NEW SOUTH WALES

LIFETIME WOOL

MAXIMISING THE GENETIC POTENTIAL OF YOUR FLOCK

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What is Lifetime Wool?

A national project funded by Australian Wool Innovation Limited that will run over seven years with AWI investing over $6 million. Lifetime wool is managed by the Victorian DPI in Hamilton with input from government agricultural agencies across Australia and CSIRO.

The project objective for Lifetime Wool is to develop profitable ewe management guidelines that allow the allocation of feed resources to breeding ewes to optimise their production and the lifetime performance of their progeny.

Lifetime wool has two phases with research sites located across Australia (Figure 1):

Phase1: Two plot-scale research sites at Coleraine (VIC) and Kendenup (WA).

Phase 2: 15 paddock scale experimental sites in all southern states.

Figure 1: Lifetime wool research sites across Australia.

Optimising genetic potential for wool production and quality through maternal nutrition

Genetics plays a key role in determining the potential lifetime wool production and wool quality of an individual sheep. However the environment, both pre and post weaning can also play a significant role. The nutritional intake of the ewe during pregnancy and lactation must be sufficient to satisfy her own needs for maintenance and wool growth as well as supply adequate nutrients to her foetus and lamb for growth and development until weaning. As the nutrients available to the foetus during pregnancy and lactation can have a significant impact on the development the follicle population it provides an opportunity through improved management of the breeding ewe flock, to maximise the wool production and wool quality potential of future generations of Merino sheep.

Genetic potential – can we maximise it?

Individual animals inherit their complement of genes from their parents, 50% from each. Selection of rams and ewes that have been identified as superior for the traits of interest is the starting point to determine the genetic potential of the next generation. However, in practice the heritability (h^2) or the degree to which variation in a particular trait is under genetic control, of most wool production and quality traits are moderate to high, none reach the theoretical maximum of 1 which would occur if the genetic potential of an animal was realised. Thus the environment does provide a strong mediating influence and explains why the phenotype of an animal (ie how the genes are expressed) is not necessarily the same as the genotype of an animal.

The maximum number of follicles that a lamb will form is determined genetically however estimates of h^2 for skin traits are only low to moderate. For total follicle density h^2 ranges between 0.18 to 0.46 and the ratio of secondary to primary follicles (S/P ratio) between 0.21 and 0.52 depending on the strain of Merino studied. Nearly 50 years ago researchers

recognised that poor nutrition during pregnancy and lactation can impose a permanent limitation on the subsequent capacity of sheep to produce wool by reducing the number of follicles developed. Lambs whose mothers are being poorly fed, progeny of young ewes and twin lambs develop fewer follicles and this reduces their adult wool-producing capacity.

Investigations of the development of skin follicles in Merino sheep, assessed by observing changes in S/P ratio have identified the period from 30 days prior to birth to 35 days after birth as the period during which that nutritional level is critical to the optimal development of the follicle population. Research has shown that nutritional modification of the follicle population pre-weaning does have an impact on the wool production and wool quality of the progeny. Poor ewe nutrition through pregnancy will reduce secondary follicle density in the developing lamb while poor nutrition during lactation will impact on the ability of secondary follicles to produce a wool fibre thus decreasing its lifetime wool production and quality potential.

Lambs born to better fed ewes grow more clean wool that is finer than lambs born to underfed ewes.

Breeding alone and careful selection of superior genetics will not lead to the expression of the full genetic potential or an animal for wool production and quality throughout its lifetime. Minimising adverse environmental conditions, particularly during the last third of pregnancy when secondary follicles are initiated and prior to weaning when these follicle mature is essential to allow progeny of breeding ewes to maximise the expression of their genetic potential.

The national Lifetime Wool project will develop guidelines to enable commercial wool producers to strategically manage the nutrition of their breeding ewes in a cost effective and sustainable manner. This is expected to benefit not only the lifetime wool production and quality of the progeny but also their survival, growth and parasite resistance. Additional benefits are also likely to be seen with respect to the wool production and quality, reproductive efficiency and disease resistance of the breeding ewes.

This article was summarised from a paper of the same name by Dr Sue Hatcher & Peter Johnson prepared for the 2004 Australian Farm Business Management Network Conference "Profile in an Uncertain Environment". A copy of the paper can be viewed from the website of the AFBMNetwork www.afbmnetwork.orange.usyd.edu.au and clicking on the 'Conferences' link.

Phase 1 of Lifetime Wool - Victoria and WA

Optimal allocation of feed resources to breeding ewes is dependent on the clear identification of the critical periods during the reproductive cycle where nutritional manipulation can influence progeny lifetime performance as well as the level of nutrition required to produce these responses.

The first phase of Lifetime Wool involved plot-scale research in both Victoria and WA, ewes at each site were fed to maintain or lose weight during early and mid pregnancy, before grazing different levels of pasture. This type of dose-response experiment will determine the level of ewe nutrition needed at different stages of the reproductive cycle to optimise both wool and meat production per hectare.

Phase 1 commenced in 2001 at both Coleraine and Kendenup and continued during the 2002 and 2003 seasons. At each site flocks of more than 1000 breeding ewes were managed to achieve a difference in fat score of about 1 (2 versus 3) by day 90 of pregnancy. Ewes (300 to 400) from each of these two fat score groups were then further split and grazed on one of 5 feed on offer or herbage mass levels until weaning (Figure 2).

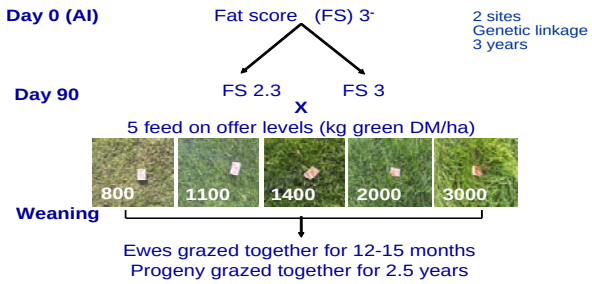


Figure 2: Experimental design for phase 1.

Following weaning, the ewes grazed together for until the next joining to determine any carry-over effects on their next pregnancy. The progeny grazed together for 2.5 years to look at the long term effects on their wool production and wool quality.

This article was summarised from a paper by Thompson and Oldham prepared for the 2004 conference of Australian Society of Animal Production. If you would like a copy of their paper and others in the series, please contact Sue Hatcher.

What has Lifetime Wool Phase 1 shown us so far?

- There eight important stages in the reproductive cycle of Merino breeding ewes which can each have a significant impact on their progeny's performance (Figure 3).

Figure 3: The 8 key phases of the Merino reproductive cycle.

- Ewes in better condition at joining conceive more lambs (Figure 4).

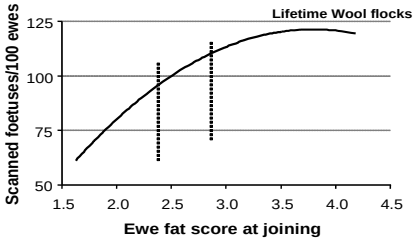


Figure 4: Increased fat score increases conception rates.

- Ewe management during pregnancy, especially late pregnancy, is critical to optimise lamb birth weights and subsequent survival.
- Improving ewe nutrition during lactation means better weaners, with live weight at weaning explaining 95% of differences in weaner mortality.
- Lifetime improvement in progeny wool production and quality in response to better ewe nutrition during pregnancy and lactation are:
  - greater than predicted
  - progeny clean fleece weight and fibre diameter is influenced by ewe nutrition during early/mid pregnancy and late pregnancy/lactation
  - the effects on progeny hogget wool production are permanent and for the rest of life and,
  - these responses are curvilinear and predictable which will allow models to be used to develop 'optimum' ewe feeding regimes.

The national Lifetime Wool team is currently preparing a handbook for wool producers which will further explain the 8 important phases in the Merino ewe reproductive cycle and highlight how on-farm management can influence the outcome of each phase. To register your interest in receiving a copy of this publication when available in mid 2005, please contact your local NSW Lifetime Wool Team member (contact details on last page).

Phase 2 across southern Australia

Phase 2 of Lifetime Wool involves paddock-scale research and demonstration where the findings of the plot-scale research are applied to commercial flocks of breeding ewes at 15 sites across southern Australia. These sites will also further explore the performance of twins versus single progeny as well as aid in developing the optimal management guidelines. In addition these on farm sites will allow estimates of the variation in ewe and progeny response to the environment and genotype to be made. This will add further commercial relevance to the optimum management guidelines for ewe nutrition that will be a key outcome of this project.

At each of the 15 paddock-scale sites across southern Australia, approximately 1000 Merino ewes were randomly split into either a HIGH or LOW nutrition group at about 21 days from the start of joining (Figure 5).

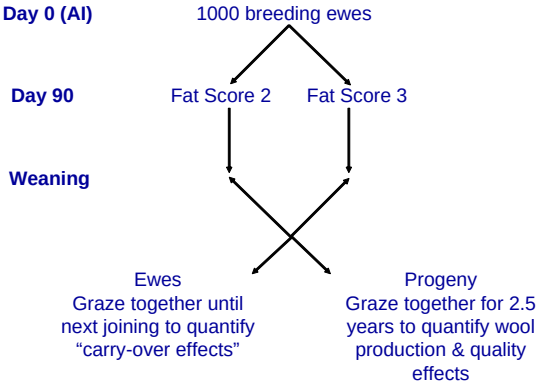


Figure 5: Phase 2 design.

Pasture growth and supplementary feed rations along with liveweight and fat score were monitored monthly to ensure a difference of 1 fat score between the HIGH and LOW groups from about day 90 of pregnancy. Faecal egg counts are also monitored monthly using Wormtest. Monthly hip staples are sampled for fibre diameter measurement. The difference in fat score is maintained until weaning. After weaning the ewes will be grazed together and monitored until their 2005 joining to quantify any carryover effects of the nutrition treatment on their next pregnancy.

All weaned progeny will be grazed together until 2.5 years of age to quantify any wool production and quality differences arising from the nutrition treatment prior to their birth.

Phase 2 in New South Wales

Phase 2 commenced at three sites in NSW with joining in early 2004. The three paddock scale experimental sites in NSW are located in the major wool producing regions:

Southern Tablelands - Carwoola

Darren Price	Carwoola	Joined 1 April 04

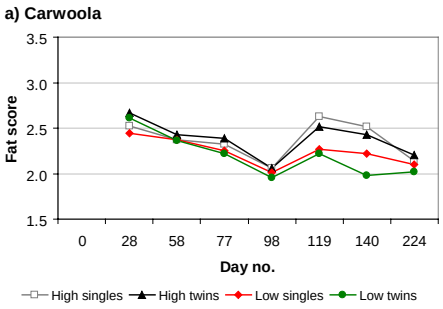
Northern Tablelands – Kialami

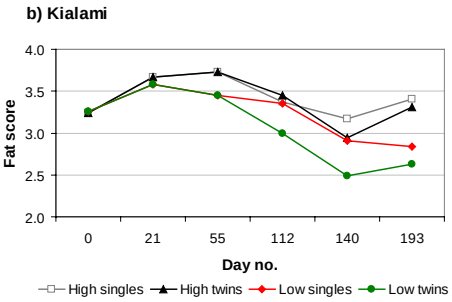
Charles Belfield	Armidale	Joined 29 April 04

Central - Oak Hills
Craig & Grant Dunn Mandagery Joined 15 March 04

Each of the NSW Lifetime Wool sites were affected to some degree by the drought conditions prevailing across the state in 2004. Of the three sites, Carwoola was the most negatively affected with all of the breeding ewes monitored being fully ration fed until the end of October when small amounts of pasture became available following some welcome rain. At Oak Hills the ewes had access to minimal pasture feed and were ration fed until late August. The Kialami site was the only NSW site that experienced close to a 'normal' season in 2004

Despite the difficult environmental conditions, each of the three NSW experimental sites did manage to achieve a difference in fat score between the high and low nutrition groups (Figure 6).





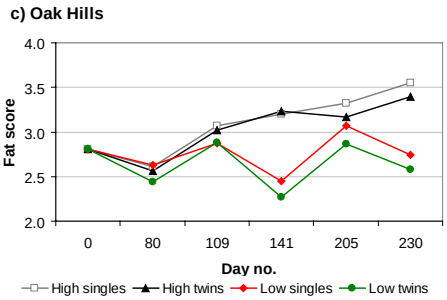


Figure 6: Fat score differences between high and low single and twin bearing ewes during pregnancy at each of the three NSW sites.

Further details on the impact of these differences in ewe fat score on conception rates, progeny marking and weaning percentages and growth will be detailed in future issues of NSW Lifetime Wool.

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