

	Type of ewe: Merino mated to Merino rams	Merino mated to Meat-breed rams	Cross-bred ewes	Other ……..
Month rams put in with ewes 2003				
Month rams taken out in 2003				
Marking % in 2003 (adults only)	…… (%)	…… (%)	…… (%)	…… (%)
Typical marking % (adults only)	…… (%)	…… (%)	…… (%)	…… (%)
Month lambs weaned in 2003				

Q19. Who is the main advisor for worm control on your property?

Please tick one only

Me or member of my staff	☐
Local vet	☐
Private veterinary consultant	☐
Ag consultant	☐
Ag Department officer	☐
Rural Merchandise representative	☐
Drug company representative	☐
Other *(Please specify)* ……..	☐

SECTION C: BLOWFLY CONTROL

Q21. If you had blowfly strike on your property during 2003, please provide details below.

Type of Strike	Percentage Ewes affected	Percentage Whethers affected	Percentage Weaners affected
Breech Strike	%	%	%
Body Strike	%	%	%

Q22. How do you typically treat for blowfly strike?

Please tick any that apply

Treat routinely for prevention at about the same time each year	☐
Treat when the weather suggests a flywave might occur	☐
Treat the whole mob once strike starts	☐
Treat individual sheep which become struck	☐
Other *(Please specify)* ……	☐

Q23. Who performs the mules operation on your sheep?

……..

Q18. Please rank how important the following factors are when deciding whether to drench weaner sheep. T*ick one per line.*

	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	☐	☐	☐	☐
Other (*Please specify*) ……..	☐	☐	☐	☐

Q19. Which of the following techniques treatments or techniques do you use for sheep worm control? *Please tick strategies used.*

		Description
Prepare pastures by 'Smart grazing'	☐	
Prepare pastures by other grazing techniques	☐	
Leave some sheep un-drenched at summer treatments	☐	Show % left un-drenched: ……..%
Feeding strategy	☐	
Use rams selected for resistance to worms	☐	Are these EBV tested? ……
Organic methods	☐	
Drenching	☐	
Other (*Please specify)* ……	☐	

Q10. What type of grazing strategies did you use in 2003?

Please tick any that apply

Set stocked	☐
Set stocked lambing only	☐
Alternating between sheep & cattle	☐
Alternating between sheep & crop stubble	☐
Alternating between sheep and forage crop	☐
Cell grazing (large mobs, small paddocks for periods of 1-4 days)	☐
Rotational grazing (smaller mobs, large paddocks for. 2-6 weeks)	☐
Other *(Please specify)* ……	☐

Q11. What are your key objectives for using the type(s) of grazing strategies indicated above?

……

……

……

Q12. Describe the supplementary feeding program for your property in a *typical* year:

	Type of feed (Oats, wheat, lupins, meal, blocks or licks etc)	Amount fed	Months fed (e.g. Jan-April)
Ewes (older than 12 months)			
Weaners (less than 12 months)			

SECTION B: WORM CONTROL

Q13. Show the number and type of drenches and controlled-release capsules given to each class of sheep from September 2002 to December 2003. ***Tick appropriate treatment.***

	Month/s of Treatment	Treatment Method		
		Drench	Capsule	Product used
Unweaned lambs	1.			
	2.			
Weaners (less than 12 months)	1.			
	2.			
	3.			
	4.			
Maiden ewes (12 – 24 months)	1.			
	2.			
	3.			
Adult ewes (older than 24 months)	1.			
	2.			
	3.			
Wethers (over 12 months)	1.			
	2.			
	3.			

Q14. Do you drench newly introduced sheep on their arrival to the property? *Please tick one only*

YES	☐	*Go toQ14A below*
Don't buy sheep	☐	*Skip to Q.15*
NO	☐	*Skip to Q.15*

Q14A. Please indicate what drench you typically use for newly introduced sheep.

……..

Q15. How many times did you monitor worm egg counts in each class of sheep in 2003?

	Number of times monitored
Weaners (Less than 12 months)	
Wethers (Older than 12 months)	
Adult ewes (Older than 24 months)	

Q16. Have you ever tested for drench resistance in your flock?

YES ☐ *Go to Q16A below*

NO ☐ *SKIP to Q17.*

Q16A. Please indicate the year of your most recent drench resistance test and the test you used:

Year? …… **Test?** ……

Q17. Please rank how important the following factors are when deciding whether to drench ewes. *Tick one per line*.

	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	☐	☐	☐	☐
Other *(Please specify)*	☐	☐	☐	☐

2004 BENCHMARK SURVEY

iPM-sheep
integrated parasite management

australian wool
another innovation
limited

2004 BENCHMARK SURVEY

Ian Reeve

Lyndall Thompson

REPORT TO IPM-SHEEP

July 2005

CONTENTS

LIST OF APPENDICES

EXECUTIVE SUMMARY

ACKNOWLEDGMENTS

The benchmark survey was funded by Australian Wool Innovations Ltd as part of the IPM-sheep project.

The assistance of the Board of Management of the IPM-sheep project in developing the content of the questionnaires and in designing the analysis approach is greatly appreciated.

We are indebted to the farmers who kindly gave their time to fill in the questionnairess 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 Ruth McGregor.

1 INTRODUCTION

The IPM-sheep (Integrated Parasite Management – sheep) project, funded by Australian Wool Innovations Ltd, is devising and demonstrating integrated parasite control programs for the major sheep parasite areas within Australia. The primary focus of the project is mainstream wool producers with a lesser emphasis on organic producers. The institutions involved are University of New England, Department of Primary Industries, Queensland, Western Australian Department of Agriculture, University of Melbourne and Chr. Hansen group (commercial partner).

Adoption of principles being developed in IPM-sheep across the wool industry will require producers to make incremental, but nevertheless significant, changes in their management approach. Integrated parasite management may involve changes in grazing management, animal husbandry operations and the timing of various management operations. These changes may require producers to entertain a broader range of practices for parasite control than that to which they are accustomed. There may also be production and business risks associated with changes in parasite management which will play an important role in the adoption of integrated parasite management practices and the ultimate success of the project. For these reasons, an understanding of current practices and the views of producers about parasite control are an important aspect of the design of technology transfer programs later in the project. Information for this aspect of the technology transfer is being supplied by the socio-economic component of the IPM-sheep project.

AIMS OF THE SOCIO-ECONOMIC COMPONENT OF IPM-SHEEP

To quantify regional key performance indicators.

To determine regional parasite control practices.

To investigate and solve on-farm and industry barriers to adoption

To achieve the above aims, two benchmark surveys of wool producers are to be conducted, one close to project commencement, and a second one after several years of the project have elapsed. In addition, a program of focus groups and interviews with producers is to be undertaken.

This report presents the findings of the first benchmark survey.

2 METHODS

2.1 Survey

The methods are described in full in Appendix 1. The results presented in this report are based on a random sample of wool producers drawn from a list of levy-payer addresses supplied by Australian Wool Innovations Ltd. The list covers postcode areas in the regions identified 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 pilot tested in a mail out to 300 addresses from this list. On the basis of a satisfactory number of correctly filled out responses received in the first two weeks after mailing, the main survey was proceeded with. A copy of the questionnaire is provided in Appendix 2. This questionnaire was mailed out to 6362 addresses during September 2004, with a reminder and second copy of the questionnaire mailed out to non-responders a month later. A short one-page questionnaire containing a small number of key questions was mailed to remaining non-responders several weeks after the reminder. The survey data to be analysed for this report was taken as all questionnaires received by 10 February 2005. The final response rates are shown in Table 2.1. Further details of the final response rates are provided in 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	33.5	51.3
New England	35.7	56.5
NSW(remainder)	31.0	54.9
VIC	34.3	55.6
SA	37.3	56.5
WA	20.3	42.1
TOTAL	30.4	52.3

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. A brief description of analysis techniques is provided where necessary in the presentation of results in section 3, below. A full description of analysis techniques is given in Appendix 1.

As described in sections A1.8 to A1.10 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 greater numbers of cattle and under-representation of producers who had tested their sheep flock for drench resistance (for a full listing of significant differences between those responding to the full and short surveys, see Tables A1.2 to A1.11 in section A1.8 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 IPM-sheep project 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 sections A1.9 and A1.10 in Appendix 1. Tables with adjusted figures include those relating to:

- total cattle and sheep numbers,
- testing for drench resistance,
- factors considered to be important in deciding when to drench ewes,
- grazing strategies, and
- treatments for blowfly strike.

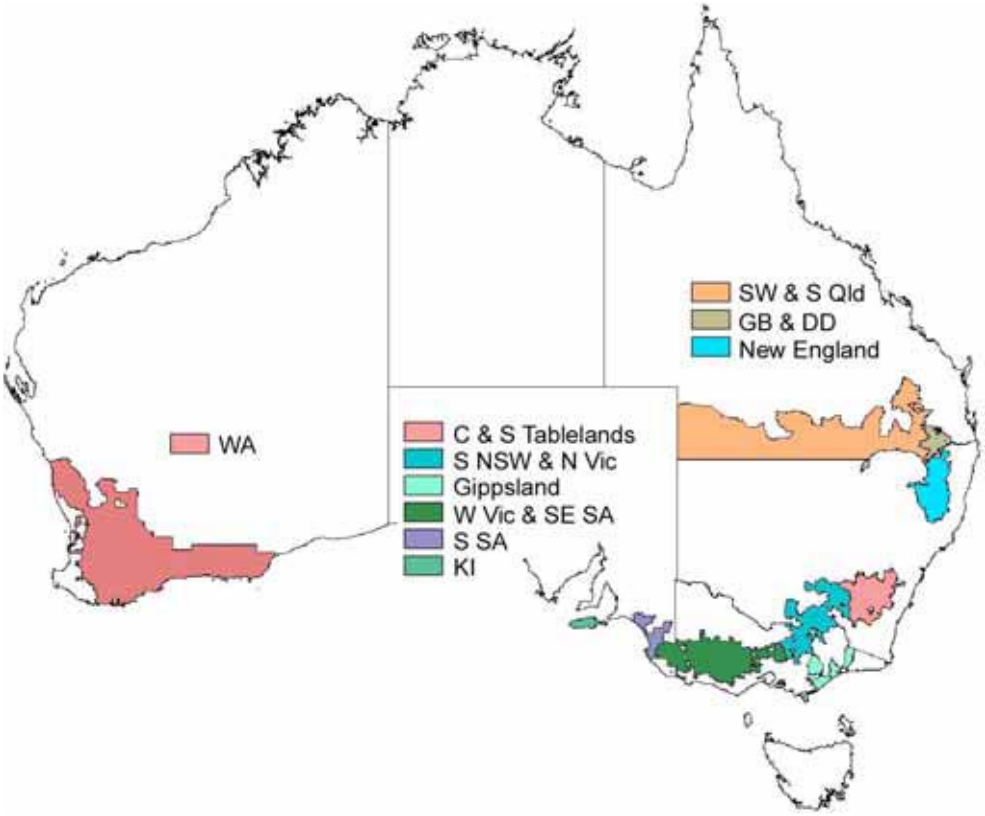
Tables with adjusted figures are noted as such where they occur in the report.

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 postcodes area within these regions is shown in Figure 3.2, below.

Figure 3.1 Regions in which respondents were located.

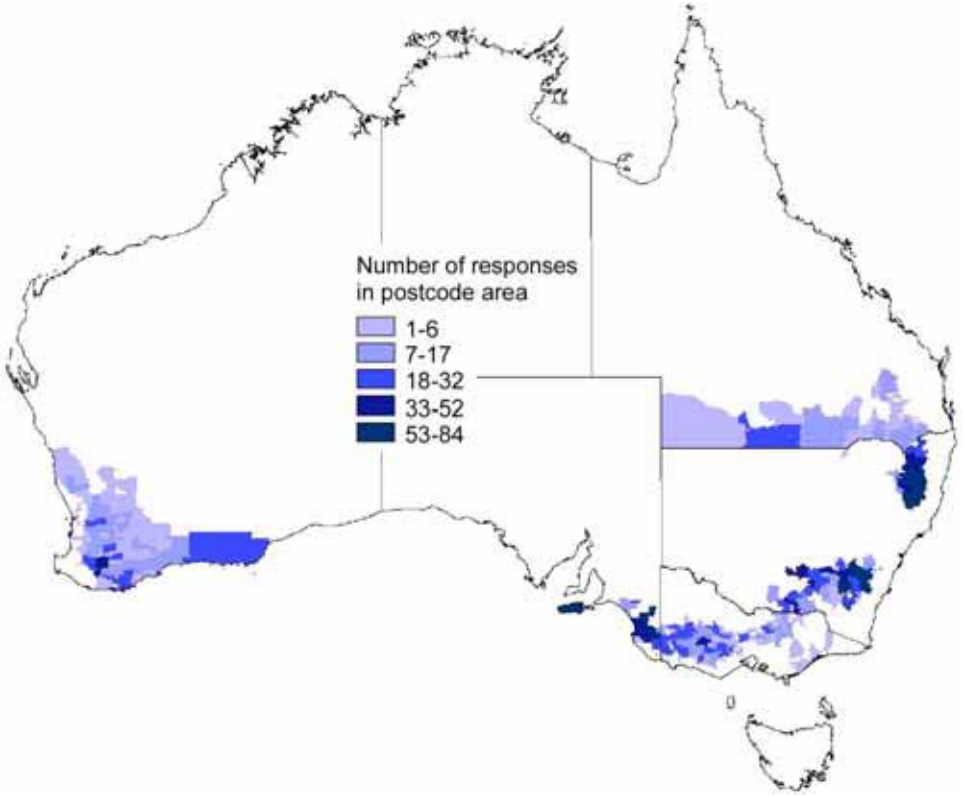


Abbreviation	Region
SW & S Qld	South western and southern Queensland
GB & DD	Queensland Granite Belt and Darling Downs
New England	New England region of New South Wales
C & S Tablelands	Central and southern tablelands of New South Wales
S NSW & N Vic	Southern New South Wales and northern Victoria
Gippsland	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
SW & S Qld	63	40	103
GB & DD	23	8	31
New England	180	105	285
C & S Tablelands	186	133	319
S NSW & N Vic	163	139	302
Gippsland	12	9	21
W Vic & SE SA	389	236	625
S SA	71	39	110
KI	42	13	55
WA	208	235	443
All regions	1337	957	2294

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 two 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.

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 low 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 an analysis of variance to test whether there are significance differences in the mean between regions. Some care should be exercised in interpreting the analysis of variance statistics when the histograms show a strongly bi-modal or skewed distribution, i.e. the tallest bars are at each end, or all up one end (see Appendix A1.11).

A number of questions provided ordinal data, such as ranking of importance of factors used in deciding whether to drench ewes. As the number of categories used in these questions was four or less, which is below the threshold at which ordinal data can be treated as continuous data, the findings are presented as proportions of respondents in each category. The sample size (n) is also provided.

For nominal data, such as type of grazing strategy used, the findings are presented as proportions of respondents in each category, together with the sample size (n).

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 italicised text to the left and right of the proportion. Details of the significance of regional differences, if any, in the table are provided immediately below the table. Significance values are calculated by Monte Carlo simulation when the number of cells with expected frequencies less than 5 exceeds 12.5 per cent of the total number of cells in the table, otherwise significance values are calculated from the chi squared distribution with the number of degrees of freedom shown.

Where there are significant regional differences, individual proportions that are significantly higher than the national average are bolded and underlined, and those that are significantly lower than the national average are bolded.

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.

Respondents who omitted 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 number of usable responses listed on the previous page.

3.2 Respondent age and gender

There were no significant differences between the regions in the age or gender composition of respondents. Across all regions, the mean age of respondents was 51 years, and 95 per cent of respondents were males. Further details of the age and gender composition of respondents are provided in Appendices A2.1 and A2.2.

3.3 Property Details

Respondents were asked to provide a range of details about their property, including the average annual rainfall, the rainfall in 2003, the proportion of their income derived from various sources and the areas under various land uses.

3.3.1 Rainfall

3.3.1.1 Mean annual rainfall in district (mm)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	62	229	508	800	517	35	
GB & DD	20	635	693	750	686	14	
New England	175	620	813	1250	828	13	
C & S Tablelands	183	178	650	1628	637	20	
S NSW & N Vic	160	250	594	950	591	19	
Gippsland	12	600	633	712	640	23	
W Vic & SE SA	382	203	610	914	612	10	
S SA	68	330	488	660	512	22	
KI	42	457	563	825	575	26	
WA	201	203	450	1143	473	20	
All Regions	1305	178	610	1628	611	8	

Histogram class limits: 100-260-420-580-740-900-1060-1220-1380-1540-1700.
Anova: F=117.12, d.f.=9, p<0.0005.

Comparison of 2003 rainfall with average annual rainfall showed that the northern regions had experienced a drier than average year in 2003, while the southern regions had experienced a wetter 2003. For example, half of respondents in south western and southern Queensland had experienced a deficit of over 101mm in 2003 compared to the annual average for their district. The corresponding figure for the Granite Belt and Darling Downs was 132mm. Regions further south in eastern Australia

also suffered deficits in 2003, although not as great as in Queensland. However, many respondents from the southern region of South Australia and from Kangaroo Island reported higher than average rainfalls for 2003. For example, half of Kangaroo Island respondents reported a 21mm or greater increase in rainfall in 2003 compared to their district average. In Western Australia, half of respondents reported more rainfall in 2003 than their district average and half reported less.

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	60	2	72	100	68	7	
GB & DD	21	40	90	100	79	11	
New England	173	18	72	100	71	3	
C & S Tablelands	181	15	80	100	76	3	
S NSW & N Vic	162	0	58	100	59	4	
Gippsland	12	17	95	100	74	20	
W Vic & SE SA	383	10	70	100	70	2	
S SA	70	8	50	100	55	6	
KI	41	20	90	100	79	8	
WA	203	7	55	100	56	4	
All Regions	1306	0	70	100	67	1	

Histogram class limits: 0-10-20-30-40-50-60-70-80-90-100.
Anova: F=13.64, d.f.=9, p<0.0005.

3.3.2.2 Other sources of income

Across all regions, the mean proportion of income derived from beef cattle was 12.5 per cent. The mean proportion of income from beef was significantly different across the regions (anova: F=21.24, d.f.=9, p<0.0005). The highest mean proportion of income from beef was in the New England region, with 24.4 per cent, while the lowest proportion was in Western Australia, with 4.1 per cent.

The mean proportion of income derived from cropping was 17.1 per cent across all regions, and this was also significantly different across the regions (anova: F=38.24, d.f.=9, p<0.0005). The highest mean proportion occurred in Western Australia (36.8 per cent) and the lowest in the New England region (0.9 per cent).

The mean proportion of income derived from sources other than sheep, beef and cropping was 3.5 per cent and there was no significant difference between the regions. Across all regions, 84.0 per cent of respondents had no income derived from sources other than sheep, beef and cropping, while 97.7 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, 58.5 per cent derived income from some other primary production (such as dairying, goats, pigs, grapes, olives), 17.0 per cent worked off-farm and 13.0 per cent derived income from off-farm investment.

3.3.3 *Types of sheep and wool income*

Considering just income from sheep and wool, respondents could be separated using cluster analysis (see Appendix 1.12) 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. These two groups are labelled "Group 1" and "Group 2" in the two tables below.

Income source	Mean percentage of income*		Significance of difference between means (t-test)
	Group 1	Group 2	
Wool sales	26.6	67.8	p<0.0005
Sheep sales (stores, culls and cast for age, boat wethers	20.1	24.9	p<0.0005
First cross ewe sales for breeding	2.2	1.4	n.s.
Meat sheep (1st or 2nd cross prime or store lambs)	61.2	6.0	p<0.0005

** income from each of the categories in the left hand column of the table, as a percentage of total income derived from wool sales, sheep sales, first cross ewe sales and meat sheep.*

Region	n	Proportion of respondents in Groups 1 and 2 (%)					
		Group 1			Group 2		
SW & S Qld	61	5	**13**	22	78	87	95
GB & DD	21	0	10	22	78	91	103
New England	178	11	**17**	22	78	83	89
C & S Tablelands	184	16	22	28	72	78	84
SW NSW & NE Vic	162	34	**42**	50	50	**58**	66
Gippsland	12	1	25	50	51	75	100
W Vic & SE SA	388	31	**36**	41	59	**64**	69
S SA	70	37	**49**	60	40	**51**	63
KI	42	5	17	28	72	83	95
WA	211	11	**16**	20	80	**84**	89
All regions	**1329**	**25**	**28**	**30**	**70**	**73**	**75**

$\chi 2 = 87.332$, d.f. = 9, $p < 0.00005$. 1 cell (5.0%) has expected count less than 5.

As the table above shows, there were significant differences between regions in the proportions of respondents in Group 1 (sheep and wool income mainly from meat sheep) and Group 2 (sheep and wool income mainly from wool sales). South-western New South Wales and north-eastern Victoria, western Victoria and south-eastern South Australia, and southern Australia have relatively more

producers whose sheep and wool income is mainly from meat sheep, while Western Australia has relatively more producers whose sheep and wool income is mainly from wool sales.

3.3.4 Property size and land use

Respondents were asked to provide the areas of their properties under various grazing, cropping and other land uses, as well the total property area. For 52.3 per cent of respondents, the areas under the various grazing, cropping and other land uses were equal to the total property area. For the remainder, there were minor to very large disparities between the sum of areas and the total property areas, due mainly to either the omission of areas or the double counting of part or all of the four land uses: "Area grazed", "Area cropped", "Cropping area grazed as stubble" and "Cropping area grazed as green". The procedures followed to provide the best estimates of land use areas and total property area are described in Appendix 1.7.1.

3.3.4.1 Total area of property (ha)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	62	140	7,285	161,880	18,909	8,027	
GB & DD	22	350	2,410	7,285	2,861	860	
New England	178	51	874	5,261	1,119	138	
C & S Tablelands	183	86	700	8,903	987	159	
S NSW & N Vic	161	108	760	40,470	1,365	552	
Gippsland	12	255	443	3,830	1,051	714	
W Vic & SE SA	385	72	660	64,752	1,210	367	
S SA	71	123	1,200	9,308	1,547	333	
KI	41	62	672	2,752	692	151	
WA	207	95	1,578	11,900	2,030	238	
All Regions	1322	51	867	161,880	2,172	440	

Histogram class limits: 0-610-1220-1830-2440-3050-3660-4270-4880-5490-6100
Anova: F=38.74, d.f.=9, p<0.0005.
***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.*

3.3.4.2 Proportion of total property area grazed (incl. cropping areas grazed (%)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	61	64	100	100	95	61	
GB & DD	21	85	100	100	96	21	
New England	178	40	100	100	97	178	
C & S Tablelands	183	33	100	100	92	183	
S NSW & N Vic	161	10	96	100	86	161	
Gippsland	12	50	92	100	87	12	
W Vic & SE SA	384	15	100	100	90	384	
S SA	71	37	96	100	89	71	
KI	41	56	89	100	85	41	
WA	207	18	90	100	83	207	
All Regions	1319	10	100	100	90	1319	

Histogram class limits:10-19-28-37-46-55-64-73-82-91-100
Anova: F=11.59, d.f.=9, p<0.0005.

3.3.4.3 Proportion of total property area cropped (%)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	61	0	0	40	6	3	
GB & DD	21	0	0	18	3	3	
New England	178	0	0	98	3	2	
C & S Tablelands	183	0	5	75	14	3	
S NSW & N Vic	161	0	24	100	28	4	
Gippsland	12	0	0	49	8	10	
W Vic & SE SA	384	0	7	89	16	2	
S SA	71	0	8	89	21	6	
KI	41	0	7	58	12	5	
WA	207	0	32	96	33	3	
All Regions	1319	0	7	100	17	1	

Histogram class limits: 0-10-20-30-40-50-60-70-80-90-100.
Anova: F=36.39, d.f.=9, p<0.0005.

3.3.4.4 Proportion of cropping area grazed as stubble (%)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	20	0	0	100	35	20	
GB & DD	7	0	0	100	21	36	
New England	56	0	0	100	11	8	
C & S Tablelands	108	0	46	100	48	9	
S NSW & N Vic	125	0	50	100	50	8	
Gippsland	6	0	0	0	0	0	
W Vic & SE SA	231	0	33	100	47	6	
S SA	45	0	62	100	56	14	
KI	27	0	18	100	40	18	
WA	186	0	100	100	68	6	
All Regions	811	0	50	100	50	3	

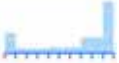
Histogram class limits: 0-10-20-30-40-50-60-70-80-90-100.
Anova: F=9.91, d.g.=9, p<0.0005.

3.3.4.5 Proportion of cropping area grazed as green (%)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	20	0	13	100	25	17	
GB & DD	7	0	16	100	28	34	
New England	56	0	100	100	59	13	
C & S Tablelands	108	0	0	100	22	7	
S NSW & N Vic	125	0	0	67	6	2	
Gippsland	6	0	25	100	42	52	
W Vic & SE SA	231	0	0	100	13	4	
S SA	45	0	0	100	8	7	
KI	27	0	0	0	0	0	
WA	186	0	0	100	6	3	
All Regions	811	0	0	100	15	2	

Histogram class limits: 0-10-20-30-40-50-60-70-80-90-100.
Anova: F=21.85, d.g.=9, p<0.0005.

3.3.4.6 Proportion of pastures improved (%)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	62	0	4	100	25	9	
GB & DD	22	0	0	100	11	11	
New England	179	0	60	100	54	5	
C & S Tablelands	185	0	80	100	69	5	
S NSW & N Vic	162	0	85	100	71	5	
Gippsland	12	20	68	100	66	20	
W Vic & SE SA	386	0	90	100	76	3	
S SA	71	0	90	100	78	7	
KI	42	0	100	100	82	10	
WA	207	0	95	100	75	5	
All Regions	1328	0	80	100	68	2	

Histogram class limits: 0-10-20-30-40-50-60-70-80-90-100.
Anova: F=8.80, d.g.=9, p=0.0005.

3.3.4.7 Number of paddocks

Almost one fifth of respondents (18.1 per cent) did not provide the number of paddocks in their response to Question 4. Using the information provided by the remainder, the number of paddocks and its distribution is not substantively different between the regions (although it is still statistically significant: F=3.30, d.f.=9, p=0.001). The mean number of paddocks ranged from 20 in the Granite Belt and Darling Downs to 39 in South Australia, with a national mean of 30. In all regions, the great majority of respondents had less than 36 paddocks.

3.3.4.8 Average paddock size (ha)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	55	19	283	5153	773	284	
GB & DD	16	29	173	438	173	63	
New England	148	6	33	111	37	4	
C & S Tablelands	150	6	28	144	33	3	
S NSW & N Vic	131	7	31	1349	50	21	
Gippsland	12	9	29	157	47	30	
W Vic & SE SA	320	5	27	1294	44	11	
S SA	60	5	35	354	44	12	
KI	32	9	24	61	27	5	
WA	169	5	59	231	66	6	
All Regions	1093	5	33	5153	84	17	

Histogram class limits: 0-46-92-138-184-230-276-322-368-414-460.
Anova: F=50.98, d.g.=9, p<0.0005.
***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.*

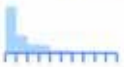
3.3.5 Cattle

3.3.5.1 Proportion of respondents with cattle in a typical year

Region	n	Proportion with cattle (%)		
SW & S Qld	102	79	**86**	92
GB & DD	30	57	73	89
New England	280	85	**89**	92
C & S Tablelands	313	47	53	58
SW NSW & NE Vic	312	47	52	58
Gippsland	21	44	65	85
W Vic & SE SA	600	51	55	59
S SA	110	56	65	74
KI	53	33	47	60
WA	444	19	**23**	27
All regions	2265	51	53	55

$\chi 2 = 360.66$, d.f. = 9, $p < 0.00005$.
Note: percentages are adjusted for non-response bias as described in Appendix A1.10.

3.3.5.2 Cattle DSEs in a typical year

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	54	180	3203	18400	4395	1184	
GB & DD	12	48	1427	8236	2313	1634	
New England	152	19	2096	32210	2926	573	
C & S Tablelands	91	42	946	17650	1916	614	
S NSW & N Vic	90	24	1102	11032	1956	483	
Gippsland	7	131	359	9055	1775	3012	
W Vic & SE SA	215	12	1437	43300	2443	522	
S SA	43	259	1924	8790	2692	698	
KI	19	206	770	2866	1029	423	
WA	43	24	1750	14450	2412	866	
All Regions	726	12	1449	43300	2530	249	

Histogram class limits: 0-1000-2000-3000-4000-5000-6000-7000-8000-9000-10000.
Anova: F=3.20, d.f.=9, p=0.001.
***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.*

3.3.5.3 2003 compared to a typical year

Respondents with cattle who were carrying the same number of cattle DSEs in 2003 as in a typical year comprised 47.5 per cent of the sample. Those who were carrying less cattle in 2003 than in a typical year comprised 37.9 per cent of the sample, while the remaining 14.6 per cent of respondents were carrying more cattle DSEs in 2003, compared to a typical year.

There was a significant different between the regions in the proportions of respondents who were carrying more, less or the same cattle DSEs in 2003, compared to a typical year ($\chi 2$=66.63, d.f.=18, p<0.0005). Across the southern Australian regions, over 50 per cent of respondents were carrying the same number of cattle DSEs as in a typical year, with as many as 30 per cent carrying more in 2003 than in a typical year. The proportion who were carrying the same number of cattle DSEs declined northwards, to 25 per cent in the Granite Belt and Darling Downs. In south western and southern Queensland, 57 per cent of respondents were carrying fewer cattle DSEs in 2003 than in a typical year. Further details are provided in Appendix A2.3.

3.3.5.4 Calving

There were significant differences between the regions in the length of the calving period for cows (anova: F=4.89, d.f.=9, p<0.0005), with relatively longer mean calving periods around four months in duration in south western and southern Queensland, Granite Belt and Darling Downs, and southern South Australia. The mean length of calving period in the other regions was around 2.5 months. The mean length of calving period for heifers across all regions was 2.3 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 A2.4 – A2.5.

Time of calving tended to be later in the calendar year in northern regions – around August to October – and earlier in the southern regions – around March to April. Further details on the time of calving are provided in Appendix A2.6 – A2.7.

3.3.6 Sheep

3.3.6.1 Sheep DSEs in a typical year

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	63	600	6000	72585	8773	2747	
GB & DD	24	500	3234	8846	3373	941	
New England	180	50	3553	28670	4845	646	
C & S Tablelands	186	22	2971	50750	4794	890	
S NSW & N Vic	172	0	2596	21687	3464	491	
Gippsland	12	1193	2728	17570	4564	3152	
W Vic & SE SA	378	420	3068	39200	4288	408	
S SA	71	680	2630	16240	4078	871	
KI	42	625	3750	15820	4170	955	
WA	209	300	4405	53150	5798	782	
All Regions	1337	0	3284	72585	4746	279	

Histogram class limits: 0-2000-4000-6000-8000-10000-12000-14000-16000-18000-20000.
Anova: F=7.33, d.f.=9, p<0.0005.
***Note**: respondents with average sheep DSEs of 20,000 and over (21) 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.*

3.3.6.2 2003 compared to a typical year

The figures for all regions and the regional pattern of differences between sheep DSEs in 2003 and in a typical year was very similar to that for cattle. Across all regions, 47.5 per cent of respondents carried the same number of sheep DSEs in 2003 as they did in a typical year, while 38.5 per cent carried less and 14.0 per cent carried more. The proportion of respondents carrying less DSEs in 2003 than in a typical year increased from 20-30 per cent in southern Australia to 70 per cent in south western and southern Queensland. Further details are provided in Appendix A2.8.

3.3.6.3 Flock composition in a typical year – ewes as a proportion of the total flock

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	63	0	46	100	44	7	
GB & DD	24	0	1	99	18	12	
New England	180	0	44	100	45	3	
C & S Tablelands	186	0	49	100	54	4	
S NSW & N Vic	171	0	52	100	57	4	
Gippsland	12	28	42	98	55	17	
W Vic & SE SA	378	0	50	100	56	3	
S SA	71	0	62	100	65	5	
KI	42	29	51	99	53	5	
WA	209	0	53	100	55	2	
All Regions	1336	0	50	100	53	1	

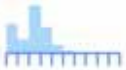
Histogram class limits: 0-10-20-30-40-50-60-70-80-90-100.
Anova: F=12.40, d.f.=9, p<0.0005.

3.3.6.4 Flock composition in a typical year – wethers as a proportion of the total flock

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	63	0	23	100	32	9	
GB & DD	24	0	99	100	75	15	
New England	180	0	27	100	27	3	
C & S Tablelands	186	0	21	100	22	3	
S NSW & N Vic	171	0	0	100	16	3	
Gippsland	12	0	31	47	25	11	
W Vic & SE SA	378	0	17	100	21	3	
S SA	71	0	0	100	8	4	
KI	42	0	24	49	23	4	
WA	209	0	8	100	12	2	
All Regions	1336	0	16	100	21	1	

Histogram class limits: 0-10-20-30-40-50-60-70-80-90-100.
Anova: F=24.96, d.f.=9, p<0.0005.

3.3.6.5 Flock composition in a typical year – weaners as a proportion of the total flock

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	63	0	22	100	23	5	
GB & DD	24	0	0	39	6	5	
New England	180	0	26	100	26	2	
C & S Tablelands	186	0	25	100	23	2	
S NSW & N Vic	171	0	26	100	26	3	
Gippsland	12	0	22	33	19	8	
W Vic & SE SA	378	0	23	100	22	2	
S SA	71	0	25	54	26	4	
KI	42	0	23	50	23	3	
WA	209	0	33	89	31	2	
All Regions	1336	0	25	100	25	1	

Histogram class limits: 0-10-20-30-40-50-60-70-80-90-100.
Anova: F=8.55, d.f.=9, p<0.0005.

3.4 Wool Cut and Fibre Diameter

3.4.1.1 Adult breeding ewe wool cut and fibre diameter by breed – all regions

	Merino	Merino crosses	Dual purpose breeds	Meat breed	Data given for several breeds
n	668	78	17	5	44
Average cut per head - kg	5.03	4.52	5.26	3.90	4.48
n	766	72	23	5	50
Average fibre diameter - µ	19.92	28.35	26.64	28.60	26.02

Cut per head - anova: F=6.22, d.f.=4, p<0.0005; fibre diameter – anova: F=424.96, d.f.=4, p<0.0005.

3.4.1.2 Sheep other than ewes

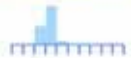
For wethers and weaners, there were insufficient data supplied by respondents to warrant reporting wool cut and fibre diameters for any breed other than Merino. Across all regions, Merino dry ewes and wethers averaged 5.28kg per head wool cut and 19.64µ fibre diameter. The corresponding figures for Merino weaners were 2.62kg per head wool cut and 18.14µ fibre diameter.

3.4.1.3 Wool cut (kg/head), 2003 clip, adult sheep (breeding ewes, dry ewes and wethers) by region

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	47	2.5	4.6	7.0	4.8	0.3	
GB & DD	17	3.0	4.0	7.0	4.3	0.5	
New England	130	2.3	4.2	8.0	4.3	0.2	
C & S Tablelands	137	2.7	4.8	9.0	5.0	0.2	
S NSW & N Vic	129	2.0	5.0	8.5	5.3	0.2	
Gippsland	8	3.3	5.6	7.4	5.2	1.1	
W Vic & SE SA	286	2.3	5.0	9.3	5.2	0.1	
S SA	58	2.8	6.0	8.0	5.9	0.3	
KI	28	3.0	5.6	7.4	5.6	0.4	
WA	151	3.0	5.2	7.5	5.3	0.1	
All Regions	991	2.0	5.0	9.3	5.1	0.1	

Histogram class limits: 2.00-2.73-3.46-4.19-4.92-5.65-6.38-7.11-7.84-8.57-9.30.
Anova: F=15.42, d.f.=9, p<0.0005.

3.4.1.4 Fibre diameter (μ), 2003 clip, adult sheep (breeding ewes, dry ewes and wethers) by region

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	51	15.1	20.4	32.0	20.5	0.6	
GB & DD	17	16.4	18.0	27.0	18.9	1.3	
New England	151	15.5	18.4	35.0	19.0	0.4	
C & S Tablelands	142	16.7	19.4	32.0	20.5	0.6	
S NSW & N Vic	140	15.6	20.6	31.5	21.8	0.6	
Gippsland	10	17.6	20.0	29.0	22.0	3.1	
W Vic & SE SA	322	16.5	20.5	33.0	21.9	0.4	
S SA	64	18.5	22.2	30.0	22.8	0.7	
KI	30	20.0	21.9	23.8	21.8	0.3	
WA	174	17.5	20.6	23.2	20.6	0.2	
All Regions	1101	15.1	20.2	35.0	21.0	0.2	

Histogram class limits: 15-17-19-21-23-25-27-29-31-33-35.
Anova: F=15.52, d.f.=9, p<0.0005.

Separate figures for wool cut and fibre diameter for breeding ewes, dry ewes and wethers, and weaners are provided in Appendix A2.9-A2.14

3.5 Animal Husbandry (Other Than Parasite Management)

3.5.1 Shearing and crutching

3.5.1.1 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
SW & S Qld	53		52	
GB & DD	13		14	
New England	171		169	
C & S Tablelands	176		173	
S NSW & N Vic	158		160	
Gippsland	12		12	
W Vic & SE SA	352		347	
S SA	69		69	
KI	38		39	
WA	197		186	
All Regions	1239		1221	

Figures for the histograms above are provided in Appendix A2.15.

3.5.1.2 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
SW & S Qld	48		44	
GB & DD	20		20	
New England	148		136	
C & S Tablelands	131		129	
S NSW & N Vic	88		87	
Gippsland	9		9	
W Vic & SE SA	253		245	
S SA	38		36	
KI	34		33	
WA	141		130	
All Regions	910		869	

Figures for the histograms above are provided in Appendix A2.16.

3.5.1.3 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
SW & S Qld	50		43	
GB & DD	6		4	
New England	147		145	
C & S Tablelands	144		126	
S NSW & N Vic	120		103	
Gippsland	9		9	
W Vic & SE SA	270		236	
S SA	52		38	
KI	37		29	
WA	181		118	
All Regions	1016		851	

Figures for the histograms above are provided in Appendix A2.17.

3.5.2 *Breeding program*

3.5.2.1 Proportion of respondents putting rams with ewes each month of the year in 2003

Region	Merino ewes mated to Merino rams	Merino ewes mated to meat breed rams	Cross-bred ewes
SW & S Qld			
GB & DD			
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 A2.18.

3.5.2.2 Number of weeks Merino rams left with Merino ewes

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	42	6.0	8.1	16.0	9.4	0.8	
GB & DD	7	6.0	6.0	10.0	7.1	1.5	
New England	151	3.0	6.0	20.0	6.9	0.4	
C & S Tablelands	134	1.4	6.0	20.0	7.3	0.5	
S NSW & N Vic	99	1.1	7.0	20.0	8.0	0.7	
Gippsland	8	5.0	6.3	13.0	7.0	2.1	
W Vic & SE SA	230	2.0	7.0	28.0	7.8	0.5	
S SA	47	5.0	8.0	32.0	9.2	1.3	
KI	35	5.0	7.0	28.0	8.4	1.5	
WA	189	1.4	7.0	52.1	7.9	0.6	
All Regions	942	1.1	7.0	52.1	7.8	0.2	

Histogram class limits: 1.0-3.1-5.2-7.3-9.4-11.5-13.6-15.7-17.8-19.9-22.0
Anova: F=3.52, d.f.=9, p<0.0005.
***Note**: respondents who left rams with ewes from six months or more (6) have been excluded from the histograms (and **only** from the histograms) to prevent the distribution being reduced to a single bar, due to the influence of the small number of relatively long time periods.*

3.5.2.3 Number of weeks meat breed rams left with Merino ewes

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	12	6.0	8.0	12.9	8.7	1.4	
GB & DD	4	6.0	8.3	12.0	8.6	4.0	
New England	46	5.0	6.5	16.0	7.7	0.9	
C & S Tablelands	65	1.4	7.0	21.7	8.3	0.9	
S NSW & N Vic	70	5.0	8.0	28.0	9.6	1.0	
Gippsland	4	5.7	6.3	20.0	9.6	11.1	
W Vic & SE SA	174	2.0	8.0	52.1	8.9	0.7	
S SA	45	6.0	8.0	32.0	10.0	1.4	
KI	26	5.0	8.0	32.0	10.1	2.6	
WA	93	4.6	8.0	52.1	9.3	1.5	
All Regions	539	1.4	8.0	52.1	9.0	0.4	

Histogram class limits: 1.0-3.1-5.2-7.3-9.4-11.5-13.6-15.7-17.8-19.9-22.0
Anova: F=0.96, d.f.=9, p=0.476.
***Note**: respondents who left rams with ewes from six months or more (10) have been excluded from the histograms (and **only** from the histograms) to prevent the distribution being reduced to a single bar, due to the influence of the small number of relatively long time periods.*

3.5.2.4 Number of weeks rams left with Cross-bred ewes

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	4	4.0	10.0	12.9	9.2	6.5	
GB & DD							
New England	36	5.0	8.0	16.0	8.6	1.0	
C & S Tablelands	43	1.4	8.0	20.0	9.9	1.4	
S NSW & N Vic	50	5.0	10.0	30.3	12.0	1.8	
Gippsland	5	6.0	8.0	26.0	11.4	10.3	
W Vic & SE SA	140	1.1	8.0	26.0	10.0	0.7	
S SA	20	5.0	10.0	20.0	10.6	1.9	
KI	9	5.0	10.0	26.1	11.7	5.5	
WA	13	4.6	8.0	52.1	16.0	10.2	
All Regions	320	1.1	8.0	52.1	10.5	0.6	

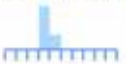
Histogram class limits: 1.0-3.5-6-8.5-11-13.5-16-18.5-21-23.5-26.0
Anova: F=2.78, d.f.=9, p=0.006.
***Note**: respondents who left rams with ewes from six months or more (9) have been excluded from the histograms (and **only** from the histograms) to prevent the distribution being reduced to a single bar, due to the influence of the small number of relatively long time periods.*

3.5.2.5 Typical marking percentage – Merino ewes mated to Merino rams

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	40	65	89	115	87	4	
GB & DD	5	75	80	90	81	7	
New England	139	40	85	110	86	2	
C & S Tablelands	118	60	85	110	83	2	
S NSW & N Vic	90	65	85	108	86	2	
Gippsland	7	70	80	100	84	9	
W Vic & SE SA	201	60	85	120	85	1	
S SA	41	70	93	120	92	4	
KI	28	50	84	100	82	5	
WA	168	60	85	120	86	1	
All Regions	837	40	85	120	86	1	

Histogram class limits: 40-48-56-64-72-80-88-96-104-112-120.
Anova: F=3.72, d.f.=9, p<0.0005.

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

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	8	80	93	100	92	6	
GB & DD	4	80	80	85	81	4	
New England	41	60	92	110	92	3	
C & S Tablelands	53	60	90	110	90	3	
S NSW & N Vic	59	60	90	115	90	3	
Gippsland	3	90	90	110	97	29	
W Vic & SE SA	145	65	90	120	91	2	
S SA	37	70	100	120	98	4	
KI	22	65	90	120	89	6	
WA	76	60	90	110	88	2	
All Regions	448	60	90	120	91	1	

Histogram class limits: 60-66-72-78-84-90-96-102-108-114-120.
Anova: F=3.04, d.f.=9, p=0.002.

3.5.2.7 Typical marking percentage – Cross-bred ewes

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	2	90	93	95	93	32	
GB & DD							
New England	31	90	130	145	123	6	
C & S Tablelands	39	70	110	145	108	5	
S NSW & N Vic	43	75	100	130	107	4	
Gippsland	5	98	120	120	115	12	
W Vic & SE SA	121	80	118	150	116	3	
S SA	16	90	123	150	119	9	
KI	6	85	108	180	115	37	
WA	8	80	100	140	104	20	
All Regions	271	70	115	180	114	2	

Histogram class limits: 70-81-92-103-114-125-136-147-158-169-180.
Anova: F=3.76, d.f.=9, p<0.0005.

3.5.2.8 Marking percentages in 2003 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, there were more respondents reporting lower marking percentages in 2003 compared to a typical year, than respondents who reported either the same marking percentage in 2003, or a higher percentage in 2003. For Merino ewes mated to Merino rams, there were sufficient responses in each of the regions to indicate a significant difference between the regions, with greater proportions of respondents in some Queensland and New South Wales regions experiencing lower marking percentages in 2003 and lower proportions of respondents in Western Australia experiencing lower marking percentages.

Detailed figures on the differences between 2003 marking percentages and those for a typical year are given in Appendix A2.19.

3.5.3 Supplementary Feeding

3.5.3.1 Proportion of respondents who use supplementary feeds

Region	n	Proportion using feeds (%)		
SW & S Qld	57	34	**47**	60
GB & DD	16	32	56	81
New England	171	67	74	80
C & S Tablelands	179	75	81	87
SW NSW & NE Vic	169	83	88	93
Gippsland	12	40	67	93
W Vic & SE SA	369	75	79	84
S SA	69	62	72	83
KI	41	68	80	93
WA	204	93	**96**	99
All regions	1287	78	80	83

$\chi 2$ =92.16, d.f. = 9, $p < 0.00005$. 2 cells (10.0%) have expected counts less than 5.

3.5.3.2 Feed types in supplementary feeding of ewes

Region	n*	Proportion of feeds mentioned in categories below (%)						
		Barley, oats, wheat, triticale, corn	Lupins, beans, lentils, peas	Cottonseed, cottonseed meal	Straw, hay, silage, forage	Pellets, nuts	Bypass meal	Blocks, licks
SW & S Qld	34	15	3	18	3	0	9	53
GB & DD	14	14	0	14	0	21	0	50
New England	200	25	22	2	3	16	4	30
C & S Tablelands	237	50	13	0	12	10	0	14
S NSW & N Vic	269	57	10	0	16	3	0	13
Gippsland	8	63	0	0	13	25	0	0
W Vic & SE SA	501	49	14	0	23	2	0	12
S SA	71	20	38	0	34	0	0	8
KI	62	47	24	0	27	0	0	2
WA	376	39	35	0	18	1	0	7
All Regions	1772	43	20	1	17	5	1	14

** n in this table is the number of feed types mentioned by respondents. Respondents were able to indicate more than one feed type. For example, pellets and nuts comprised 5 per cent of the feed types mentioned across all regions.*

3.5.3.3 Feed types in supplementary feeding of weaners

Region	n*	Proportion of feeds mentioned in categories below (%)						
		Barley, oats, wheat, triticale, corn	Lupins, beans, lentils, peas	Cottonseed, cottonseed meal	Straw, hay, silage, forage	Pellets, nuts	Bypass meal	Blocks, licks
SW & S Qld	18	17	17	17	6	6	0	39
GB & DD	9	11	0	11	0	33	0	44
New England	134	28	18	1	5	15	6	26
C & S Tablelands	188	47	23	0	16	7	1	5
S NSW & N Vic	197	51	19	1	19	2	0	9
Gippsland	13	46	8	0	23	15	0	8
W Vic & SE SA	392	45	17	1	26	2	0	9
S SA	46	26	35	0	30	0	0	9
KI	62	40	31	0	27	0	2	0
WA	335	36	37	0	18	2	0	7
All Regions	1394	41	24	1	19	4	1	10

** n in this table is the number of feed types mentioned by respondents. Respondents were able to indicate more than one feed type. For example, pellets and nuts comprised 4 per cent of the feeds mentioned across all regions.*

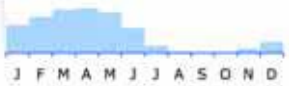
3.5.3.4 Duration of supplementary feeding

The duration of the period over which ewes received supplementary feeding varied from one month to 12 months, with a mean of five months across all regions. The mean duration of the supplementary feeding period ranged from four months in south western and southern Queensland, in New England, in southern South Australia and Kangaroo Island, to six months in Gippsland.

The figures for the supplementary feeding of weaners were very similar, with the same range of durations, and mean duration, as for the feeding of ewes. The differences in the mean duration between regions were also very similar to those for the feeding of ewes.

Further details on the duration of supplementary feeding for ewes and weaners are in Appendix A2.21.

3.5.3.5 Proportion of respondents feeding ewes and weaners in each month of the year

Region	n	Proportion of respondents feeding ewes	n	Proportion of respondents feeding weaners
SW & S Qld	20		12	
GB & DD	8		5	
New England	112		70	
C & S Tablelands	124		104	
S NSW & N Vic	133		95	
Gippsland	5		6	
W Vic & SE SA	252		187	
S SA	43		20	
KI	32		27	
WA	190		163	
All Regions	919		689	

Figures for the histograms above are provided in Appendix A2.20.

3.6 Grazing Management

3.6.1 Grazing strategies used in 2003

Region	n	Proportion with grazing strategy below (%)						
		Set stocked	Set stocked at lambing only	Alternating between sheep and cattle	Alternating between sheep and crop stubble	Alternating between sheep and forage crop	Cell grazing	Rotational grazing
SW & S Qld	94	52	17	42	16	15	4	41
GB & DD	30	70	10	45	1	10	10	18
New England	281	57	33	32	3	8	11	33
C & S Tablelands	310	54	30	18	34	11	4	38
S NSW & N Vic	294	39	40	26	47	11	3	44
Gippsland	21	48	41	33	10	2	10	39
W Vic & SE SA	615	55	31	23	31	11	6	40
S SA	110	17	46	27	31	5	4	71
KI	55	44	49	23	39	0	4	40
WA	435	41	26	7	60	6	6	30
All Regions	2245	48	31	22	36	9	6	38

Note 1: percentages may sum to more than 100 as respondents could give more than one strategy.
Note 2: percentages are adjusted for non-response bias as described in Appendix 1.10.

3.6.2 Key objectives in using grazing strategies

Region	n	Proportion with key objective below (%							
		Parasite control	Pasture mgt	Animal mgt	Sustain-ability	Ease	Use of crops and stubbles	Maximise or increase productivity or production	Other
SW & S Qld	55	27	31	27	7	7	4	5	35
GB & DD	19	16	47	21	5	16	0	11	21
New England	146	36	47	33	5	13	1	9	17
C & S Tablelands	150	21	47	44	2	13	7	3	15
S NSW & N Vic	129	18	38	46	2	11	15	8	18
Gippsland	8	38	38	63	0	13	0	0	13
W Vic & SE SA	307	21	40	37	2	14	5	5	19
S SA	63	32	35	35	0	13	27	5	13
KI	36	22	44	31	3	19	0	11	14
WA	159	14	48	36	3	13	15	11	17
All Regions	1072	23	42	37	3	13	8	7	18

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

3.7 Worm Control

3.7.1 Number, timing and type of treatment – September 2002 to December 2003

3.7.1.1 Unweaned lambs

Region	n*	Prop'n treating unweaned lambs (%)	Mean number of times treated	Prop'n using capsules (%)**	Month with highest prop'n of treatments**	Prop'n which were the most popular product - ML Moxidectin (%)**
SW & S Qld	45	36	1.2	0	Dec	29
GB & DD	24	29	1.4	0	Feb	25
New England	166	65	1.4	0.7	Dec	29
C & S Tablelands	181	45	1.3	0	Oct	24
S NSW & N Vic	157	34	1.2	0	Jul, Sep	21
Gippsland	11	46	1.3	0	Aug	17
W Vic & SE SA	360	40	1.3	0	Sep	37
S SA	70	30	1.2	0	Jul	30
KI	39	51	1.3	0	Jul	80
WA	194	16	1.3	2.6	Aug, Sep	29
All Regions	1247	39	1.3	0.3	Sep	32

Chi-squared test for proportion treating unweaned lambs: $\chi 2=101.27$, d.f.=9, $p<0.0005$.
Kruskal-Wallis test for number of times treated: $\chi 2=6.83$, d.f.=9, $p=0.655$
** the sample size given is for the proportion treating unweaned lambs. For the remaining figures in the table, the sample size will be equal to the sample size given, multiplied by the proportion treating unweaned lambs.*
*** proportion of treatments.*

Further details for the treatments for worm control in unweaned lambs are provided in Appendix A2.22.1 and Appendix A2.22.3.

3.7.1.2 Weaners

Region	n*	Prop'n treating weaners (%)	Mean number of times treated	Prop'n using capsules (%)**	Month with highest prop'n of treatments**	Prop'n which were the most popular product - ML Moxidectin (%)**
SW & S Qld	45	73	1.9	0	Feb	39
GB & DD	24	38	2.9	0	Aug	42
New England	166	90	2.9	2.8	Apr	32
C & S Tablelands	181	86	2.3	2.3	Dec	27
S NSW & N Vic	157	83	2.1	3.3	Nov	29
Gippsland	11	91	2.4	4.0	Nov	27
W Vic & SE SA	360	82	2.2	4.2	Dec	36
S SA	70	79	1.8	3.9	Jul, Sep, Nov	41
KI	39	87	2.4	2.4	Feb, Sep	63
WA	194	94	1.6	1.1	Dec	24
All Regions	1247	84	2.2	2.9	Dec	33

Chi-squared test for proportion treating weaners: $\chi 2=67.33$, d.f.=9, $p<0.0005$.
Kruskal-Wallis test for number of times treated: $\chi 2=128.14$, d.f.=9, $p<0.0005$
** the sample size given is for the proportion treating weaners. For the remaining figures in the table, the sample size will be equal to the sample size given, multiplied by the proportion treating weaners.*
*** proportion of treatments.*

Further details for the treatments for worm control in weaners are provided in Appendix A2.22.2 and Appendix A2.22.4.

3.7.1.3 Maiden ewes

Region	n*	Prop'n treating maiden ewes (%)	Mean number of times treated	Prop'n using capsules (%)**	Month with highest prop'n of treatments**	Prop'n which were the most popular product - ML Moxidectin (%)**
SW & S Qld	45	53	2.2	0	Feb, Nov	43
GB & DD	24	29	3.2	0	Aug	39
New England	166	78	2.9	2.3	Sep	27
C & S Tablelands	181	75	2.4	2.6	Nov	26
S NSW & N Vic	157	69	1.9	4.8	Nov	25
Gippsland	11	64	2.6	0	Nov	24
W Vic & SE SA	360	72	2.1	4.1	Dec	40
S SA	70	73	1.6	4.8	Dec	33
KI	39	87	2.2	1.3	Jan	64
WA	194	77	1.4	1.9	Dec	23
All Regions	1247	73	2.1	3.1	Dec	32

Chi-squared test for proportion treating maiden lambs: $\chi 2=41.93$, d.f.=9, $p<0.0005$.
Kruskal-Wallis test for number of times treated: $\chi 2=198.15$, d.f.=9, $p<0.0005$.
** the sample size given is for the proportion treating maiden ewes. 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.*
*** proportion of treatments.*

Further details for the treatments for worm control in maiden ewes are provided in Appendix A2.22.1 and Appendix A2.22.3.

3.7.1.4 Adult ewes

Region	n*	Prop'n treating adult ewes (%)	Mean number of times treated	Prop'n using capsules (%)**	Month with highest prop'n of treatments**	Prop'n which were the most popular product - ML Moxidectin (%)**
SW & S Qld	45	76	2.3	0	Dec	44
GB & DD	24	50	3.0	0	Aug	39
New England	166	92	3.2	2.2	Sep	27
C & S Tablelands	181	91	2.4	3.0	Dec	27
S NSW & N Vic	157	89	1.9	3.5	Nov	25
Gippsland	11	100	2.6	0	Nov	27
W Vic & SE SA	360	91	2.2	4.9	Dec	41
S SA	70	96	1.7	5.1	Jan	32
KI	39	97	2.3	1.1	Jan	64
WA	194	85	1.4	0	Dec	23
All Regions	1247	89	2.2	3.0	Dec	33

Chi-squared test for proportion treating adult ewes: $\chi 2=61.73$, d.f.=9, $p<0.0005$. 4 cells (20.0%) have expected counts less than 5.
Kruskal-Wallis test for number of times treated: $\chi 2=249.81$, d.f.=9, $p<0.0005$
** the sample size given is for the proportion treating adult ewes. 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.*

Further details for the treatments for worm control in adult ewes are provided in Appendix A2.22.6 and Appendix A2.22.8.

3.7.1.5 Wethers

Region	n*	Prop'n treating wethers (%)	Mean number of times treated	Prop'n using capsules (%)**	Month with highest prop'n of treatments**	Prop'n which were the most popular product - ML Moxidectin (%)**
SW & S Qld	45	62	2.0	0	Feb	50
GB & DD	24	88	3.0	0	Jan, Mar, Aug, Sep, Nov	33
New England	166	74	2.6	0.3	Sep	25
C & S Tablelands	181	66	2.0	0.4	Dec	27
S NSW & N Vic	157	47	1.7	3.5	Dec	26
Gippsland	11	73	2.0	0	Nov	17
W Vic & SE SA	360	58	1.7	4.9	Dec	39
S SA	70	34	1.2	5.1	Dec	36
KI	39	77	1.8	1.1	Jan	56
WA	194	44	1.3	0	Dec	24
All Regions	1247	58	1.9	3.0	Dec	32

Chi-squared test for proportion treating wethers: $\chi 2=76.07$, d.f.=9, $p<0.0005$.
Kruskal-Wallis test for number of times treated: $\chi 2=153.05$, d.f.=9, $p<0.0005$
** the sample size given is for the proportion treating wethers. For the remaining figures in the table, the sample size will be equal to the sample size given, multiplied by the proportion treating wethers.*
*** proportion of treatments.*

Further details for the treatments for worm control in wethers are provided in Appendix A2.22.9 and Appendix A2.22.10.

3.7.2 Drenching of newly introduced sheep

Across all regions, 59 per cent of respondents reported that they purchased sheep and brought them on to their property. The proportion ranged from 49 per cent in Western Australia to 91 per cent in the Granite Belt and Darling Downs. Further details are provided in Appendix A2.22.11.

The proportions of those who purchased sheep who also drenched them on their arrival to their property are shown below.

Region	n	Proportion drenching sheep on arrival (%)		
SW & S Qld	46	54	67	81
GB & DD	20	85	95	105
New England	100	89	94	99
C & S Tablelands	102	84	90	96
SW NSW & NE Vic	105	72	80	88
Gippsland	7	60	86	112
W Vic & SE SA	227	82	86	91
S SA	38	63	76	90
KI	26	71	85	98
WA	97	60	69	78
All regions	768	81	83	86

$\chi 2$ =39.96, d.f. = 9, p <0.0005.

Across all regions, the drench most commonly used was ML Moxidectin, which was used by 41 per cent of respondents. Further details are provided in Appendix A2.22.12.

3.7.3 *Monitoring worm egg counts*

Region	n	Proportion of respondents monitoring worm egg counts (%)		
SW & S Qld	63	42	54	66
GB & DD	24	43	63	82
New England	174	51	**59**	66
C & S Tablelands	179	41	49	56
SW NSW & NE Vic	169	32	39	46
Gippsland	12	40	67	93
W Vic & SE SA	368	35	40	45
S SA	70	26	37	48
KI	42	23	38	53
WA	206	26	**33**	39
All regions	1307	41	44	46

$\chi 2$ =41.75, d.f. = 9, p <0.0005.

3.7.3.1 Frequency of monitoring worm egg counts

Across all regions, the frequency with which respondents typically monitored worm egg counts ranged from an average of 3.0 times per year for weaners to 2.6 times per year for adult ewes. The typical frequency of monitoring was significantly different between regions for weaners, adult ewes and wethers, with higher frequencies being reported in the Granite Belt and Darling Downs, and in the New England region, and generally lower frequencies in the southern Australian regions.

Additional information on the typical frequency of monitoring worm egg counts is provided in Appendices A2.22.13–A2.22.15.

3.7.3.2 Frequency of monitoring worm egg counts in 2003 compared to typical frequency

Across all regions, and for all three classes of sheep, 95 per cent or more of respondents had the same frequency of monitoring in 2003 as they did in a typical year.

Additional information on the comparison between the frequency of monitoring of worm egg counts in 2003 and in a typical year is provided in Appendices A2.22.16 – A2.22.18.

3.7.4 *Drench resistance testing*

Region	n	Proportion of respondents who have tested for drench resistance (%)		
SW & S Qld	101	19	**28**	37
GB & DD	33	42	59	76
New England	277	51	**57**	63
C & S Tablelands	314	39	44	50
SW NSW & NE Vic	311	40	45	51
Gippsland	21	44	65	85
W Vic & SE SA	606	44	48	52
S SA	108	38	47	57
KI	54	44	57	70
WA	438	46	51	56
All regions	2263	46	48	50

χ^2 =35.78, d.f. = 9, p <0.0005.
Note: percentages are adjusted for non-response bias as described in Appendix A1.10.

3.7.4.1 Year of most recent drench resistance test – all regions

Year of most recent drench resistance test	Proportion of respondents (%)
1980	0.4
1982	0.2
1986	0.2
1989	0.6
1990	3.9
1991	0.4
1992	1.3
1993	0.7
1994	2.6
1995	4.4
1996	2
1997	3
1998	7.2
1999	7.2
2000	13.3
2001	11.9
2002	17.8
2003	14.6
2004	8.3

n=540

Respondents were grouped into those whose most recent drench resistance test was previous to the year 2000 and those whose most recent test was in 2000 or more recently, as a measure of the recency of adoption of drench resistance testing. There was no significant difference between the regions in this measure. Further information is provided in Appendix A2.22.19.

3.7.4.2 Type of drench resistance test

Region	n	Proportion of respondents using tests below (%)											
		DrenchRite			FECR			DrenchRite or FECR*			Other**		
SW & S Qld	7	0	0	0	6	43	80	0	14	40	6	43	80
GB & DD	6	0	0	0	0	0	0	0	17	46	54	83	113
New England	55	0	4	9	22	35	47	0	7	14	41	55	68
C & S Tablelands	45	5	16	26	2	11	20	1	9	17	50	64	78
SW NSW & NE Vic	30	0	7	16	0	3	10	0	10	21	66	80	94
Gippsland	5	0	40	83	0	20	55	0	0	0	0	40	83
W Vic & SE SA	88	3	9	15	6	14	21	2	7	12	61	70	80
S SA	17	0	6	17	0	12	27	0	6	17	56	76	97
KI	11	0	0	0	0	18	41	0	18	41	35	64	92
WA	53	0	4	9	4	13	22	4	13	22	57	70	82
All regions	317	5	8	10	12	16	20	6	9	12	62	67	72

$\chi 2$ =42.84, d.f. = 27, p = 0.027. 26 cells (65.0%) have expected counts less than 5.
** Sufficient information given to identify test as DrenchRite or FECR test, but not sufficient to determine which of the two.*
*** Tests other than DrenchRite and FECR tests, or cases where information given was only sufficient to identify that some form of drench resistance testing had been carried out by the respondent.*

3.7.5 Treatments and techniques for worm control

Region	n	Proportion of respondents using technique below (%)							
		Smart grazing	Other grazing	Sheep un-drenched	Feeding	Rams	Organic	Drenching	Other
SW & S Qld	54	19	28	2	11	13	4	80	15
GB & DD	24	4	21	0	8	8	0	96	8
New England	177	29	46	2	13	24	1	89	10
C & S Tablelands	184	34	33	5	21	8	3	89	11
S NSW & N Vic	165	30	35	3	21	5	2	84	15
Gippsland	12	25	25	0	33	17	8	100	17
W Vic & SE SA	363	33	34	2	23	10	3	91	10
S SA	70	40	30	3	26	19	1	84	16
KI	42	31	48	14	36	21	5	86	5
WA	200	23	23	18	19	21	1	89	18
All regions	1291	29	33	5	20	14	2	89	12

Note: percentages may sum to more than 100 as respondents could give more than one strategy.
"Sheep un-drenched" = Leave some sheep un-drenched at summer treatments. "Feeding" = Feeding strategy. "Rams" = Use rams selected for resistance to worms. "Organic" = Organic methods.

A small number of respondents gave explanatory descriptions of the treatments or techniques they were using. Further information about these is provided in Appendix A2.22.20.

APPENDIX 1

A1 METHODS

A1.1 Survey content

A first draft of the benchmark survey questionnaire was prepared in consultation with the participating institutions in the IPM-sheep project.

A1.2 First pilot survey

A pilot questionnaire of 300 was sent out in May 2004 to four regions, including New England, Southern Queensland, Victoria and Western Australia. Addresses were chosen from a database of rural addresses selected randomly from Australian Federal Electoral Rolls. Addresses within this database were selected according to areas within each region identified as being within a 'sphere of influence' of the programs being run by regional IPM-sheep project managers. Postcodes deemed to fall within these areas provided the basis for the random selection of addresses from the Electoral Rolls.

A response rate of 24.5% (85 surveys) was achieved - this figure includes those who were ineligible (i.e. they had less than 500 sheep), as well as those who completed the survey. Eight completed surveys were received in total (response rate from 300 of 2.6% or 10% of those returned).

After four weeks a short form was sent out on 4 June to all addresses from which no response had been received. Those who had responded as either ineligible or RTS were not included in the mail-out. This abbreviated one-page survey aimed to provide information as to whether the low response rate was due to a low proportion of wool producers in the sampling frame, or to factors specific to the questionnaire content and format that were discouraging responses. In addition, a number of non–respondents in WA and Victoria were phoned shortly after the short survey was sent out. This revealed some issues that may have affected response rate. In particular, respondents in WA indicated that they were finalising their seeding operations and non-vital mail had not been looked at for several weeks. A similar situation occurred in Victoria, and it was also noted that several Victorian addresses had received two surveys from IRF in error - the other being one on foot-and-mouth preparedness, which being smaller was filled out in preference to the IPMS survey.

The short survey form achieved a response rate of 22% (48 of 218) by 25th June. Important feedback was received via e-mail from one respondent phoned as part of the pilot follow-up, and his comments were incorporated into the new version of the questionnaire.

A1.3 Analysis of first pilot survey

The completed surveys were relatively well filled in, with most responses indicating that the questions were easily understood, though some have required reworking (e.g. Q6, Q11). Several of the more detailed questions were frequently skipped or poorly answered (Qs 9, 10, 18, 26 & 34). There was no negative feedback regarding length or format of the survey, however the low response rate to the pilot was taken as an indication of this.

The response to the short survey suggested that the length and format of the full questionnaire was reducing response rates. This was indicated by several factors, including:

- the more immediate initial response to the short survey;
- the response of wool producers with well over 500 sheep to the short survey but not to the full questionnaire used in the pilot;
- indication from the same producers that they regarded IPM as being applicable to their property.

To reduce the perceived length of the questionnaire, the format was changed back to that originally specified by IRF, an A5 booklet. In consultation with the Board of Management, the survey content

was altered with several questions that were too complex and time consuming to answer, removed. Other questions were rearranged to make them easier to read and answer. Further, approval was sought from AWI to use its levy-payers database. A request was placed on 21 June 2004 and the database was received on 23 August.

A1.4 Second pilot survey

The second pilot using the new questionnaire content and formatting in A5 booklet form was sent out to 300 sheep farmers using the AWI database from 27 August 2004. This second pilot achieved a response of 36 completed surveys in the first two weeks. On the basis of this relatively quick response compared to the first pilot, and without analysis of the results, it was decided to proceed with the main survey. Time was a factor affecting the decision to proceed, as well as the knowledge that the AWI database was being used and it was assumed that the target audience was being achieved. The prompt response indicated that the new format was not a problem. An initial analysis of the first 25 completed surveys confirmed that most respondents were able to understand the questions (by filling them in correctly) and that most questions were not problematic (since a majority were answered by most respondents). A total of 36 completed surveys were eventually received.

A1.5 Main survey

The addresses provided in the AWI database were from a list of postcodes provided to AWI. These postcodes were selected, as before, on the basis of the regions of influence indicated by the IPM-sheep regional project managers. Addresses were sorted by State and region basis (QLD, New England, NSW, VIC, SA & WA), then assigned random numbers. Due to there being less than 1500 addresses (the target number per state) in QLD (383), SA (751) and New England (728), all addresses provided by AWI were used in these areas. In NSW, VIC and WA the first 1500 addresses were selected from the randomised list (excluding any addresses used in the pilot). A total of 6362 addresses were selected.

The first surveys were sent out from late September over a period of several weeks, with surveys being sent to WA addresses later in the period. Reminders were sent out during the week beginning 25 October 2004 to New England, QLD, NSW, VIC and SA, with reminders sent to WA addresses the week after. A short one page letter and questionnaire (short survey) was developed in consultation with the board of management members and sent out from 25 November 2004 to those who had not responded at this time. This was to encourage non-responders to answer just a few key 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 10 February 2005 was included in the analysis. Surveys received after this date were entered into the survey database and the data will be used in the analysis and report that follows the second report.

Figures for responses received up until 10 February 2005 are shown in Table A1.1. The total number of geographically locatable responses from respondents with 500 or more sheep in 2003 or in a typical year was 1342 full surveys and 961 short surveys.

A1.6 Coding of text answers

The full questionnaire contained 77 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	719	181	101	105	19	506	35.7	56.5
QLD	383	374	88	49	47	8	263	33.5	51.3
NSW (rem)	1500	1472	319	212	245	32	1027	31.0	54.9
VIC	1500	1472	357	215	222	24	1042	34.3	55.6
SA	751	729	202	95	104	11	541	37.3	56.5
WA	1500	1460	218	122	235	40	1075	20.3	42.1
TOTAL	6362	6226	1365	794	958	134	4456	33.6	52.1

There was only one question where text answers indicated that an item important to respondents had been omitted (question 21, concerning incidence of flystrike). In this case, the text answers were used to create another item in the list of types of strike (pizzle strike) in the survey dataset. The remaining 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.

A1.7 Data quality control

Data was analysed using SPSS and R (SPSS Inc, 2001;R Development Core Team, 2004). 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

A1.7.1 Property area

The total property area reported by the respondent was compared with the sum of the areas under various land uses, viz. area grazed, area cropped, cropping area grazed as stubble, cropping area grazed as green and 'Other'. For 52.3 per cent of respondents the sum of areas under various land uses was equal to the area given as total property area. In these cases, it is assumed that respondents provided the land uses on the property at a particular point in time. Consequently, the figures reported under "Area grazed", "Cropping area grazed as stubble" and "Cropping area grazed as green" were summed to give the overall area grazed on the property. Similarly, the three land uses: "Area cropped", "Cropping area grazed as stubble" and "Cropping area grazed as green", were summed to provide a figure for the area cropped.

The sum of the areas of the various types of land use was greater than the total property area for 33.8 per cent of respondents. Four of these respondents had obviously made errors in reporting their total property area, possibly leaving off some digits from their answer. In these cases the total property area was set to the sum of areas and the adjustments described in the previous paragraph made.

In the remaining cases where the areas of the various types of land use was greater than the total property area, the areas entered under "Area grazed", "Area cropped", "Cropping area grazed as stubble" and "Cropping area grazed as green" referred to all or part of the same area of land, i.e. the respondent had provided figures typical of land use over time, such that there was an element of double counting, resulting in the sum of areas exceeding the total property area. Inspection of individual responses suggested that the commonest form of double counting was when "Area cropped", "Cropping area grazed as stubble" and "Cropping area grazed as green" referred to all or part of the one area of land. Consequently, "Area cropped" was let stand, while the overall area grazed was obtained by adding "Area grazed" to the greater of "Cropping area grazed as stubble" and "Cropping area grazed as green".

The remaining 13.9 per cent of respondents provided a total property area that was greater than the sum of areas. In several cases, this disparity was due to a total property area in acres being written in the space for total property area in hectares and these cases were corrected. For the remaining respondents, it appears that the cause of the disparity was the omission of some land uses from the figures provided. For this reason, the total property area provided by the respondent was taken as the total property area. Similar to the approach taken where the sum of land uses equalled the total property area, the figures reported under "Area grazed", "Cropping area grazed as stubble" and "Cropping area grazed as green" were summed to give the overall area grazed on the property. The three land uses: "Area cropped", "Cropping area grazed as stubble" and "Cropping area grazed as green", were summed to provide a figure for the area cropped.

A1.8 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.

A1.8.1 Cattle numbers

Those who did not fill in the full survey, but responded to the short survey, had significantly more cattle.

Table A1.2. Difference in cattle numbers between the full and short surveys.

Responders to ...	Proportion of respondents with cattle numbers in the ranges below (%)			
	No cattle	Less than 50	50 – 149	150 or more
Full survey	62.1	15.0	12.6	10.2
Short survey	48.1	8.6	17.3	26.0

Chi-squared test: $\chi 2=128.09$, d.f.=3, $p<0.00005$, n=2274.

A1.8.2 Drench resistance test

Those who did not fill in the full survey, but responded to the short survey, were more likely to have tested for drench resistance in their flock.

Table A1.3. Difference in testing for drench resistance between the full and short surveys.

Responders to ...	% who had tested for drench resistance
Full survey	43.7
Short survey	49.8

Fisher's Exact Test, p=0.005, n=2272

A1.8.3 Ranking of factors important in deciding when to drench ewes

Those who did not fill in the full survey, but responded to the short survey, appear to be less convinced about the importance of faecal egg counts when deciding when to drench ewes.

Table A1.4. Difference between the full and short surveys in respondents' ranking of the importance of faecal egg count results in deciding when to drench ewes.

Responders to ...	Proportion of respondents indicating the ranks below (%)			
	Very important	Important	Somewhat important	Not important
Full survey	59.0	17.9	9.1	14.0
Short survey	48.8	24.8	13.2	13.1

Chi-squared test: $\chi 2=24.71$, d.f.=3, $p<0.00005$, n=1723.

Those who did not fill in the full survey, but responded to the short survey, also appear to be less convinced about the importance of the time of year when deciding when to drench ewes.

Table A1.5. Difference between the full and short surveys in respondents' ranking of the importance of the time of year in deciding when to drench ewes.

Responders to ...	Proportion of respondents indicating the ranks below (%)			
	Very important	Important	Somewhat important	Not important
Full survey	54.0	32.7	9.2	4.1
Short survey	46.3	40.1	9.9	3.6

Chi-squared test: $\chi 2=14.29$, d.f.=3, p=0.003, n=2074.

A similar pattern of response differences between the full and short survey is evident in the ranking of the importance of seasonal weather conditions in deciding when to drench ewes.

Table A1.6. Difference between the full and short surveys in respondents' ranking of the importance of seasonal weather conditions in deciding when to drench ewes.

Responders to ...	Proportion of respondents indicating the ranks below (%)			
	Very important	Important	Somewhat important	Not important
Full survey	30.5	32.7	23.6	13.2
Short survey	23.8	38.9	24.2	13.2

Chi-squared test: $\chi 2=13.01$, d.f.=3, p=0.005, n=1934.

Those who did not fill in the full survey, but responded to the short survey, appear to rank pasture quality slightly higher than those who responded to the full survey.

Table A1.7. Difference between the full and short surveys in respondents' ranking of the importance of pasture quality in deciding when to drench ewes.

Responders to ...	Proportion of respondents indicating the ranks below (%)			
	Very important	Important	Somewhat important	Not important
Full survey	16.6	34.0	27.0	22.4
Short survey	17.6	38.7	28.3	15.4

Chi-squared test: $\chi 2=15.01$, d.f.=3, p=0.002, n=1832.

Those who did not fill in the full survey, but responded to the short survey, appear to rank the presence of daggy sheep in the mob more highly as a factor in deciding when to drench ewes.

Table A1.8. Difference between the full and short surveys in respondents' ranking of the importance of the presence of daggy sheep in the mob in deciding when to drench ewes.

Responders to ...	Proportion of respondents indicating the ranks below (%)			
	Very important	Important	Somewhat important	Not important
Full survey	23.7	28.3	31.9	16.1
Short survey	27.4	33.7	30.0	8.9

Chi-squared test: $\chi 2=27.62$, d.f.=3, p<0.00005, n=1957.

A1.8.4 Grazing strategy

Those who did not fill in the full survey, but responded to the short survey, were less likely to be following a set stocked grazing strategy.

Table A1.9. Difference between the full and short surveys in the proportion of respondents with a set stocked grazing strategy.

Responders to ...	% with set stocking grazing strategy
Full survey	55.4
Short survey	46.0

Fisher's Exact Test, p<0.00005, n=2223

Those who did not fill in the full survey, but responded to the short survey, were more likely to be following a grazing strategy that involved alternating between sheep and crop stubble.

Table A1.10. Difference between the full and short surveys in the proportion of respondents with a grazing strategy that involved alternating between sheep and crop stubble.

Responders to ...	% with a grazing strategy that involved alternating between sheep and crop stubble
Full survey	27.0
Short survey	38.7

Fisher's Exact Test, p<0.00005, n=2218

A1.8.5 Treatment for blowfly strike

Those who did not fill in the full survey, but responded to the short survey, were less likely to indicate that they typically treated blowfly strike by treating individual sheep that become struck.

Table A1.11. Difference between the full and short surveys in the proportion of respondents who indicated that they typically treated blowfly strike by treating individual sheep that become struck.

Responders to ...	% treating individual sheep
Full survey	75.6
Short survey	65.9

Fisher's Exact Test, p<0.00005, n=2241

A1.9 Derivation of weights for non-response bias

The preceding tables show that there are some significant differences between those who filled in the full survey and those who filled in the short survey, suggesting that estimates of the characteristics of the population of sheep producers derived from the full survey sample may be affected by non-response bias. This bias may be corrected by weighting procedures based on the differences in the tables above. However, where there are differences across a relatively large number of survey questions, the numbers of full survey respondents in the groups to which particular weighting factors are applied may become unduly small. Large weighting factors applied to small groups of respondents may introduce other biases that are not apparent from the subset of questions common to the full and short surveys. For this reason, it is necessary to rank the tables listed in the preceding section according to the magnitude of the differences exhibited and examine the size of respondent groups and weighting factors as the number of tables included in the calculation is increased to include tables with smaller differences (Table A1.12).

Table A1.12. Table of respondent groups and calculated weighting factors based on including one, two or three questions in the calculation. Cattle numbers show the greatest difference between the full and short surveys, followed by a grazing strategy that involves alternating between sheep and crop stubble, followed by blowfly treatment that typically involves treating individuals in the mob that become struck.

No of tables in weighting calculation	Cattle numbers	Alternating between sheep and crop stubble	Typically treat individuals that become struck	Number of respondents to full survey	Calculated weighting factor
1	No cattle			816	0.84
	Less than 50			197	0.70
	50-149			166	1.26
	150 or more			134	2.08
2	No cattle	No		532	0.68
	Less than 50	No		145	0.65
	50-149	No		128	1.13
	150 or more	No		107	1.94
	No cattle	Yes		238	1.21
	Less than 50	Yes		49	0.77
	50-149	Yes		31	1.76
	150 or more	Yes		21	3.00
3	No cattle	No	No	123	0.84
	Less than 50	No	No	39	0.76
	50-149	No	No	37	1.15
	150 or more	No	No	19	3.72
	No cattle	Yes	No	50	1.64
	Less than 50	Yes	No	9	1.75
	50-149	Yes	No	6	2.65
	150 or more	Yes	No	6	3.59
	No cattle	No	Yes	392	0.62
	Less than 50	No	Yes	101	0.61
	50-149	No	Yes	86	1.16
	150 or more	No	Yes	82	1.59
	No cattle	Yes	Yes	182	1.07
	Less than 50	Yes	Yes	40	0.54
	50-149	Yes	Yes	25	1.53
	150 or more	Yes	Yes	15	2.61

It can be seen from Table A1.12, that as the number of questions included in the calculation of weighting factors increases, there is also an increase in the incidence of small respondent groups with relatively large weighting factors. As might be expected, the small respondent groups are those with relatively larger cattle numbers who are pursuing a grazing strategy that involves alternating between sheep and crop stubbles. With two questions included in the calculation of weighing factors, there are only 21 respondents with 150 or more cattle and pursuing the above grazing strategy. These 21 would be multiplied by a weighting factor of 3 if the full survey data was to be adjusted for non-response bias using cattle numbers and the grazing strategy of alternating between sheep and crop stubbles. This was judged as attributing too much weight to a relatively small group of respondents. Accordingly, non-response weights were based solely on cattle numbers.

A1.10 Significance of weighted distributions

Using the weighting factors in the top four rows of Table A1.12, above, i.e. those based solely on cattle numbers, weighted frequency distributions were calculated for a selection of the questions common to the full and short surveys. The weighted and unweighted frequency distributions are shown in the tables below.

Table A1.13. Difference in sheep number (typical year) estimates with and without weighting for non-response bias.

Basis	Proportion of respondents with sheep numbers in the ranges below (%)			
	500-1499	1500-2999	3000-4999	5000 or more
Unweighted	24.4	28.2	22.5	24.9
Weighted	21.4	26.9	22.7	28.9

Chi-squared goodness-of-fit test: $\chi 2=13.97$, d.f.=3, p=0.003, n=1342.

Table A1.14. Difference in cattle number estimates with and without weighting for non-response bias.

Basis	Proportion of respondents with cattle numbers in the ranges below (%)			
	No cattle	Less than 50	50 – 149	150 or more
Unweighted	62.2	15.0	12.6	10.2
Weighted	52.3	10.6	15.9	21.2

Chi-squared goodness-of-fit test: $\chi 2=133.65$, d.f.=3, p<0.00005, n=1313.

Table A1.15. Difference between unweighted and weighted estimates of the proportion of sheep producers testing for drench resistance.

Basis	% who had tested for drench resistance
Unweighted	43.7
Weighted	45.9

Binomial test, p=0.116, n=1326.

Table A1.16. Difference between the unweighted and weighted estimates of respondents' ranking of the importance of faecal egg count results in deciding when to drench ewes.

Basis	Proportion of respondents indicating the ranks below (%)			
	Very important	Important	Somewhat important	Not important
Unweighted	59.0	17.9	9.1	14.0
Weighted	60.7	17.4	8.7	13.3

Chi-squared goodness-of-fit test: $\chi 2=1.08$, d.f.=3, p=0.782, n=900.

Table A1.17. Difference between the unweighted and weighted estimates of respondents' ranking of the importance of the time of year in deciding when to drench ewes.

Basis	Proportion of respondents indicating the ranks below (%)			
	Very important	Important	Somewhat important	Not important
Unweighted	54.0	32.7	9.2	4.1
Weighted	52.6	34.2	9.1	4.1

Chi-squared goodness-of-fit test: $\chi 2=1.23$, d.f.=3, p=0.745, n=1159.

Table A1.18. Difference between the unweighted and weighted estimates of respondents' ranking of the importance of seasonal weather conditions in deciding when to drench ewes.

Basis	Proportion of respondents indicating the ranks below (%)			
	Very important	Important	Somewhat important	Not important
Unweighted	30.5	32.7	23.6	13.2
Weighted	29.8	33.7	23.6	12.9

Chi-squared goodness-of-fit test: $\chi 2=0.53$, d.f.=3, p=0.911, n=1054.

Table A1.19. Difference between the unweighted and weighted estimates of respondents' ranking of the importance of pasture quality in deciding when to drench ewes.

Basis	Proportion of respondents indicating the ranks below (%)			
	Very important	Important	Somewhat important	Not important
Unweighted	16.6	34.0	27.0	22.4
Weighted	15.7	33.9	27.3	23.0

Chi-squared goodness-of-fit test: $\chi 2=0.67$, d.f.=3, p=0.880, n=969.

Table A1.20. Difference between the unweighted and weighted estimates of respondents' ranking of the importance of the presence of daggy sheep in the mob in deciding when to drench ewes.

Basis	Proportion of respondents indicating the ranks below (%)			
	Very important	Important	Somewhat important	Not important
Unweighted	23.7	28.3	31.9	16.1
Weighted	22.5	27.4	33.4	16.6

Chi-squared goodness-of-fit test: $\chi 2=1.90$, d.f.=3, p=0.594, n=1067.

Table A1.21. Difference between the unweighted and weighted estimates of the proportion of respondents with a set stocked grazing strategy.

Basis	% with set stocking grazing strategy
Unweighted	55.4
Weighted	56.2

Binomial test, p=0.573, n=1283

Table A1.22. Difference between the unweighted and weighted estimates of the proportion of respondents with a grazing strategy that involved alternating between sheep and crop stubble.

Basis	% with a grazing strategy that involved alternating between sheep and crop stubble
Unweighted	27.0
Weighted	25.4

Binomial test, p=0.199, n=1279

Table A1.23. Difference between the unweighted and weighted estimates of the proportion of respondents who indicated that they typically treated blowfly strike by treating individual sheep that become struck.

Basis	% treating individual sheep
Unweighted	75.6
Weighted	75.9

Binomial test, p=0.770, n=1297

The preceding tables show that, apart from the estimates of sheep and cattle numbers, there is no significant difference between unweighted and weighted estimates from a range of questions about grazing and sheep parasite management. It can be be concluded from this that, although sheep producers with larger numbers of cattle are significantly under-represented in the full survey sample, there appears to be little difference in grazing and sheep parasite management between those with relatively more and those with fewer cattle. Consequently, adjustment for the under-representation of sheep producers with larger numbers of cattle has no significant effect on the estimates of characteristics associated with grazing and parasite management.

However, these findings then raise the question, if weighting was based on one or more of the questions about grazing and parasite management, whether the adjustment for non-response biases shown by these questions would lead to weighted estimates that were significantly different from unweighted estimates. Table A1.24 shows the size of respondent groups and weighting factors for the three questions about grazing and parasite management that showed the greatest differences between the full and short surveys. The possibility of using a fourth question was investigated, however, because the next question in the sequence had four categories, this resulted in unsatisfactorily small respondent groups.

Table A1.24. Table of respondent groups and calculated weighting factors based on including one, two or three questions relating to grazing and sheep parasite management in the calculation. A grazing strategy that involves alternating between sheep and crop stubble shows the greatest difference between the full and short surveys, followed by blowfly treatment that typically involves treating individuals in the mob that become struck, and a set stocked grazing strategy.

No of tables in weighting calculation	Alternating between sheep and crop stubble	Typically treat individuals that become struck	Set stocked grazing strategy	Number of respondents to full survey	Calculated weighting factor
1	No			934	0.89
	Yes			345	1.31
2	No	No		225	0.68
	Yes	No		73	0.65
	No	Yes		676	1.76
	Yes	Yes		266	3.00
3	No	No	No	89	1.30
	Yes	No	No	45	2.21
	No	Yes	No	268	0.87
	Yes	Yes	No	154	1.22
	No	No	Yes	136	1.00
	Yes	No	Yes	28	1.38
	No	Yes	Yes	408	0.78
	Yes	Yes	Yes	112	1.00

Table A1.24 shows that three grazing and parasite management questions can be used to calculate weighting factors, without resulting in unduly small respondent groups or unduly large weighting factors.

Using the weighting factors in the lower eight rows of Table A1.24, above, i.e. those based on the three grazing and parasite management questions with the greatest difference between the full and short surveys, weighted frequency distributions were calculated for a selection of the questions common to the full and short surveys. The weighted and unweighted frequency distributions are shown in the tables below.

Table A1.25. Difference in sheep number (typical year) estimates with and without weighting for non-response bias.

Basis	Proportion of respondents with sheep numbers in the ranges below (%)			
	500-1499	1500-2999	3000-4999	5000 or more
Unweighted	24.4	28.2	22.5	24.9
Weighted	22.5	26.6	28.3	22.5

Chi-squared goodness-of-fit test: $\chi 2=22.86$, d.f.=3, $p<0.00005$, n=1342.

Table A1.26. Difference in cattle number estimates with and without weighting for non-response bias.

Basis	Proportion of respondents with cattle numbers in the ranges below (%)			
	No cattle	Less than 50	50 – 149	150 or more
Unweighted	62.2	15.0	12.6	10.2
Weighted	62.9	15.3	12.4	9.5

Chi-squared goodness-of-fit test: $\chi 2=0.95$, d.f.=3, $p<0.812$, n=1313.

Table A1.27. Difference between unweighted and weighted estimates of the proportion of sheep producers testing for drench resistance.

Basis	% who had tested for drench resistance
Unweighted	43.7
Weighted	44.9

Binomial test, p=0.408, n=1326.

Table A1.28. Difference between the unweighted and weighted estimates of respondents' ranking of the importance of faecal egg count results in deciding when to drench ewes.

Basis	Proportion of respondents indicating the ranks below (%)			
	Very important	Important	Somewhat important	Not important
Unweighted	59.0	17.9	9.1	14.0
Weighted	58.0	17.9	10.2	14.0

Chi-squared goodness-of-fit test: $\chi 2=1.17$, d.f.=3, $p=0.761$, n=900.

Table A1.29. Difference between the unweighted and weighted estimates of respondents' ranking of the importance of the time of year in deciding when to drench ewes.

Basis	Proportion of respondents indicating the ranks below (%)			
	Very important	Important	Somewhat important	Not important
Unweighted	54.0	32.7	9.2	4.1
Weighted	54.7	32.8	8.9	3.7

Chi-squared goodness-of-fit test: $\chi 2=0.77$, d.f.=3, p=0.857, n=1159.

Table A1.30. Difference between the unweighted and weighted estimates of respondents' ranking of the importance of seasonal weather conditions in deciding when to drench ewes.

Basis	Proportion of respondents indicating the ranks below (%)			
	Very important	Important	Somewhat important	Not important
Unweighted	30.5	32.7	23.6	13.2
Weighted	29.3	32.8	24.4	13.6

Chi-squared goodness-of-fit test: $\chi 2=0.88$, d.f.=3, p=0.831, n=1054.

Table A1.31. Difference between the unweighted and weighted estimates of respondents' ranking of the importance of pasture quality in deciding when to drench ewes.

Basis	Proportion of respondents indicating the ranks below (%)			
	Very important	Important	Somewhat important	Not important
Unweighted	16.6	34.0	27.0	22.4
Weighted	15.9	34.1	27.4	22.6

Chi-squared goodness-of-fit test: $\chi 2=0.40$, d.f.=3, p=0.941, n=969.

Table A1.32. Difference between the unweighted and weighted estimates of respondents' ranking of the importance of the presence of daggy sheep in the mob in deciding when to drench ewes.

Basis	Proportion of respondents indicating the ranks below (%)			
	Very important	Important	Somewhat important	Not important
Unweighted	23.7	28.3	31.9	16.1
Weighted	23.4	27.8	32.8	16.0

Chi-squared goodness-of-fit test: $\chi 2=0.40$, d.f.=3, p=0.939, n=1067.

Table A1.33. Difference between the unweighted and weighted estimates of the proportion of respondents with a set stocked grazing strategy.

Basis	% with set stocking grazing strategy
Unweighted	55.4
Weighted	48.7

Binomial test, p<0.00005, n=1283

Table A1.34. Difference between the unweighted and weighted estimates of the proportion of respondents with a grazing strategy that involved alternating between sheep and crop stubble.

Basis	% with a grazing strategy that involved alternating between sheep and crop stubble
Unweighted	27.0
Weighted	35.3

Binomial test, $p<0.00005$, $n=1279$

Table A1.35. Difference between the unweighted and weighted estimates of the proportion of respondents who indicated that they typically treated blowfly strike by treating individual sheep that become struck.

Basis	% treating individual sheep
Unweighted	75.6
Weighted	68.6

Binomial test, $p<0.00005$, $n=1297$

Tables A1.25 – A1.35 show weighting based on the three grazing and parasite management questions with the greatest difference between the full and short surveys results in four frequency distributions that are significantly different from the unweighted distributions, viz., the distribution of flock size (in a typical year) and the three questions on which the weighting was based: whether or not producers used a grazing strategy involving alternation between sheep and crop stubbles, whether or not producers typically treated individual sheep that become struck, and whether or not producers used a set stocked grazing strategy. For other aspects of parasite management, such as the ranking of the importance of various factors to be considered when deciding when to drench ewes and testing for drench resistance, there was no significant difference between the weighted and unweighted distributions.

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.

For example, producers with 150 or more cattle are under-represented in the full survey by a factor of around 2.5 (Table A1.2). Examination of the relationship between cattle numbers and drench resistance testing shows that 59.3 per cent of producers with 150 or more cattle had tested for drench resistance in their sheep flock, compared to 44.1 per cent of producers who had no cattle. However, producers with 150 or more cattle comprise only 16.8 per cent of producers, so that weighting of the data from the full survey to compensate for the under-representation of producers with 150 or more cattle results in only a small and non-significant increase in the estimate of the proportion of producers who have tested for drench resistance, from 43.7 per cent to 45.9 per cent (Table A1.15).

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 for which there were significant differences between the full and short surveys. Given that the questions common to the full and short surveys were chosen for their central relevance to informing the extension phase of the IPM-sheep project, it is worth using the data from the short survey to provide the best possible estimates of the producer characteristics which these questions are concerned. It was also decided that, for reasons of consistency, the findings from the remaining questions common to both surveys (those for which there was not a significant difference between the two surveys) would also be presented as estimates adjusted to take account of the data from both full and short surveys.

For example, 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.

A1.11 Analysis of Variance

Analysis of variance was used to indicate the significance of the differences between the regional means of continuous variables. In a number of cases, these variables are strongly bi-modal, with the bulk of responses at the minimum and maximum values of the range. In these cases, the distributions are departing substantially from that assumed in the analysis of variance procedure, 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.

A1.12 Cluster Analysis

The form of cluster analysis used was "partitioning around medoids" ("pam"), as implemented in the R statistical package (R Development Core Team, 2004) This method is similar to the well known k-means iterative re-allocation method (Hartigan and Wong, 1979), but has the advantage of greater robustness and a derived silhouette coefficient which provides guidance as to the number of clusters that best represent the structure in the data (Kaufman and Rousseeuw, 1987). Where "pam" was used, the silhouette coefficient was calculated for 2 to 8 cluster solutions and the solution with the maximum silhouette coefficient accepted. Silouhette coefficients were interpreted following the guidelines provided by Kaufman and Rousseeuw (1987), shown below.

Silhouette coefficient	Interpretation
0.71 – 1.00	A strong structure
0.51 – 0.70	A reasonable structure
0.26 – 0.50	A weak structure, possibly an artefact.
0.00 – 0.25	No structure

Only cluster solutions with a silhouette coefficient greater than 0.50 have been reported. The coefficients obtained for the various cluster analyses are given in the table below.

Cluster analysis	Section of main report	No of clusters with maximum silouhette coefficient	Silhouette coefficent
Q3 – sheep and wool income	3.2.3	2	0.55

A1.13 Calculation of DSEs

Where stock numbers have been converted to DSEs, the conversion factors used were taken from Attwood (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

A1.14 Calculation of Mean Wool Cut and Mean Fibre Diameter for Adult Sheep

In Q8 of the survey questionnaire, respondents provided data on the number of sheep shorn, wool cut and fibre diameter for adult breeding ewes and adult dry ewes and wethers. To provided a single figure for adult sheep, a weighted mean was calculated for each respondent by multiplying the wool cut or fibre diameter figure by the number of sheep to which the figure applied, adding the products so obtained, and dividing by the total number of adult sheep shorn.

A1.15 References

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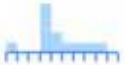
APPENDIX 2

A2 Additional Results

A2.1 Age of Respondents

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	61	27	52	75	51	3	
GB & DD	24	25	44	69	47	5	
New England	169	16	50	76	51	2	
C & S Tablelands	180	24	48	78	50	2	
S NSW & N Vic	169	19	51	84	51	2	
Gippsland	12	20	44	73	47	9	
W Vic & SE SA	373	20	51	80	51	1	
S SA	69	25	52	83	52	3	
KI	42	26	50	81	51	3	
WA	201	18	51	81	52	2	
All Regions	1300	16	51	84	51	1	

Histogram class limits:16-22.8-29.6-36.4-43.2-50-56.8-63.6-70.4-77.2-84
Anova: F=1.01, d.f.=9, p=0.436.

A2.2 Gender of Respondents

Region	n	Proportion of respondents (%)	
		Male	Female
SW & S Qld	63	92	8
GB & DD	24	100	0
New England	174	93	7
C & S Tablelands	180	94	6
S NSW & N Vic	169	96	4
Gippsland	12	100	0
W Vic & SE SA	375	95	5
S SA	71	99	1
KI	42	93	7
WA	201	94	6
All regions	1311	95	5

$\chi 2$ = 7.79, d.f. = 9, p =0.556. 5 cells (25.0%) have expected counts less than 5.

A2.3 Cattle DSEs in 2003 Compared to a Typical Year

Region	n	Proportion of respondents (%)								
		2003 < typical			2003 = typical			2003 > typicalt		
SW & S Qld	54	44	**57**	71	22	35	48	0	7	14
GB & DD	12	22	50	78	1	25	50	1	25	50
New England	152	44	**52**	60	30	38	45	6	11	15
C & S Tablelands	91	39	49	60	30	40	50	5	11	17
S NSW & N Vic	90	28	38	48	35	46	56	9	17	24
Gippsland	7	0	29	62	20	57	94	0	14	40
W Vic & SE SA	215	21	**27**	33	51	**57**	64	11	16	21
S SA	43	9	21	33	34	49	64	17	**30**	44
KI	19	0	16	32	61	79	97	0	5	15
WA	43	7	**19**	30	46	60	75	9	21	33
All Regions	726	34	38	41	44	48	51	12	15	17

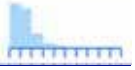
Chisquare = 66.63, d.f. = 18, p < 0.0005. 6 cells (20.0%) have expected counts less than 5.

A2.4 Length of Calving Period - Cows

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	43	1.0	3.0	12.0	4.4	1.1	
GB & DD	11	1.0	3.0	12.0	4.2	2.7	
New England	123	1.0	2.0	10.0	2.3	0.3	
C & S Tablelands	77	1.0	2.0	12.0	2.4	0.6	
S NSW & N Vic	70	1.0	2.0	12.0	3.3	0.7	
Gippsland	6	1.0	2.0	4.0	2.0	1.1	
W Vic & SE SA	175	1.0	2.0	12.0	2.7	0.3	
S SA	40	1.0	3.0	12.0	4.0	1.0	
KI	14	1.0	2.0	12.0	2.6	1.7	
WA	36	1.0	2.0	6.0	2.5	0.5	
All Regions	595	1.0	2.0	12.0	2.9	0.2	

Histogram class limits:1-2.1-3.2-4.3-5.4-6.5-7.6-8.7-9.8-10.9-12
Anova: F=4.89, d.f.=9, p <0.0005.

A2.5 Length of Calving Period - Heifers

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	2	1.0	1.5	2.0	1.5	6.4	
GB & DD	0						
New England	19	1.0	2.0	4.0	2.2	0.5	
C & S Tablelands	10	1.0	2.0	10.0	2.8	2.0	
S NSW & N Vic	10	1.0	2.0	7.0	2.5	1.2	
Gippsland	0						
W Vic & SE SA	16	1.0	1.0	9.0	1.9	1.1	
S SA	5	1.0	3.0	6.0	3.4	2.6	
KI	4	1.0	2.0	3.0	2.0	1.3	
WA	3	1.0	1.0	1.0	1.0	0.0	
All Regions	69	1.0	2.0	10.0	2.3	0.4	

Histogram class limits:1-1.9-2.8-3.7-4.6-5.5-6.4-7.3-8.2-9.1-10
Anova: F=0.80, d.f.=7, p = 0.593.

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

Region	n	Months in which the highest proportion(s) of respondents report cows calving
SW & S Qld	43	September, October
GB & DD	11	October
New England	123	August
C & S Tablelands	77	August
S NSW & N Vic	70	August
Gippsland	6	August, October
W Vic & SE SA	175	May
S SA	40	March
KI	14	March
WA	36	April
All Regions	595	August

A2.7 Heifer Calving Months with Highest Proportion(s) of Respondents

Region	n	Months in which the highest proportion(s) of respondents report heifers calving
SW & S Qld	2	August
GB & DD	0	
New England	19	August
C & S Tablelands	10	September
S NSW & N Vic	70	February, March
Gippsland	0	
W Vic & SE SA	16	March
S SA	5	February - May
KI	4	March
WA	3	March
All Regions	69	August

A2.8 Sheep DSEs in 2003 Compared to a Typical Year

Region	n	Proportion of respondents (%)								
		2003 < typical			2003 = typical			2003 > typicalt		
SW & S Qld	63	59	**70**	81	9	**19**	29	3	11	19
GB & DD	24	34	54	74	8	25	42	5	21	37
New England	180	45	**52**	60	31	38	45	5	9	14
C & S Tablelands	186	39	46	53	29	**36**	43	12	18	23
S NSW & N Vic	172	34	42	49	39	47	54	7	12	16
Gippsland	12	40	67	93	1	25	50	0	8	24
W Vic & SE SA	378	28	33	37	50	**55**	60	9	13	16
S SA	71	18	28	39	52	63	75	2	8	15
KI	42	9	21	34	52	67	81	2	12	22
WA	209	16	**22**	27	50	56	63	16	**22**	28
All Regions	1337	36	38	41	45	47	50	12	14	16

Chisquare = 112.64, d.f. = 18, p < 0.0005. 3 cells (10.0%) have expected counts less than 5.

A2.9 Wool Cut from Breeding Ewes, 2003 Clip (kg/head)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	39	2.5	4.5	6.8	4.6	0.3	
GB & DD	8	3.0	4.0	4.8	3.9	0.7	
New England	126	2.0	4.0	8.5	4.1	0.2	
C & S Tablelands	134	2.5	4.5	9.0	4.8	0.2	
S NSW & N Vic	127	2.0	5.0	8.5	5.2	0.2	
Gippsland	8	3.0	4.7	7.4	4.9	1.2	
W Vic & SE SA	269	2.3	5.0	9.3	5.0	0.1	
S SA	60	2.5	6.0	8.0	5.9	0.3	
KI	30	3.0	5.5	7.4	5.5	0.4	
WA	153	3.0	5.1	8.6	5.3	0.2	
All Regions	954	2.0	5.0	9.3	5.0	0.1	

Histogram class limits:2.00-2.73-3.46-4.19-4.92-5.65-6.38-7.11-7.84-8.57-9.30
Anova: F=16.61, d.f.=9, p<0.0005.

A2.10 Fibre Diameter, Breeding Ewes, 2003 Clip (μ)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	41	17.5	20.2	32.0	20.7	0.7	
GB & DD	8	16.8	18.3	27.0	19.6	2.7	
New England	150	15.0	18.4	35.0	19.0	0.4	
C & S Tablelands	143	16.6	19.5	32.0	20.5	0.6	
S NSW & N Vic	139	15.6	20.6	31.5	21.8	0.6	
Gippsland	11	17.4	19.5	29.0	21.4	2.9	
W Vic & SE SA	309	16.5	20.5	33.0	22.0	0.4	
S SA	66	18.2	22.2	30.0	22.8	0.6	
KI	34	20.0	22.0	23.8	21.7	0.3	
WA	179	17.5	20.5	23.2	20.7	0.2	
All Regions	1080	15.0	20.1	35.0	21.1	0.2	

Histogram class limits:15-17-19-21-23-25-27-29-31-33-35
Anova: F=14.79, d.f.=9, p<0.0005.

A2.11 Wool Cut from Adult Dry Ewes and Wethers, 2003 Clip (kg/head)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	34	3.0	4.8	7.5	4.9	0.4	
GB & DD	16	3.2	4.2	7.0	4.4	0.5	
New England	104	2.5	4.3	7.0	4.3	0.2	
C & S Tablelands	94	3.0	5.0	8.0	5.1	0.2	
S NSW & N Vic	65	2.0	5.8	9.0	5.7	0.3	
Gippsland	6	4.0	5.6	7.5	5.5	1.4	
W Vic & SE SA	188	2.7	5.3	9.0	5.5	0.2	
S SA	26	3.0	5.7	8.0	5.7	0.5	
KI	25	3.0	6.0	8.0	6.0	0.5	
WA	98	1.2	5.5	8.3	5.6	0.2	
All Regions	656	1.2	5.0	9.0	5.3	0.1	

Histogram class limits:1.10-1.89-2.68-3.47-4.26-5.05-5.84-6.63-7.42-8.21-9.00
Anova: F=12.76, d.f.=9, p<0.0005.

A2.12 Fibre Diameter, Adult Dry Ewes and Wethers, 2003 Clip (μ)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	40	15.1	20.5	22.0	20.1	0.5	
GB & DD	17	16.4	18.0	21.0	18.2	0.7	
New England	122	15.5	18.1	28.0	18.3	0.2	
C & S Tablelands	109	16.0	19.0	30.0	19.1	0.3	
S NSW & N Vic	75	15.6	20.0	30.0	20.1	0.4	
Gippsland	9	17.8	20.0	28.0	20.3	2.4	
W Vic & SE SA	220	16.0	20.0	32.0	20.1	0.3	
S SA	27	17.8	21.0	30.0	21.4	1.1	
KI	28	20.0	22.0	23.0	21.8	0.3	
WA	113	17.0	20.6	23.0	20.5	0.3	
All Regions	760	15.1	19.5	32.0	19.8	0.1	

Histogram class limits:15-16.7-18.4-20.1-21.8-23.5-25.2-26.9-28.6-30.3-32
Anova: F=22.73, d.f.=9, p<0.0005.

A2.13 Wool Cut from Weaners Less than 12 Months, 2003 Clip (kg/head)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	31	1.0	2.0	4.3	2.4	0.3	
GB & DD	6	1.4	2.7	3.5	2.6	0.8	
New England	112	0.4	2.5	8.7	2.6	0.2	
C & S Tablelands	111	0.7	2.5	5.3	2.6	0.2	
S NSW & N Vic	94	1.0	2.2	6.0	2.5	0.2	
Gippsland	7	1.2	2.3	3.9	2.5	0.9	
W Vic & SE SA	208	0.5	2.3	7.0	2.6	0.2	
S SA	45	0.8	2.0	7.0	2.6	0.5	
KI	27	1.0	2.5	5.1	2.8	0.5	
WA	139	0.6	2.0	6.0	2.4	0.2	
All Regions	780	0.4	2.3	8.7	2.5	0.1	

Histogram class limits:0.40-1.23-2.06-2.89-3.72-4.55-5.38-6.21-7.04-7.87-8.70
Anova: F=0.56, d.f.=9, p = 0.840.

A2.14 Fibre Diameter, Weaners Less than 12 Months, 2003 Clip (μ)

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	32	16.4	18.6	21.5	18.8	0.4	
GB & DD	3	15.3	16.0	18.0	16.4	3.5	
New England	125	13.7	17.0	24.0	16.9	0.2	
C & S Tablelands	116	15.0	17.8	28.0	18.3	0.5	
S NSW & N Vic	89	15.8	18.0	27.0	18.9	0.5	
Gippsland	9	16.0	17.8	26.0	18.6	2.3	
W Vic & SE SA	233	14.5	18.5	29.0	19.5	0.4	
S SA	44	15.5	19.0	28.0	19.9	0.8	
KI	30	17.0	19.4	21.5	19.5	0.4	
WA	153	15.4	18.6	24.0	18.8	0.2	
All Regions	834	13.7	18.0	29.0	18.7	0.2	

Histogram class limits:13.0-14.6-16.2-17.8-19.4-21-22.6-24.2-25.8-27.4-29.0
Anova: F=12.85, d.f.=9, p<0.0005.

A2.15 Proportion of Respondents (%) Shearing and Crutching Ewes Each Month of the Year

A2.15.1 Shearing Ewes

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
SW & S Qld	53	8	4	8	9	11	15	17	17	6	11	4	8
GB & DD	13	23	0	15	8	0	8	8	15	8	15	15	0
New England	171	2	1	4	1	2	8	15	39	34	9	5	2
C & S Tablelands	176	5	9	10	8	10	9	14	17	18	15	18	9
S NSW & N Vic	158	6	15	15	13	6	7	5	18	22	11	10	4
Gippsland	12	17	0	8	0	0	0	8	17	17	0	33	0
W Vic & SE SA	352	8	11	10	9	6	7	11	13	19	19	20	13
S SA	69	0	4	6	7	0	1	3	19	26	22	17	6
KI	38	5	16	13	13	5	0	0	0	26	24	13	11
WA	197	15	16	15	11	3	5	8	11	20	12	8	7
All regions	1239	7	10	10	9	5	7	10	18	21	15	14	8

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

A2.15.2 Crutching Ewes

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
SW & S Qld	52	12	23	19	17	15	8	13	6	8	6	10	10
GB & DD	14	7	0	0	7	21	14	14	14	21	21	0	0
New England	169	12	27	41	44	34	25	28	14	4	2	3	4
C & S Tablelands	173	14	20	26	21	21	18	18	14	12	16	16	13
S NSW & N Vic	160	12	26	23	18	15	13	14	14	15	21	18	12
Gippsland	12	8	8	25	25	33	33	33	33	25	25	17	8
W Vic & SE SA	347	10	18	28	25	20	19	21	18	20	20	16	10
S SA	69	10	20	41	35	28	35	33	35	30	14	6	9
KI	39	3	5	13	33	21	21	21	21	41	23	15	5
WA	186	3	10	16	19	11	9	8	16	33	18	6	3
All regions	1221	10	19	26	26	20	18	19	17	19	16	12	8

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

A2.16 Proportion of Respondents (%) Shearing and Crutching Wethers Each Month of the Year

A2.16.1 Shearing Wethers

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
SW & S Qld	48	8	8	8	13	19	19	21	17	19	10	2	8
GB & DD	20	35	15	20	15	10	10	15	25	35	35	35	10
New England	148	1	2	1	0	0	4	8	16	31	32	19	3
C & S Tablelands	131	6	6	7	8	8	8	8	13	22	18	18	7
S NSW & N Vic	88	6	15	14	13	8	8	10	18	18	7	13	7
Gippsland	9	0	0	0	0	0	0	11	22	11	11	44	0
W Vic & SE SA	253	6	13	9	7	7	11	9	16	22	17	19	9
S SA	38	3	5	5	8	3	5	0	18	13	18	21	5
KI	34	6	15	12	15	6	0	0	3	24	24	12	9
WA	141	8	11	8	8	3	4	11	20	23	13	9	6
All regions	910	6	9	8	7	6	8	9	16	23	18	16	7

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

A2.16.2 Crutching Wethers

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
SW & S Qld	44	20	25	25	18	16	9	9	7	9	7	14	16
GB & DD	20	15	15	15	20	50	40	40	25	20	30	10	5
New England	136	4	13	22	29	30	25	24	13	9	3	3	2
C & S Tablelands	129	11	16	19	19	15	19	16	18	14	16	12	12
S NSW & N Vic	87	13	28	22	16	15	13	16	13	10	20	22	15
Gippsland	9	11	11	22	22	22	33	22	0	11	0	0	0
W Vic & SE SA	245	10	16	21	22	20	20	20	21	17	18	13	10
S SA	36	14	11	28	28	19	22	19	17	31	19	11	19
KI	33	3	6	15	27	12	9	15	12	36	24	21	6
WA	130	1	7	18	25	8	8	8	12	24	12	4	1
All regions	869	9	15	21	23	19	18	17	16	17	14	11	9

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

A2.17 Proportion of Respondents (%) Shearing and Crutching Weaners (Less than 12 Months) Each Month of the Year

A2.17.1 Shearing Weaners

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
SW & S Qld	48	8	8	8	13	19	19	21	17	19	10	2	8
GB & DD	20	35	15	20	15	10	10	15	25	35	35	35	10
New England	148	1	2	1	0	0	4	8	16	31	32	19	3
C & S Tablelands	131	6	6	7	8	8	8	8	13	22	18	18	7
S NSW & N Vic	88	6	15	14	13	8	8	10	18	18	7	13	7
Gippsland	9	0	0	0	0	0	0	11	22	11	11	44	0
W Vic & SE SA	253	6	13	9	7	7	11	9	16	22	17	19	9
S SA	38	3	5	5	8	3	5	0	18	13	18	21	5
KI	34	6	15	12	15	6	0	0	3	24	24	12	9
WA	141	8	11	8	8	3	4	11	20	23	13	9	6
All regions	910	6	9	8	7	6	8	9	16	23	18	16	7

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

A2.17.2 Crutching Weaners

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
SW & S Qld	44	20	25	25	18	16	9	9	7	9	7	14	16
GB & DD	20	15	15	15	20	50	40	40	25	20	30	10	5
New England	136	4	13	22	29	30	25	24	13	9	3	3	2
C & S Tablelands	129	11	16	19	19	15	19	16	18	14	16	12	12
S NSW & N Vic	87	13	28	22	16	15	13	16	13	10	20	22	15
Gippsland	9	11	11	22	22	22	33	22	0	11	0	0	0
W Vic & SE SA	245	10	16	21	22	20	20	20	21	17	18	13	10
S SA	36	14	11	28	28	19	22	19	17	31	19	11	19
KI	33	3	6	15	27	12	9	15	12	36	24	21	6
WA	130	1	7	18	25	8	8	8	12	24	12	4	1
All regions	869	9	15	21	23	19	18	17	16	17	14	11	9

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

A2.18 Proportion of respondents (%) putting rams with ewes each month of the year in 2003

A2.18.1 Merino mated to Merino rams

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
SW & S Qld	39	13	15	21	23	18	3	3	0	0	3	3	0
GB & DD	7	0	0	14	14	43	29	0	0	0	0	0	0
New England	140	0	2	6	53	35	4	1	0	0	0	0	0
C & S Tablelands	113	6	10	34	21	2	0	0	0	0	2	12	14
S NSW & N Vic	93	13	15	27	8	1	0	0	0	0	4	15	17
Gippsland	7	0	14	29	14	14	0	0	0	0	0	0	29
W Vic & SE SA	215	8	12	20	15	1	0	0	1	0	3	17	20
S SA	45	18	18	2	2	0	0	0	0	0	9	29	22
KI	32	25	31	3	0	0	0	0	0	0	0	13	28
WA	173	26	20	2	0	1	0	0	0	0	2	16	34
All regions	864	12	13	15	17	8	1	0	0	0	2	13	18

Chisquare =704.20, d.f. = 90, p<0.0005. 62 cells (56.4%) have expected counts less than 5.

A2.18.2 Merino mated to Meat breed rams

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
SW & S Qld	11	0	36	27	27	9	0	0	0	0	0	0	0
GB & DD	4	0	0	0	50	0	25	0	0	0	0	0	25
New England	47	0	4	15	62	17	0	0	0	2	0	0	0
C & S Tablelands	54	15	17	20	6	0	0	0	0	0	0	22	20
S NSW & N Vic	62	18	16	8	3	0	0	0	0	0	10	31	15
Gippsland	3	0	0	0	0	33	0	0	0	0	0	33	33
W Vic & SE SA	162	15	7	9	6	1	0	1	0	0	5	22	34
S SA	39	15	5	3	0	0	0	0	0	5	31	8	33
KI	24	25	21	0	0	0	0	0	0	0	0	17	38
WA	82	27	16	0	1	0	0	1	0	0	6	18	30
All regions	488	16	11	8	10	2	0	0	0	1	6	18	25

Chisquare =511.52, d.f. = 90, p<0.0005. 77 cells (70.0%) have expected counts less than 5.

A2.18.3 Cross-bred ewes

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
SW & S Qld	4	0	50	0	0	25	0	0	25	0	0	0	0
GB & DD	1	0	100	0	0	0	0	0	0	0	0	0	0
New England	34	0	6	29	59	3	3	0	0	0	0	0	0
C & S Tablelands	47	17	15	13	2	0	2	0	0	0	2	28	21
S NSW & N Vic	47	26	11	4	0	0	0	0	0	0	13	26	21
Gippsland	4	50	0	0	0	0	0	0	0	0	25	25	0
W Vic & SE SA	137	15	13	7	3	1	0	0	0	0	6	18	38
S SA	17	12	6	6	0	0	0	0	0	0	12	24	41
KI	8	38	25	0	0	0	0	0	0	0	0	13	25
WA	7	14	29	0	0	0	0	0	14	0	0	14	29
All regions	306	16	13	9	8	1	1	0	1	0	6	18	27

Chisquare =303.64, d.f. = 81, p<0.0005. 82 cells (82.0%) have expected counts less than 5.

A2.19 Marking percentages in 2003 compared to a typical year

A2.19.1 Merino ewes mated to Merino rams

Region	n	Proportion of respondents (%)								
		2003 < typical			2003 = typical			2003 > typicalt		
SW & S Qld	39	64	**77**	90	1	10	20	2	13	23
GB & DD	5	0	40	83	0	40	83	0	20	55
New England	136	36	44	52	20	27	35	21	29	36
C & S Tablelands	118	63	**71**	79	9	16	23	7	**13**	19
S NSW & N Vic	89	59	**69**	78	3	**9**	15	14	22	31
Gippsland	7	20	57	94	0	14	40	0	29	62
W Vic & SE SA	198	48	55	62	19	25	31	14	20	25
S SA	41	26	41	57	11	24	38	20	34	49
KI	28	21	39	57	15	32	49	12	29	45
WA	167	19	**26**	32	24	**31**	38	36	**44**	51
All Regions	828	47	51	54	20	23	26	23	26	29

Chisquare = 100.43, d.f. = 18, p < 0.0005. 6 cells (20.0%) have expected counts less than 5.

A2.19.2 Merino ewes mated to meat breed rams

Region	n	Proportion of respondents (%)								
		2003 < typical			2003 = typical			2003 > typicalt		
SW & S Qld	8	29	63	96	0	13	35	0	25	55
GB & DD	4	1	50	99	0	25	67	0	25	67
New England	39	28	44	59	12	26	39	16	31	45
C & S Tablelands	53	55	68	80	10	21	32	3	11	20
S NSW & N Vic	59	42	54	67	13	24	35	11	22	33
Gippsland	3	100	100	100	0	0	0	0	0	0
W Vic & SE SA	145	35	43	52	28	36	44	14	21	27
S SA	36	16	31	46	16	31	46	23	39	55
KI	22	16	36	56	29	50	71	0	14	28
WA	76	24	34	45	28	39	50	16	26	36
All Regions	445	41	46	50	27	32	36	19	23	27

Chisquare =34.43, d.f. = 18, p = 0.011. 10 cells (33.3%) have expected counts less than 5.

A2.19.3 Cross-bred ewes

Region	n	Proportion of respondents (%)								
		2003 < typical			2003 = typical			2003 > typicalt		
SW & S Qld	2	100	100	100	0	0	0	0	0	0
GB & DD	1	100	100	100	0	0	0	0	0	0
New England	31	28	45	63	13	29	45	10	26	41
C & S Tablelands	39	33	49	64	16	31	45	8	21	33
S NSW & N Vic	41	49	63	78	11	24	38	2	12	22
Gippsland	5	100	100	100	0	0	0	0	0	0
W Vic & SE SA	119	32	40	49	34	43	52	10	17	24
S SA	16	14	38	61	4	25	46	14	38	61
KI	6	0	17	46	0	33	71	10	50	90
WA	8	0	25	55	29	63	96	0	13	35
All Regions	268	40	46	52	29	35	40	14	19	24

Chisquare = 29.44, d.f. = 18, p = 0.043. 16 cells (33.3%) have expected counts less than 5.

A2.20 Proportion of Respondents (%) Feeding Ewes and Weaners Each Month of the Year

A2.20.1 Ewes

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
SW & S Qld	20	5	5	15	20	30	65	80	90	55	40	20	10
GB & DD	8	0	0	13	13	50	88	100	88	88	75	25	0
New England	112	8	8	13	18	28	54	87	94	65	21	10	8
C & S Tablelands	124	32	50	63	73	73	58	54	43	23	6	4	7
S NSW & N Vic	133	26	63	77	86	78	56	34	20	6	4	3	5
Gippsland	5	20	20	40	80	60	80	80	80	80	20	20	20
W Vic & SE SA	252	35	64	82	88	79	56	34	24	9	2	3	7
S SA	43	19	42	65	79	79	49	21	9	5	5	2	5
KI	32	38	81	84	81	59	13	0	0	0	0	0	9
WA	190	41	61	83	93	86	58	18	5	1	1	2	5
All regions	919	30	52	67	75	71	55	40	31	17	7	4	7

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

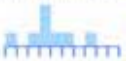
A2.20.2 Weaners

Region	n	J	F	M	A	M	J	J	A	S	O	N	D
SW & S Qld	12	8	17	17	17	25	67	75	83	58	25	8	8
GB & DD	5	0	0	0	0	40	80	100	80	80	60	0	0
New England	70	13	14	19	27	39	70	94	96	70	26	11	10
C & S Tablelands	104	53	69	79	82	73	52	39	29	18	6	3	11
S NSW & N Vic	95	51	75	80	79	66	42	25	16	5	5	5	16
Gippsland	6	50	50	67	67	67	67	67	67	67	50	33	33
W Vic & SE SA	187	57	80	89	91	77	51	31	19	7	2	6	17
S SA	20	60	70	70	90	85	40	15	10	5	5	5	10
KI	27	52	89	100	96	70	15	0	0	0	0	4	19
WA	163	56	73	87	90	82	50	13	4	1	2	8	21
All regions	689	49	67	76	79	71	50	34	25	15	7	7	16

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

A2.21 Duration of feeding period (months)

A2.21.1 Ewes

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	20	2	4	7	4	1	
GB & DD	8	2	5	9	5	2	
New England	110	1	3	12	4	0	
C & S Tablelands	123	1	5	12	5	0	
S NSW & N Vic	132	1	4	12	5	0	
Gippsland	5	2	6	12	6	5	
W Vic & SE SA	248	1	5	12	5	0	
S SA	43	1	3	12	4	1	
KI	32	1	4	6	4	0	
WA	186	1	5	12	5	0	
All Regions	907	1	4	12	5	0	

Histogram class limits: 1.0-2.1-3.2-4.3-5.4-6.5-7.6-8.7-9.8-10.9-12.0.
Anova: F=3.41, d.f.=9, p <0.0005.

A2.21.2 Weaners

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	12	2	4	7	4	1	
GB & DD	5	2	5	6	4	2	
New England	69	1	4	12	5	1	
C & S Tablelands	103	1	5	12	5	0	
S NSW & N Vic	94	1	5	9	5	0	
Gippsland	6	4	5	12	7	4	
W Vic & SE SA	187	1	5	12	5	0	
S SA	20	1	5	12	5	1	
KI	27	3	4	7	4	0	
WA	159	1	5	12	5	0	
All Regions	682	1	5	12	5	0	

Histogram class limits: 1.0-2.1-3.2-4.3-5.4-6.5-7.6-8.7-9.8-10.9-12.0.
Anova: F=1.98, d.f.=9, p = 0.039.

A2.22 Worm Control, September 2002 – December 2003

A2.22.1 Proportion of treatments (%) of unweaned lambs in each month of the year

Region	n*	J	F	M	A	M	J	J	A	S	O	N	D
SW & S Qld	16	0	19	0	6	0	0	0	0	6	6	6	56
GB & DD	10	20	30	0	0	0	0	0	0	0	10	20	20
New England	126	17	13	1	4	0	0	0	1	1	8	24	32
C & S Tablelands	84	5	2	1	2	1	7	11	11	14	20	17	8
S NSW & N Vic	55	2	4	2	4	2	5	20	9	20	9	18	5
Gippsland	5	0	0	0	0	0	0	0	60	0	20	0	20
W Vic & SE SA	167	2	4	1	1	2	9	17	11	20	10	8	15
S SA	22	0	0	0	5	0	14	45	5	27	0	0	5
KI	24	0	0	0	0	4	0	38	13	33	13	0	0
WA	28	4	0	0	4	4	11	14	21	21	4	0	18
All regions	537	6	6	1	2	1	6	13	9	15	10	13	17

** number of treatments.*

A2.22.2 Proportion of treatments (%) of weaners in each month of the year

Region	n*	J	F	M	A	M	J	J	A	S	O	N	D
SW & S Qld	54	11	19	9	13	4	11	6	7	6	6	7	2
GB & DD	23	9	4	13	13	4	9	4	17	0	9	9	9
New England	360	12	11	11	13	8	8	5	8	8	5	5	6
C & S Tablelands	303	5	12	9	4	4	7	5	5	9	7	15	18
S NSW & N Vic	244	5	15	3	3	7	3	10	7	9	8	15	14
Gippsland	22	9	5	9	5	5	5	9	5	9	5	27	9
W Vic & SE SA	561	8	11	8	6	7	6	5	7	6	9	11	17
S SA	90	9	7	7	2	1	6	16	2	16	6	16	14
KI	78	14	13	4	5	4	6	6	1	14	13	6	13
WA	255	12	5	5	5	2	3	2	5	9	14	16	20
All regions	1990	9	11	8	7	6	6	6	6	8	8	12	14

** number of treatments.*

A2.22.3 Products used – unweaned lambs

Active constituent(s)	Proportion of treatments (%)
Drench not specified	1.1
Cobalt	0.2
Selenium	0.2
Broadspectrum	0.2
BZ unspecified	2
BZ Albendazole	5.6
BZ Fenbendazole	0.4
BZ Oxfendazole	0.2
Clear not specified	1.1
Levamisole	5.4
ML non specified	0.7
ML Abamectin	1.7
ML Ivermectin	13.5
ML Moxidectin	31.9
Naphthalophos	0.2
Closantel	2.8
Triclabendazole	0.6
White + tape	0.2
Clear + tape	0.2
Levamisole + BZ	10.9
Firstdrench + tape	0.4
ML Cydectin + tapeworm	0.9
ML Cydectin + selenium	1.1
Cydectin + Levamisole	0.4
Mineral drench + Ivomectin	0.2
Rametin + BZ	0.6
Rametin + Albendazole	0.6
Rametin + Levamisole	0.4
Closantel + Albendazole	1.3
Closantel + Oxfendazole	0.4
Praziquantel + Abamectin	6.3
Praziquantel + Levamisole	6.1
Ivermectin + Levamisole + BZ	1.5
Triton + Cydectin	0.2
Rametin + Levamisole + BZ	0.4
Ivomec + Praziquantel + Levamisole	0.2
Triton + Closantel	0.4

A2.22.4 Products used – weaners

Active constituent(s)	Proportion of treatments (%)
Drench not specified	1.1
Alternative	0.3
Selenium	0.1
Broadspectrum	0.1
BZ unspecified	1.7
BZ unspecified capsule	0.2
BZ Albendazole	2.5
BZ Albendazole –capsules	0.4
BZ Fenbendazole	0.4
BZ Mebendazole	0.1
BZ Oxfendazole	0.1
Clear not specified	1.1
Levamisole	5.8
ML non specified	1.3
ML Abamectin	2.4
ML Ivermectin	19.6
ML Ivermectin – capsule	0.8
ML Moxidectin	32.8
Naphthalophos	1.9
Closantel	2.2
Triclabendazole	1.2
Combination unspecified	0.3
Oxyclosanide + Levamisole	0.1
Levamisole + unspecified	0.1
Levamisole + BZ	9.0
Levamisole + Albendazole	0.1
Levamisole + Fenbendazole	0.6
Firstdrench + tape	0.1
Ivermectin + white	0.1
ML Cydectin + tapeworm	0.2
ML Cydectin + selenium	0.6
Cydectin + combination	0.2
Cydectin + Fasinex	0.3
Cydectin + Rametin	0.1
Cydectin + Levamisole	0.2
Mineral drench + Ivomectin	0.1
ivermectin + Fasinex	0.1
Cydectin + Closantel	0.1
Rametin + combination unspecified	0.5
Rametin + BZ	1.6
Rametin + Albendazole	0.9
Rametin + Levamisole	1.9
Rametin + Oxfenendazole	0.1
Closantel + Albendazole	0.6
Closantel + Oxfendazole	0.1
Closantal + Levamisole	0.1
Praziquantel + Abamectin	2.0
Praziquantel + Levamisole	1.0
Ivermectin + Levamisole + BZ	2.2
Ivermectin + Ramatin + white	0.2

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Products used – weaners (contd)

Active constituent(s)	Proportion of treatments (%)
Cydectin + BZ +Levamisole	0.2
Rametin + Cydectin + Levamisole	0.1
Rametin + Levamisole + BZ	0.8
Closantel + Levamisole + BZ	0.1
Praziquantel + Levamisole + Febendazole	0.1
Abamectin + Albendazole + Levamisole + Closantel	0.2

A2.22.5 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
SW & S Qld	48	4	13	8	6	2	10	6	10	10	8	13	8
GB & DD	19	16	0	11	16	0	0	5	21	5	5	11	11
New England	299	13	12	8	7	6	3	2	8	16	7	8	9
C & S Tablelands	280	6	13	9	4	4	5	8	6	6	9	15	14
S NSW & N Vic	180	11	15	7	6	4	3	6	7	3	2	21	17
Gippsland	18	0	6	11	6	6	6	6	0	11	6	28	17
W Vic & SE SA	479	11	11	8	6	4	8	7	7	5	4	14	16
S SA	72	15	15	11	6	3	6	4	3	7	0	8	22
KI	70	23	11	4	4	6	9	16	6	10	3	3	6
WA	179	20	9	6	8	4	5	2	3	6	5	10	22
All regions	1644	12	12	8	6	4	5	6	6	8	5	13	15

* *number of treatments.*

A2.22.6 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
SW & S Qld	64	6	13	8	6	2	8	8	11	9	9	6	14
GB & DD	27	15	4	7	15	7	0	4	19	4	7	11	7
New England	399	11	11	7	10	6	3	2	9	16	6	9	10
C & S Tablelands	323	4	12	9	4	3	6	9	7	7	9	14	16
S NSW & N Vic	220	11	15	10	5	4	2	4	6	5	2	19	18
Gippsland	29	3	7	10	3	3	7	7	3	7	3	34	10
W Vic & SE SA	627	10	10	8	6	5	7	9	7	4	5	13	16
S SA	101	18	11	11	7	4	7	6	0	9	2	9	17
KI	84	20	12	4	5	6	8	14	5	13	4	4	6
WA	199	19	8	9	10	4	4	4	4	7	4	6	24
All regions	2073	11	11	8	7	5	5	6	7	8	5	12	15

* *number of treatments.*

A2.22.7 Products used – maiden ewes

Active constituent(s)	Proportion of treatments (%)
Drench not specified	0.7
Alternative	0.3
Cobalt	0.1
Broadspectrum	0.1
BZ unspecified	1.4
BZ unspecified capsule	0.2
BZ Albendazole	1.9
BZ Albendazole –capsules	0.2
BZ Fenbendazole	0.2
BZ Oxfendazole	0.1
Clear not specified	1.2
Levamisole	6.6
ML non specified	1.1
ML Abamectin	1.8
ML Ivermectin	17.9
ML Ivermectin – capsule	1.1
ML Moxidectin	31.9
Naphthalophos	2.0
Closantel	3.4
Triclabendazole	1.6
Combination unspecified	0.1
Oxyclosanide + Levamisole	0.1
Levamisole + BZ	10.7
Levamisole + Albendazole	0.3
Levamisole + Fenbendazole	0.7
ML + Closantel	0.1
ML Cydectin + tapeworm	0.2
ML Cydectin + selenium	0.4
Cydectin + combination	0.2
Cydectin + Fasinex	0.1
Cydectin + Rametin	0.2
Cydectin + Levamisole	0.9
Cydectin + Closantel	0.1
ivermectin + combination unspecified	0.1
Rametin + combination unspecified	0.4
Rametin + BZ	1.3
Rametin + Albendazole	0.7
Rametin + Levamisole	2.2
Rametin + Oxfenendazole	0.1
Rametin + Closantel	0.1
Closantel + Albendazole	0.7
Closantel + Oxfendazole	0.3
Closantal + Levamisole	0.1
Closantel + Triclabendazole	0.1
Closantal + Abamectin	0.1
Closantal + Fasinex	0.1
Praziquantel + Abamectin	1.1
Ivermectin + Levamisole + BZ	2.6
Ivermectin + Ramatin + white	0.3
Cydectin + BZ +Levamisole	0.1

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Products used –maiden ewes (contd)

Active constituent(s)	Proportion of treatments (%)
Rametin + Cydectin + Levamisole	0.1
Rametin + Levamisole + BZ	1.1
Closantel + Levamisole + BZ	0.1
Rametin + BZ + Closantel	0.1
Rametin + Levamisole + Closantel	0.1
Praziquantel + Abamectin + Levamisole	0.1
Abamectin + Albendazole + Levamisole + Closantel	0.2

A2.22.8 Products used – adult ewes

Active constituent(s)	Proportion of treatments (%)
Drench not specified	1.0
Alternative	0.3
Cobalt	0.0
Broadspectrum	0.0
BZ unspecified	1.3
BZ unspecified capsule	0.1
BZ Albendazole	2.5
BZ Albendazole –capsules	0.3
BZ Fenbendazole	0.2
BZ Oxfendazole	0.0
Clear not specified	1.2
Levamisole	6.3
ML non specified	0.9
ML Abamectin	2.0
ML Ivermectin	17.6
ML Ivermectin – capsule	1.0
ML Moxidectin	32.9
Naphthalophos	2.0
Closantel	3.4
Triclabendazole	2.1
Combination unspecified	0.1
Oxyclosanide + Levamisole	0.3
Levamisole + BZ	9.9
Levamisole + Albendazole	0.2
Levamisole + Fenbendazole	0.6
Levamisole + Fasinex	0.1
ML + Closantel	0.0
ML Cydectin + tapeworm	0.0
ML Cydectin + selenium	0.7
Cydectin + combination	0.3
Cydectin + Fasinex	0.1
Cydectin + Rametin	0.1
Cydectin + Levamisole	0.5
Mineral drench + Ivomectin	0.1
Ivermectin + combination unspecified	0.1
Ivermectin + Levamisole	0.1
Rametin + combination unspecified	0.3
Rametin + BZ	0.9

table continued on next page

Products used – adult ewes (contd)

Active constituent(s)	Proportion of treatments (%)
Rametin + Albendazole	1.0
Rametin + Levamisole	1.8
Rametin + Oxfenendazole	0.0
Rametin + Closantel	0.0
Closantel + BZ	0.0
Closantel + Albendazole	0.6
Closantel + Oxfendazole	0.3
Closantal + Levamisole	0.1
Closantal + Abamectin	0.0
Praziquantel + Abamectin	1.6
Praziquantel + Levamisole	0.0
Ivermectin + Levamisole + BZ	2.6
Triton + Cydectin	0.0
Ivermectin + Ramatin + white	0.2
Cydectin + BZ +Levamisole	0.0
Rametin + Levamisole + BZ	0.8
Rametin + Levamisole + Vasinex	0.0
Closantel + Levamisole + BZ	0.0
Rametin + BZ + Closantel	0.1
Rametin + Levamisole + Closantel	0.0
Praziquantel + Abamectin + Levamisole	0.1
Abamectin + Albendazole + Levamisole + Closantel	0.1

Note: due to rounding some percentages may show as zero that are actually non-zero percentages less than 0.05 per cent.

A2.22.9 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
SW & S Qld	49	4	16	4	8	6	10	4	12	14	6	8	6
GB & DD	39	13	8	13	10	5	3	3	13	13	5	13	3
New England	270	11	11	8	8	8	5	2	7	13	8	11	9
C & S Tablelands	202	4	15	11	4	3	4	5	2	6	9	15	19
S NSW & N Vic	115	11	19	6	7	3	2	5	3	3	1	19	20
Gippsland	16	0	0	13	6	6	6	0	6	13	0	38	13
W Vic & SE SA	310	10	12	11	4	4	3	4	4	5	4	18	21
S SA	26	19	8	0	4	4	4	4	4	8	0	0	46
KI	50	30	14	4	2	4	6	8	10	6	6	2	8
WA	96	18	8	7	6	4	3	2	4	7	3	8	28
All regions	1173	11	13	9	6	5	4	4	5	8	5	14	17

* *number of treatments.*

A2.22.10 Products used – wethers

Active constituent(s)	Proportion of treatments (%)
Drench not specified	1.60
Alternative	0.20
Broadspectrum	0.10
BZ unspecified	1.00
BZ unspecified capsule	0.10
BZ Albendazole	2.20
BZ Fenbendazole	0.10
BZ Oxfendazole	0.10
Clear not specified	1.40
Levamisole	9.20
ML non specified	1.30
ML Abamectin	2.10
ML Ivermectin	15.60
ML Moxidectin	32.00
Naphthalophos	2.50
Closantel	4.60
Triclabendazole	2.00
Combination unspecified	0.20
Oxyclosanide + Levamisole	0.30
Levamisole + BZ	9.50
Levamisole + Albendazole	0.20
Levamisole + Fenbendazole	0.50
Levamisole + Fasinex	0.10
ML Cydectin + selenium	0.40
Cydectin + combination	0.30
Cydectin + Closantel	0.50
Cydectin + Fasinex	0.30
Cydectin + Rametin	0.20
Cydectin + Ivermectin	0.10
Cydectin + Levamisole	0.50
Cydectin + Closantel	0.10
Ivermectin + combination unspecified	0.20
Rametin + combination unspecified	0.30
Rametin + BZ	1.20
Rametin + Albendazole	1.00
Rametin + Levamisole	1.70
Rametin + Oxfenendazole	0.20
Closantel + Albendazole	0.50
Closantel + Oxfendazole	0.30
Closantal + Levamisole	0.10
Closantal + Fasinex	0.10
Praziquantel + Abamectin	1.50
Ivermectin + Levamisole + BZ	2.10
Ivermectin + Ramatin + white	0.30
Cydectin + BZ +Levamisole	0.10
Cydectin + Closantel +Ivomectin	0.10
Rametin + Levamisole + BZ	1.20
Closantel + Levamisole + BZ	0.10
Rametin + BZ + Closantel	0.10
Abamectin + Albendazole + Levamisole + Closantel	0.10

A2.22.11 Drenching of newly introduced sheep

Region	n	Proportion buying sheep (%)		
SW & S Qld	62	63	74	85
GB & DD	22	79	91	103
New England	173	50	58	65
C & S Tablelands	177	50	58	65
SW NSW & NE Vic	167	56	63	70
Gippsland	12	30	58	86
W Vic & SE SA	369	57	62	66
S SA	69	43	55	67
KI	41	49	63	78
WA	200	42	**49**	55
All regions	1292	57	59	62

Chisquare =27.30, d.f. = 9, p = 0.001.

A2.22.12 Products used to drench newly arrived sheep

Active constituent(s)	Proportion of respondents (%)
Drench not specified	5.00
Alternative	0.20
Broadspectrum	0.70
BZ unspecified	0.30
BZ Albendazole	0.80
BZ Thiabendazole	0.20
Clear not specified	0.70
Levamisole	1.30
ML non specified	3.20
ML Abamectin	0.70
ML Ivermectin	23.80
ML Moxidectin	40.60
Naphthalophos	0.50
Closantel	0.80
Triclabendazole	0.20
Fasinex + Oxyclosanide + Levamisole	0.20
Combination unspecified	1.30
Oxyclosanide + Levamisole	0.20
Levamisole + BZ	1.20
Levamisole + Fenbendazole	0.20
ML + Fasinex	0.20
ML + BZ	0.20
ML Cydectin + selenium	0.70
Cydectin + combination	1.20
Cydectin + Closantel	0.50
Cydectin + Fasinex	0.30
Cydectin + mineral	0.20
Cydectin + Rametin	0.80
Cydectin + Ivermectin	1.70

Products used to drench newly arrived sheep (contd)

Active constituent(s)	Proportion of respondents (%)
Cydectin + Levamisole	1.50
Mineral drench + Ivomectin	0.20
Ivermectin + Fasinex	0.50
Ivermectin + combination unspecified	0.20
Ivermectin + Levamisole	0.20
Ivermectin + Closantel	0.50
Rametin + BZ	0.80
Rametin + Levamisole	0.30
Rametin + Oxfenendazole	0.20
Closantel + Albendazole	0.50
Closantal + Fasinex	0.20
Praziquantel + Abamectin	1.20
Ivermectin + Levamisole + BZ	5.70
Triton + Rametin	0.20
Triton + Fasinex	0.20
Triton + Q drench	0.20
Cydectin + Rametin + BZ (eg Valbazen)	0.30
Cydectin + Rametin + BZ (eg Valbazen) +SE	0.20
Cydectin + BZ +Levamisole	1.00
Cydectin + Closantel +Ivomectin	0.20
Rametin + BZ + Closantel	0.20
Abamectin + Albendazole + Levamisole + Closantel	1.50
Ivermectin + Rametin + BZ + Fasinez	0.20
Cydectin + Triton	0.20
Cydectin + Ramatin + BZ + Levamisole	0.70

Note: due to rounding some percentages may show as zero that are actually non-zero percentages less than 0.05 per cent.

A2.22.13 Number of times worm egg counts typically monitored – weaners

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	22	1	2	7	2.3	0.7	
GB & DD	3	2	3	6	3.7	5.2	
New England	87	1	3	43	4.3	1.1	
C & S Tablelands	77	1	2	26	3.4	0.8	
S NSW & N Vic	53	1	2	12	2.2	0.5	
Gippsland	6	1	2	3	2.0	0.7	
W Vic & SE SA	127	1	2	12	2.8	0.3	
S SA	21	1	2	12	3.1	1.5	
KI	14	1	3	10	3.4	1.4	
WA	61	1	2	8	2.1	0.4	
All Regions	471	1	2	43	3.0	0.3	

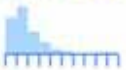
Histogram class limits: 1.0-1.9-2.8-3.7-4.6-5.5-6.4-7.3-8.2-9.1-10.0.
Kruskal-Wallis: $\chi 2=37.29$, d.f.=9, $p<0.0005$.
***Note**: respondents monitoring more than 10 times (12) have been excluded from the histograms (and **only** from the histograms) to prevent the size distribution being reduced to a single bar, due to the influence of the small number of respondents monitoring very frequently.*

A2.22.14 Number of times worm egg counts typically monitored – wethers

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	19	1	2	12	3.1	1.3	
GB & DD	13	1	5	25	5.7	3.7	
New England	61	1	3	12	3.0	0.6	
C & S Tablelands	42	1	2	13	2.4	0.7	
S NSW & N Vic	27	1	1	24	2.4	1.8	
Gippsland	5	1	1	3	1.6	1.1	
W Vic & SE SA	73	1	2	12	2.4	0.5	
S SA	5	1	2	5	2.4	2.1	
KI	11	1	2	5	2.5	0.8	
WA	23	1	2	4	2.0	0.4	
All Regions	279	1	2	25	2.7	0.3	

Histogram class limits: 1.0-1.9-2.8-3.7-4.6-5.5-6.4-7.3-8.2-9.1-10.0.
Kruskal-Wallis: $\chi 2=28.34$, d.f.=9, $p=0.001$.
***Note**: respondents monitoring more than 10 times (6) have been excluded from the histograms (and **only** from the histograms) to prevent the size distribution being reduced to a single bar, due to the influence of the small number of respondents monitoring very frequently.*

A2.22.15 Number of times worm egg counts typically monitored – adult ewes

Region	n	Minimum	Median	Maximum	Mean	95% CI	Histogram
SW & S Qld	24	1	2	12	3.1	1.0	
GB & DD	7	2	3	7	3.7	1.9	
New England	94	1	3	15	3.4	0.6	
C & S Tablelands	76	1	2	17	2.7	0.5	
S NSW & N Vic	51	1	1	6	1.6	0.3	
Gippsland	8	1	2	3	1.8	0.6	
W Vic & SE SA	131	1	2	12	2.5	0.3	
S SA	24	1	2	7	1.9	0.6	
KI	14	1	3	5	2.9	0.8	
WA	57	1	1	6	1.8	0.3	
All Regions	486	1	2	17	2.6	0.2	

Histogram class limits: 1.0-1.9-2.8-3.7-4.6-5.5-6.4-7.3-8.2-9.1-10.0.
Kruskal-Wallis: $\chi 2=56.07$, d.f.=9, $p<0.0005$.
***Note**: respondents monitoring more than 10 times (6) have been excluded from the histograms (and **only** from the histograms) to prevent the size distribution being reduced to a single bar, due to the influence of the small number of respondents monitoring very frequently.*

A2.22.16 Monitoring frequency in 2003 compared to typical frequency – weaners

Region	n	Proportion of respondents (%)								
		2003 < typical			2003 = typical			2003 > typicalt		
SW & S Qld	19	0	5	15	76	89	103	0	5	15
GB & DD	1	0	0	0	100	100	100	0	0	0
New England	85	0	1	3	97	99	101	0	0	0
C & S Tablelands	76	0	0	0	94	97	101	0	3	6
S NSW & N Vic	49	0	2	6	94	98	102	0	0	0
Gippsland	6	0	17	46	54	83	113	0	0	0
W Vic & SE SA	125	4	10	15	85	90	96	0	0	0
S SA	20	0	0	0	85	95	105	0	5	15
KI	14	0	0	0	100	100	100	0	0	0
WA	57	0	2	5	92	96	101	0	2	5
All Regions	452	2	4	6	93	95	97	0	1	2

$\chi 2 = 32.10$, d.f. = 18, $p = 0.021$. 21 cells (70.0%) have expected counts less than 5.

A2.22.17 Monitoring frequency in 2003 compared to typical frequency – wethers

Region	n	Proportion of respondents (%)								
		2003 < typical			2003 = typical			2003 > typicalt		
SW & S Qld	17	0	6	17	83	94	105	0	0	0
GB & DD	11	0	9	26	74	91	108	0	0	0
New England	60	0	2	5	92	97	101	0	2	5
C & S Tablelands	41	0	2	7	93	98	102	0	0	0
S NSW & N Vic	27	0	0	0	100	100	100	0	0	0
Gippsland	5	0	0	0	100	100	100	0	0	0
W Vic & SE SA	73	0	4	9	89	95	100	0	1	4
S SA	4	0	0	0	100	100	100	0	0	0
KI	11	0	0	0	100	100	100	0	0	0
WA	22	0	9	21	79	91	103	0	0	0
All Regions	271	1	3	5	94	96	98	0	1	2

$\chi 2$ = 8.25, d.f. = 18, p =0.975. 22 cells (73.3%) have expected counts less than 5.

A2.22.18 Monitoring frequency in 2003 compared to typical frequency – adult ewes

Region	n	Proportion of respondents (%)								
		2003 < typical			2003 = typical			2003 > typicalt		
SW & S Qld	23	0	13	27	67	83	98	0	4	13
GB & DD	5	0	20	55	45	80	115	0	0	0
New England	93	0	1	3	97	99	101	0	0	0
C & S Tablelands	75	0	3	6	92	96	100	0	1	4
S NSW & N Vic	50	0	0	0	100	100	100	0	0	0
Gippsland	8	0	0	0	100	100	100	0	0	0
W Vic & SE SA	128	2	5	9	91	95	98	0	0	0
S SA	23	0	0	0	87	96	104	0	4	13
KI	14	0	0	0	100	100	100	0	0	0
WA	53	0	2	6	94	98	102	0	0	0
All Regions	472	2	3	5	94	96	98	0	1	1

$\chi 2$ = 31.86, d.f. = 18, p =0.023. 21 cells (70.0%) have expected counts less than 5.

A2.22.19 Recency of adoption of drench resistance testing

Region	n	Proportion of respondents who have tested for drench resistance in 2000 or more recently (%)		
SW & S Qld	11	74	91	108
GB & DD	8	15	50	85
New England	79	64	73	83
C & S Tablelands	73	56	67	78
SW NSW & NE Vic	60	49	62	74
Gippsland	8	45	75	105
W Vic & SE SA	153	59	67	74
S SA	32	36	53	70
KI	16	46	69	91
WA	100	52	62	72
All regions	540	62	66	70

$\chi 2$ =9.87, d.f. = 9, p = 0.361.

A2.22.20 Explanatory descriptions of worm control treatments and techniques

Prepare pastures by 'Smart grazing' – all regions

Explanatory description	Proportion of respondents (%)
Provide or move treated sheep to clean/ low risk pastures	14
Graze first/ in rotation/ alternate with cattle	23.3
Graze first with cattle & provide crop stubbles	4.7
Graze first with attle &/ or dry sheep	4.7
Graze first with dry sheep	7
Paddocks grazed by sheep given a capsule	4.7
Use rotational grazing incl. cell grazing	9.3
Spell pasture/ paddock	11.6
Shift after treatment onto crop stubbles	11.6
Can't use any grazing techniques	2.3
Nutrition/ grazing management/ good quality pasture	4.7
Give pre-lambing drench	2.3

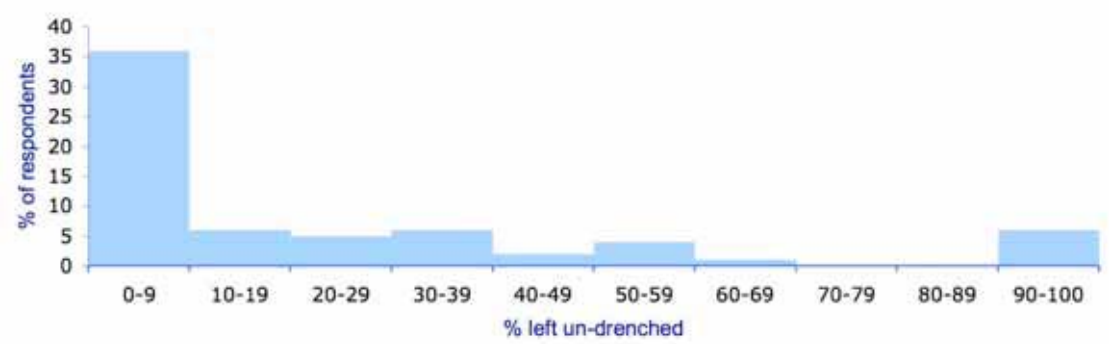
n=43

Prepare pastures by other grazing techniques – all regions

Explanatory description	Proportion of respondents (%)
Provide or move treated sheep to clean/ low risk pastures	9.8
Graze high risk pastures with dry sheep	2.0
Graze first/ in rotation/ alternate with cattle	25.5
Graze first with cattle & provide clean pastures	2.0
Graze first with cattle & provide crop stubbles	2.0
Graze first with cattle &/ or dry sheep	9.8
Graze cattle & sheep together	2.0
Graze first with dry sheep	13.7
Paddocks grazed by sheep given a capsule	2.0
Use rotational grazing incl. cell grazing	5.9
Spell pasture/ paddock	9.8
Change pasture/ paddock after treatment	2.0
Shift after treatment onto crop stubbles	3.9
Use/ shift after treatment onto fodder or standing crop	2.0
Avoid drenching onto crop stubbles	2.0
Use hay paddock	2.0
Avoid high stocking rate/ use low stocking rate	2.0
Use native pasture	2.0

n=51

Proportion of sheep left un-drenched at summer treatments – all regions



n=66, mean=21.29%

Feeding strategy – all regions

Explanatory description	Proportion of respondents (%)
Graze first/ in rotation/ alternate with cattle	7.7
Change pasture/ paddock after treatment	7.7
Shift after treatment onto crop stubbles	7.7
Keep feed availability high	7.7
Maintain condition score	38.5
Supplementary feed/ start feeding early	15.4
Feed in troughs	7.7
Nutrition/ grazing management/ good quality pasture	7.7
Graze first/ in rotation/ alternate with cattle	7.7
Change pasture/ paddock after treatment	7.7

n=13

Proportion respondents who used rams selected for worm resistance and rams were EBV tested

Across all regions, and among those respondents who used rams selected for worm resistance, 72.5 per cent indicated that the rams were EBV tested (n=120). There was no significant difference between regions.

Drenching – all regions

Explanatory description	Proportion of respondents (%)
Provide or move treated sheep to clean/ low risk pastures	4.7
Shift after treatment onto crop stubbles	4.7
Use minerals	2.3
Use strategic/ summer drenches	18.6
1-summer drench	7.0
2-summer drenches	7.0
Don't summer drench	2.3
Drench frequently	4.7
Drench as needed	9.3
Use correct dose rates	2.3
Use higher dose rates	2.3
Rotate chemicals	9.3
Monitor egg counts before drench	7.0
Assess when to drench visually (appearance of the sheep)	7.0
Don't drench much/ worms not a problem	4.7
Only drench weaners or lambs/ don't drench adult sheep	4.7
Give quarantine drench	2.3

n=43

Other treatments and techniques - all regions

Explanatory description	Proportion of respondents (%)
Provide or move treated sheep to clean/ low risk pastures	7.7
Graze first/ in rotation/ alternate with cattle	4.5
Graze first with cattle & provide crop stubbles	1.3
Graze first with dry sheep	0.6
Paddocks grazed by sheep given a capsule	1.9
Use rotational grazing incl. cell grazing	1.9
Spell pasture/ paddock	8.4
Spell lambing paddock	0.6
Change pasture/ paddock after treatment	0.6
Shift after treatment onto crop stubbles	13.5
Use/ shift after treatment onto fodder or standing crop	0.6
Use hay paddock	0.6
Graze crop stubbles	9.0
Avoid high stocking rate/ use low stocking rate	3.9
Use high stocking rate	0.6
Nutrition/ grazing management/ good quality pasture	5.2
Use minerals	8.4
Nutrition - especially vitamins	0.6

continued on next page

Other treatments and techniques - all regions (contd)

Explanatory description	Proportion of respondents (%)
Nutrition - organic	1.9
Monitor BWt	0.6
Use strategic/ summer drenches	2.6
Leave some sheep untreated at summer drench	0.6
Don't summer drench	0.6
Give pre-lambing drench	1.3
Use 'smart drenching' (~12 hrs off feed)	1.3
Rotate chemicals	3.2
Monitor egg counts before drench	1.9
Assess when to drench visually (appearance of the sheep)	1.9
Only drench tail of mob	0.6
Don't drench much/ worms not a problem	2.6
Only drench weaners or lambs/ don't drench adult sheep	2.6
Use some form of genetic strategy	1.9
Cull daggy sheep	0.6
Select low worm count sheep	0.6
Flock structure limits other control measures	1.3
Disaster & chaos - no other control possible	3.2

n=153