

# Participation in Lifetime Ewe Management results in changes in stocking rate, ewe management and reproductive performance on commercial farms

J. P. Trompf<sup>A,I</sup>, D. J. Gordon<sup>B,C</sup>, R. Behrendt<sup>B,H</sup>, M. Curnow<sup>D,H</sup>, L. C. Kildey<sup>C,E</sup>  
and A. N. Thompson<sup>B,F,G,H</sup>

<sup>A</sup>J. T. Agri-Source, Mill Park, Vic. 3082, Australia.

<sup>B</sup>Department of Primary Industries Victoria, Private Bag 105, Hamilton, Vic. 3300, Australia.

<sup>C</sup>Rural Industries Skills Training, Private Bag 105, Hamilton, Vic. 3300, Australia.

<sup>D</sup>Department of Agriculture and Food WA, 444 Albany Highway, Albany, WA 6330, Australia.

<sup>E</sup>Present address: Centre for Sustainable Agriculture, Goulburn Oven Institute of TAFE, Tone Road, Wangaratta, Vic. 3677, Australia.

<sup>F</sup>Present address: Department of Agriculture and Food Western Australia, 3 Baron-Hay Court, South Perth, WA 6151, Australia.

<sup>G</sup>Present address: School of Veterinary and Biomedical Sciences, Murdoch University, 90 South Street, Murdoch, WA 6150, Australia.

<sup>H</sup>CRC for Sheep Industry Innovation and the University of New England, Armidale, NSW 2351, Australia.

<sup>I</sup>Corresponding author. Email: j.trompf@latrobe.edu.au

**Abstract.** Lifetime Ewe Management is an extension program designed to assist sheep producers to improve their understanding of ewe nutrition and to develop the skills and confidence to improve their management. The course is based on a small-group extension model and was developed by the Lifetimewool project as a way to incorporate the research findings, economic modelling and producer guidelines developed by the project. Lifetime Ewe Management commenced in Victoria in the spring of 2006 and by the end of 2010, 221 producers had completed the 2-year program. The changes in knowledge, attitudes, skills, aspirations and management practices of 182 of these participants were examined. Participants of the Lifetime Ewe Management program increased their whole-farm stocking rates by 14%, increased lamb marking percentages by 11–13% depending on enterprise type, and decreased ewe mortality rates by 43%. These improvements resulted from a significant change in the perceived importance of managing ewes to condition-score targets to improve profitability and increases in the ability of participants to condition score ewes, assess pasture quantity and quality and feed budget. These changes were consistent regardless of how innovative the participants were at the beginning of the program. The appeal and success of the program was attributed largely to the small-group model where producers worked with their own flock under the guidance of a skilled facilitator and with access to effective decision-making tools. The Lifetime Ewe Management program design provides a blueprint for future extension programs striving to achieve widespread practice change.

## Introduction

The Australian sheep flock has declined substantially in the past 20 years, from over 170 million sheep in 1990 to ~70 million sheep (ABARE 2009), and the size of the flock has reached levels that could threaten the future of the sheep industry and established markets for lamb and sheep meat. At current turnoff rates of sheep, lambs and live exports, the national flock will continue to erode and the ability to meet projected demand for sheep meat requires a significant improvement in lamb marking rates (Curtis 2009). However, there has been little evidence of improved reproduction efficiency across the Australian sheep industry over the past 15 years, with the average marking rate remaining constant at 77% (Barnett 2007).

Many research and adoption programs have aimed to increase the reproductive efficiency of the sheep flock but have failed to

result in a widespread change in farming practices (reviewed by Barnett 2007). The key reasons for the lack of impact of these extension programs were attributed to several factors. These include limited content of programs focussing specifically on improving reproduction, the historic low comparative advantage of practices to improve reproduction and the very limited engagement and effective impact of the target audience. Furthermore, to successfully improve reproduction involves adoption of a complex set of management practices throughout different stages of the ewe reproduction cycle (Ferguson *et al.* 2011; Oldham *et al.* 2011). It is widely recognised that the more complex an innovation is to implement, the slower the rate that adoption will occur and that change will occur in the most innovative first and then be adopted by the less innovative customers (Rogers 2003). Moore (2002) argued that not only

will adoption of more complex processes be slower but that it is unlikely to occur in the majority of customers unless the processes ready to use and are seen as standard practice. The Lifetimewool project recognised that the challenge confronting the Australian sheep industry was to develop simple management guidelines and practical tools for producers and undertake targeted extension of this information to producers, which would enable them to implement these guidelines (Curnow *et al.* 2011).

The improved understanding of the impacts of ewe nutrition on ewe and progeny performance generated from the Lifetimewool project was used to develop guidelines for managing ewes that improve whole-farm profit and animal welfare (Curnow *et al.* 2011; Young *et al.* 2011). These guidelines were developed and extended through a range of approaches, including demonstration sites, workshops, practical training sessions and as well as field days on key farms as outlined by Curnow *et al.* (2011). The approaches included Lifetime Ewe Management, which is a 2-year, 'hands-on' education program for sheep producers. This program utilised an adult learning approach of experiential learning where participants learn skills through practice in the field as well as cognitive learning through information presentation and texts (Malouf 2003). This proved to be the most effective of the approaches tested. Jones *et al.* (2011) reported the results from a national survey which interviewed a random sample of 1200 sheep producers in 2008 and found that 90% of producers that had participated in Lifetime Ewe Management reported changing practices due to their involvement in the program, compared with 12% in the total survey population.

The present paper describes the Lifetime Ewe Management program and reports changes in participant's management practices and the associated changes in stocking rate, reproduction performance and ewe mortality. We also characterise who participated in the program and the components of the program that led to that change.

## Materials and methods

### *Lifetime Ewe Management*

Lifetime Ewe Management is a 2-year, 'hands-on' education program for sheep producers that is delivered as nationally accredited training by Rural Industries Skills Training, a registered training organisation in Victoria. The objectives of the program are to (i) improve producer understanding of the impact of ewe nutrition on ewe and progeny performance, (ii) develop producer skills and confidence to adopt the ewe management guidelines and (iii) enable producers to demonstrate on their property with their sheep that these guidelines are both practical and profitable. The key skills that participants repeatedly practice in the program include condition scoring, assessment of pasture quantity and quality and feed budgeting to achieve condition score and production targets for their ewes. Through participation in the program, it was expected that participants would adopt practices such as managing ewes to an optimum condition-score profile, regular condition scoring and pasture assessment to undertake effective feed budgeting for their ewe flocks, and tailored nutritional management of ewes according to their pregnancy status.

Lifetime Ewe Management involves professional facilitation of self-selected groups of four to six producers from a localised area that learn by doing, observing results and discussing outcomes with other participants. The groups meet six times per year for 2 years and each meeting is strategically timed to coincide with key stages of the reproduction cycle of the ewe. Each participant has their own flock of ewes to monitor and at every meeting the group visits all participating properties to assess the condition score of the ewes and the quantity and quality of pastures available. The aim of the first year of the program is to instil a 'measure-to-manage' approach that assists with key decision making in ewe nutrition and the second year aims to enable participants to implement the management guidelines to manage ewes to a target condition-score profile throughout the reproduction cycle.

### *Producer participation in Lifetime Ewe Management*

Lifetime Ewe Management commenced in Victoria in the spring of 2006, with 92 producers participating in the program from spring 2006 to the end of 2008. A further 57 participated from spring 2007 to the end of 2009 and 72 from spring 2008. Hence, 221 producers had completed the 2-year program by the end of 2010.

### *Survey design*

Producers commencing Lifetime Ewe Management completed a survey that recorded their base-line attitudes, farm practices and productivity. These base-line data relate to the year preceding their commencement of Lifetime Ewe Management. In other words, for producers beginning in the spring of 2006, the base-line data are for 2005. A second survey was conducted as a telephone interview at the completion of the program for each intake of producers. A total of 182 producers (of 221) completed both surveys.

In addition, the survey completed by the first intake of Lifetime Ewe Management participants in 2006 included additional questions. The first question asked the participants to rate the importance of the different components of the program for enabling practice change. The second was a series of five questions that assessed participants' willingness to adopt specific innovations related to ewe management, including pasture assessment, monitoring of ewes, ewe nutrition, feed budgeting and scanning for pregnancy. The responses to these questions were weighted to reflect the likely impact of each innovation on their livestock enterprise and the aggregate score was used to allocate each producer to a market segment according to their innovativeness (Rogers 2003). This approach determined the level of innovativeness of the participants before the training and whether the level of innovativeness of a producer influenced their degree of practice change as a result of participating in the program (Jones *et al.* 2011). These categories of innovativeness were then split into two groups, with 'innovators' and 'early adopters' as one group and 'early majority', 'late majority' and 'laggards' as the other. These two groups were compared for the changes in stocking rate, reproduction rate and ewe mortality, pre- and post-participation in Lifetime Ewe Management.

### Statistical analyses

The survey data were analysed using SPSS (SPSS Inc. 1994). Differences within the sample over time were compared using a paired *t*-test and differences between the groupings were compared by an analysis of variance (ANOVA). Because of the distribution of variables, an equivalent non-parametric test was also carried out (Kruskal–Wallis for independent samples and the Wilcoxon signed rank test for related samples). In all cases, the non-parametric test resulted in a conclusion similar to that from the parametric test.

## Results

### Survey participants

The types of sheep enterprise and number of ewes on the participants' properties at the completion of the program are summarised in Table 1.

### Change in sheep productivity

Participants made significant changes in their whole-farm stocking rate, lamb marking percentage and ewe mortality due to their participation in Lifetime Ewe Management (Table 2). These magnitudes of the changes achieved were not significantly ( $P > 0.05$ ) different for participants that concluded the training in 2008, 2009 or 2010, so these data represent the average of all participants to complete the program. On average, whole-farm stocking rate increased 14%, from 11.4 dry sheep equivalent (DSE)/ha to 13.0 DSE/ha. Participants increased their lamb marking percentages from cross-bred ewes by 13%, from Merino ewes mated to Merino rams by 11% and from Merino ewes mated to other breeds by 12%. Participants also decreased

**Table 1.** The enterprise type and number of ewes managed by the 182 participants in Lifetime Ewe Management that completed both surveys

Ewe type	Sire type	Number of ewes
Cross-bred	Maternal composites and terminals	344 699
Merino	Merino	410 805
Merino	Other (Border Leicester, maternal composites and terminals)	129 591
	Total	885 095

their annual ewe mortality rate from 4.9% to 2.8%, which represented a decrease of 43%.

The change in productivity measures during Lifetime Ewe Management was similar for producers that were innovators and early adopters in relation to improved ewe management at the commencement of the program, and for those that were relatively less innovative (early majority, late majority and laggards) (Table 3). The exception being that more innovative participants achieved a significantly greater increase in lamb marking percentage for Merino ewes mated to Merino rams than did the relatively less innovative participants.

### Change in management practices

The adoption of improved management practices by participants increased significantly due to their involvement in Lifetime Ewe Management for all practices assessed, including managing pastures, managing ewes and their nutrition and measuring performance (Table 4). The greatest change in adoption of improved management practices was in the category of nutritional management of ewes. The number of participants who 'calculated the metabolisable-energy balance of ewes regularly', 'managed ewes to condition-score targets' and 'adjusted rations after condition scoring ewes and assessing

**Table 2.** Change in farm characteristics and productivity measures for Lifetime Ewe Management (LTEM) participants during the program

These data represent the average of all participants as the responses were similar for participants from each intake. Means for productivity settings followed by different letters are significantly different at  $P = 0.01$ . DSE, dry sheep equivalent

Parameter	Pre-LTEM	Post-LTEM	Change (%)
<i>Farm characteristic</i>			
Property size (ha)	1295a	1316a	+2%
Area cropped (ha)	121a	207b	+71%
<i>Productivity measure</i>			
Stocking rate (DSE/ha)	11.4a	13.0b	+14%
Lamb marking percentage			
Cross-bred	111a	125b	+13%
Merino to Merino	75a	83b	+11%
Merino to other	84a	94b	+12%
Annual ewe mortality rate (%)	4.9a	2.8b	-43%

**Table 3.** The effect of participants' innovativeness at the beginning of the Lifetime Ewe Management program on changes in productivity measures during the program

\*,  $P < 0.05$ . DSE, dry sheep equivalent

Parameter	Innovators and early adopters	Early majority, late majority and laggards	Significance
Number of farms	43	49	
Change in stocking rate (DSE/ha)	+1.6	+1.8	n.s.
Change in lamb marking percentage			
Cross-bred	+12.3	+14.9	n.s.
Merino to Merino	+13.8	+7.4	*
Merino to other	+9.4	+9.9	n.s.
Change in annual ewe mortality rate (%)	-2.3	-1.7	n.s.

**Table 4. The proportion of Lifetime Ewe Management (LTEM) participants using specific management practices pre- and post-involvement in the program**Means followed by different letters are significantly different at  $P = 0.01$ 

Management practice	Pre-LTEM	Post-LTEM
<i>Managing pastures</i>		
Assess pasture quantity and quality	0.26a	0.91b
<i>Managing ewes</i>		
Condition scoring ewes	0.04a	0.94b
Draft ewes on condition score	0.04a	0.78b
Joining length of $\leq 5$ weeks	0.28a	0.70b
Pregnancy scan for multiples and separate	0.18a	0.71b
<i>Managing ewe nutrition</i>		
Manage ewes to achieve condition-score targets	0.06a	0.93b
Testing supplements and/or pasture for quality	0.38a	0.88b
Calculate energy balance regularly	0.02a	0.82b
Adjust rations after condition scoring and assessing pasture	0.04a	0.86b
Paddock allocation based on energy requirements and energy available	0.22a	0.88b
<i>Measuring performance</i>		
Quantify lamb survival rates	0.12a	0.65a
Quantify ewe mortality rates	0.42a	0.81b

pastures' increased by over 15-fold during the program. Similar increases were also achieved in ewe management practices, condition scoring ewes and drafting ewes on the basis of their condition score. The number of participants that recorded and quantified the rate of lamb survival increased from 12% to 65% over the program. About one-quarter of participants already assessed pasture quantity and quality before commencing Lifetime Ewe Management. However, by completion of Lifetime Ewe Management, almost all participants were assessing pasture quantity and quality.

#### *Change in perceived determinants of farm profitability*

Production per hectare was consistently perceived as the most important driver of profitability, whereas the attitudes of participants to other profit drivers changed significantly due to their involvement in Lifetime Ewe Management (Table 5). In particular, the importance of 'managing ewes to condition-score targets', which was perceived as the least important driver of profit pre-Lifetime Ewe Management, was perceived the second-

**Table 5. The importance scores given by Lifetime Ewe Management (LTEM) participants pre- and post-involvement in the program for different determinants of farm profitability**Importance scores range from 1 (not important) to 5 (very important). \*\*,  $P < 0.01$ 

Key profit driver	Pre-LTEM	Post-LTEM	Significance
Production/ha	4.37	4.74	**
Stocking rate	4.22	4.53	**
Cost of production	4.29	4.51	**
Lamb marking percentage	3.11	4.45	**
Production/head	3.03	4.24	**
Precise supplementary-feeding decisions	2.72	4.34	**
Managing ewes to condition-score targets	2.34	4.66	**

most important driver of profit by completion of the program. There were also significant ( $P < 0.01$ ) increases recorded in the importance of 'lamb marking percentage', 'production per head', 'precise supplementary feeding', 'cost of production' and 'stocking rate'.

#### *Change in skill level*

The skill level of the producers changed significantly due to their participation in Lifetime Ewe Management (Table 6). On average, participants rated their ability to perform the specific management skills at less than 2.6 of 5 before participation in Lifetime Ewe Management, compared with more than 4 of 5 after completion of the program. Participants increased their ability to condition score ewes and calculate their metabolisable energy balance by almost three-fold and doubled their ability to manage ewes to achieve condition-score targets and make precise supplementary-feeding decisions. At the completion of the program, the skills that participants rated their ability to perform the highest were condition scoring and allocating ewes to paddocks on the basis of energy requirements and energy available.

#### *Change in understanding of the effects of managing ewe condition*

Participants underwent a significant ( $P < 0.01$ ) increase in their agreement with the key messages promoted by the program, which reflects their increased understanding of the key effects of managing ewe condition score (Table 7). Producer understanding of the key effects of managing ewe condition score was less than 3.5 of 5 before participating in Lifetime Ewe Management, whereas after completion of the program, their understanding was greater than 4.5 of 5. The most profound shift in understanding was how condition scoring is a quick and reliable tool for managing ewes, with producers having the lowest level of understanding before Lifetime Ewe

**Table 6. The skill-level ratings for undertaking specific management practices, as perceived by Lifetime Ewe Management (LTEM) participants pre- and post-involvement in the program**  
Skill-level ratings range from 1 (low skill level) to 5 (high skill level). \*\*,  $P < 0.01$

Management skill	Pre-LTEM	Post-LTEM	Significance
Calculating the metabolisable-energy (ME) balance	1.47	4.17	**
Condition scoring	1.71	4.33	**
Managing ewes to condition-score targets	1.86	4.18	**
Precise supplementary-feeding decisions	2.04	4.17	**
Assessing pasture quantity and quality	2.13	4.18	**
Paddock allocation based on ME requirements and ME available	2.23	4.29	**
Managing a higher stocking rate system	2.26	4.07	**
Interpreting feed-quality tests	2.54	4.18	**

**Table 7. The belief ratings of the Lifetime Ewe Management (LTEM) participants pre- and post-involvement in the program for the effects of managing ewe condition**

Belief ratings range from 1 (strongly disagree) to 5 (strongly agree). \*\*,  $P < 0.01$

Effects of managing ewe condition	Pre-LTEM	Post-LTEM	Significance
Ewes with a higher condition score at lambing have lower mortality rates	3.45	4.87	**
Ewes with a higher condition score at joining conceive more lambs	3.25	4.90	**
Lamb survival is strongly influenced by ewe nutrition during pregnancy	3.11	4.88	**
Farm profit is responsive to ewe condition score throughout the year	2.24	4.70	**
Production from ewes and their progeny can be predicted by the ewes condition-score profile	2.47	4.80	**
Improving ewe nutrition during pregnancy increases progeny fleece weight and decreases fibre diameter	2.28	4.59	**
Condition scoring is a quick and reliable tool for managing ewes	2.27	4.89	**

Management and the second highest level of understanding by completion of the program. The highest level of understanding of the effects of managing ewe condition by completion of the program was that 'ewes in higher condition score at joining conceive more lambs'.

#### *Lifetime Ewe Management extension approach: perceived features and impacts*

Participants were very satisfied with the program (Table 8). On a scale of 1 (not satisfied) to 10 (very satisfied), participants gave Lifetime Ewe Management an overall satisfaction rating of 8.8 of 10, where the lowest rating given was 7 of 10. The average rating given for the improvement in farm business as a result of the program was 7.4 of 10. Almost all producers indicated that

they changed management practice as a result of participating in Lifetime Ewe Management and 95% of participants had recommended the program to other producers. Furthermore, almost three-quarters of participants felt that Lifetime Ewe Management is superior to other training programs for enabling producers to implement change on-farm and, as a result of participating in the program, 72% of participants felt they were more willing to undertake other training than they were before participating in Lifetime Ewe Management.

Participants regarded all of the components of Lifetime Ewe Management as important, with the exception of the 'economic-modelling session', to enable the implementation of the principles and practices promoted in the program (Table 9). Participants regarded the stand-out features of the program to be the small-group model, working with their own sheep, the

**Table 8. Producer rating of their level of satisfaction, business improvement and impact from participation in Lifetime Ewe Management**

Experiences from the program		
<i>Satisfaction</i>		
Overall satisfaction score		8.8 (of 10)
<i>Business improvement</i>		
Improvement in farm business		7.4 (of 10)
<i>Impact (proportion of participants)</i>		
Changed management practice		0.99
Have recommended the program to other producers		0.95
Agree that the program is superior to other programs for enabling producers to implement change on-farm		0.73
Agree they are more willing to undertake other training as a result of participation		0.72

**Table 9. The importance score given by Lifetime Ewe Management (LTEM) participants for the different components of the program for enabling them to implement LTEM principles and practices on-farm**

Component of the LTEM program	Importance score (of 5)
Small-group model	4.86
Working with your sheep on your farm	4.88
Hands on experience in pasture assessment, condition scoring and feed budgeting	4.88
Runs for the entire year covering the full reproduction cycle	4.86
Expertise of group facilitator	4.78
Course materials, activities, tools and charts	4.78
Case-study farm visit	4.44
Runs over 2 years	4.46
Lifetimewool research findings and key messages	4.08
Economic-modelling session	3.12

program covering the entire reproduction cycle, and the hands-on experience in assessing pastures, condition scoring and feed budgeting. The deliverer expertise and course materials, activities, tools and charts were also rated very highly as important components of Lifetime Ewe Management.

## Discussion

The Lifetime Ewe Management program has been a powerful stimulus for change in participants. After 2 years of involvement in the program, the 182 participants surveyed who managed almost a million breeding ewes, increased their whole-farm stocking rate by 14%, increased lamb marking percentages by 11–13%, depending on enterprise, and reduced ewe mortality by 43%. The changes in productivity from adopting best-practice nutritional management of ewes were consistent with those expected from Oldham *et al.* (2011) and Behrendt *et al.* (2011). The changes in productivity were also similar regardless of the enterprise type, which was surprising given the greater emphasis on reproduction rates in cross-bred enterprises (Warn *et al.* 2006; Young *et al.* 2010). Furthermore, participants also simultaneously achieved gains in stocking rate and lamb marking percentage, which is in conflict with the view of many industry advisors who believe this is not possible (Holmes and Sackett 2004). We believe that the explanation for this is that most farms are not run at optimal stocking rates. Nonetheless, if this degree of impact could be achieved across 25% of the national ewe flock, this would increase the number of lambs weaned by more than one million per annum.

Lifetime Ewe Management was successful in recruiting participants across all categories of innovativeness. This was unexpected, given that Rogers (2003) postulated that new practices are more likely to be adopted by and through deliberately targeting the most innovative producers. Once adopted by these producers, others in less innovative categories would be expected to follow. An explanation that fits with our results was proposed by Moore (2002) who postulated that ‘middle majority’ customers do not follow what the most innovative customers do, unless the technology is so ready to adopt it is seen by them as a ‘productivity improvement’ rather than a new technology. That producers across all categories were attracted to

participate in Lifetime Ewe Management indicates that the program was seen by producers as being immediately useful to their enterprise. The degree of change in productivity by participants was also similar across all categories of innovativeness, which again would be unexpected according to Rogers’ (2003) theory of adoption. Our results, however, confirmed the success of the program and the ability of the supporting guidelines and tools to influence participants from all innovativeness categories. This confirms the potential of Lifetime Ewe Management to address the imperative that the Australian producers lift reproductive rates by at least 12% to sustain an effective sheep industry (Curtis 2009).

Productivity gains achieved by participants during their involvement in the program could be attributed to changes in their use of specific management practices. Lifetime Ewe Management was effective in increasing the adoption of pasture assessment, managing ewe condition score, pregnancy scanning, improved feed allocation and measuring ewe performance. These practices reflected the key skills and principles embedded in the program.

The design of the program provided an opportunity for participants to regularly reinforce the skills that enhanced adoption. This skills practice and reinforcement is a key principle of adult learning (Malouf 2003). The continual requirement for participants to make informed nutrition decisions not only developed their management skills, but more importantly, reinforced the impact of ewe nutrition on ewe and progeny performance. As a result, participants underwent a marked change in their belief in the importance of managing ewes to condition-score targets as a determinant of farm profitability. This highlights that the design of the program enabled participants to make changes in knowledge, attitudes, skills and aspirations, which are the key pillars of practice change (Bennett 1975).

The Lifetime Ewe Management extension model, which included the use of small groups, participants working with their own sheep, covering the entire reproduction cycle, hands-on experience and access to a credible facilitator, enabled participants to implement the key principles and practices to achieve the measured productivity gains. These findings are consistent with those of Trompf and Sale (2000) who reported that the paired-paddock model incorporated the critical elements of small groups of producers (4–6) undertaking trials on their own farms, and developing skills to manage these trials, guided by a skilled facilitator, to form an effective agent for change to increase productivity on grazing properties. Given that the principles that underpin both models are so similar, it is reasonable to conclude that the combination of small groups, on-farm application of the new approach by each participant, along with skills development that is supported by qualified facilitators, should become inherent features of extension programs that aim to achieve widespread behavioural change and productivity gains across an industry.

Achieving industry impact is the ultimate challenge for any research and extension initiative. There are few examples in livestock production where the combination of research and education has resulted in the successful uptake of complex management practices. The coupling of the research from the Lifetimewool project, development of practical guidelines and

the educational model used to support Lifetime Ewe Management overcame this challenge. The Sheep CRC has adopted the Lifetime Ewe Management program as a blueprint for future extension programs striving to achieve widespread practice change (Truscott and Thomas 2010).

### Acknowledgements

The Lifetime Ewe Management program was developed as part of the Lifetimewool Project in collaboration with Rural Industries Skills Training Victoria. Lifetimewool was funded by Australian woolgrowers through Australian Wool Innovation Limited and by five state Departments of Primary Industries and Agriculture.

### References

- ABARE (2009) Australian commodity statistics 2009. In 'Principal agricultural commodities, Australia (preliminary) 2008–09'. p. 25. Australian Bureau of Agricultural and Resource Economics, Canberra.
- Barnett R (2007) Best practice sheep reproduction management: a review of current extension and adoption. Final Report, Project reference SHGEN.114, Meat and Livestock Australia and Australian Venture Consultants Pty Ltd, Perth.
- Behrendt R, van Burgel AJ, Bailey A, Barber P, Curnow M, Gordon DJ, Hocking Edwards JE, Oldham CM, Thompson AN (2011) On-farm paddock-scale comparisons across southern Australia confirm that increasing the nutrition of Merino ewes improves their production and the lifetime performance of their progeny. *Animal Production Science* **51**, 805–812. doi:10.1071/AN10183
- Bennett C (1975) Up the hierarchy. *Journal of Extension* **13**(2), 7–12.
- Curnow M, Oldham CM, Behrendt R, Gordon DJ, Hyder MW, Rose IJ, Whale JW, Young JM, Thompson AN (2011) Successful adoption of new guidelines for the nutritional management of ewes is dependent on the development of appropriate tools and information. *Animal Production Science* **51**, 851–856. doi:10.1071/EA08305
- Curtis K (2009) Wool desk survey report. DAFWA. Available at [www.agric.wa.gov.au](http://www.agric.wa.gov.au) [Verified August 2011].
- Ferguson MB, Thompson AN, Gordon DJ, Hyder MW, Kearney GA, Oldham CM, Paganoni BL (2011) The wool production and reproduction of Merino ewes can be predicted from changes in liveweight during pregnancy and lactation. *Animal Production Science* **51**, 763–775. doi:10.1071/AN10158
- Holmes P, Sackett D (2004) What is fertility worth in a Merino flock? In 'On Farm'. Issue 90, June/July, pp. 1–4. (Holmes Sackett and Associates, Wagga Wagga, Australia)
- Jones A, van Burgel AJ, Behrendt R, Curnow M, Gordon DJ, Oldham CM, Rose IJ, Thompson AN (2011) Evaluation of the impact of Lifetimewool on sheep producers. *Animal Production Science* **51**, 857–865. doi:10.2527/EA08303
- Malouf D (2003) 'How to teach adults in a fun and exciting way.' (Allen & Unwin: Sydney)
- Moore G (2002) 'Crossing the chasm.' (HarperCollins Publishers: New York)
- Oldham CM, Thompson AN, Ferguson MB, Gordon DJ, Kearney GA, Paganoni BL (2011) The birthweight and survival of Merino lambs can be predicted from the profile of liveweight change of their mothers during pregnancy. *Animal Production Science* **51**, 776–783. doi:10.1071/AN10155
- Rogers E (2003) 'Diffusion of innovations.' 5th edn. (Free Press: New York)
- SPSS Inc. (1994) 'SPSS 6.1. System user's guide. Pt 2.' (SPSS: Chicago, IL)
- Trompf JP, Sale PWG (2000) The paired-paddock model as an agent for change on grazing properties across south east Australia. *Australian Journal of Experimental Agriculture* **40**, 547–556. doi:10.1071/EA00046
- Truscott G, Thomas P (2010) A strategy for achieving innovation through Sheep Cooperative Research Centre research and development. *Animal Production Science* **50**, 1145–1151.
- Warn LK, Geenty KG, McEachern S (2006) What is the optimum wool–meat enterprise type? *International Journal of Sheep and Wool Science* **54**, 40–49.
- Young JM, Thompson AN, Kennedy AJ (2010) Bioeconomic modelling to identify the relative importance of critical control points for prime lamb production systems in southwest Victoria. *Animal Production Science* **50**, 748–756. doi:10.1071/AN09103
- Young JM, Thompson AN, Curnow M, Oldham CM (2011) Whole-farm profit and the optimum maternal liveweight profile of Merino ewe flocks lambing in winter and spring are influenced by the effects of ewe nutrition on the progeny's survival and lifetime wool production. *Animal Production Science* **51**, 821–833. doi:10.1071/AN10078

Manuscript received 30 August 2010, accepted 13 May 2011