Australian Wool Innovation Limited

MEAT & LIVESTOCK AUSTRALIA

The value of pregnancy scanning

A benefit-cost analysis

Image: MLA

Pregnancy scanning is an essential tool for improved ewe and lamb survival. The information collected during pregnancy scanning can be used to differentially manage pregnant ewes, providing both them and their lambs with optimal nutrition and conditions for survival.

Scanning has a high return on investment when the information from scanning is used to implement best practice management. A benefit-cost analysis has demonstrated that scanning for litter size has a 400% return on investment, with the profit averaging $5.55/ewe scanned across 32 scenarios in winter and summer rainfall regions. Scanning for pregnancy status only was about half as profitable at $2.65/head on average.

This report details the results of the separate cost-benefit analyses for the winter and summer rainfall regions, as well as the methodology and assumptions that underpin them. The full project report can be accessed **here**.

Methodology

Winter rainfall region

A model called Australian Farm Optimisation (AFO) was used to assess the profitability of management changes that can be implemented based on information provided by pregnancy scanning in winter rainfall regions.

For each region, three lambing times (autumn, winter, spring) and three breed types (Table 1) were evaluated. The regions included in the analysis were:

1. Hamilton, Victoria: 600–650mm winter rainfall zone with a nine-month growing season and 100% pasture enterprises. The times of lambing evaluated in this region were 15 April, 1 June and 5 August.
2. Darkan, Western Australia: 500–600mm winter rainfall zone with a six-month growing season and typically 40–50% of the farm in crop. The times of lambing evaluated in this region were 15 May, 18 June and 23 July.
3. Cunderdin, Western Australia: 350–380mm winter rainfall zone with a four-and-a-half-month growing season and typically 70–80% of the farm in crop. The times of lambing evaluated in this region were 15 May, 18 June and 23 July.

Table 1: A description of the flock types included in this analysis.

Flock	Description
Merino	A self-replacing Merino flock with emphasis on wool production. Wethers are sold as either store lambs (six months) or as shippers (18 months).
Merino-Terminal sire (TS)	A self-replacing Merino flock utilising surplus ewes (cast for age or surplus ewe hoggets) for first-cross lamb production sold as suckers (four-and-a-half months). Merino wethers can be sold as Merino prime lamb or as shippers. The emphasis is on meat and wool production.
Maternal	Composite ewes are mated to composite rams to produce composite lambs. Wethers are sold as prime lambs (four to five months). The emphasis is on meat production.

Model assumptions:

1. The agreement between scanning for litter size and lambing outcome was approximately 85%.
2. Feed budgeting was calculated using the equations from the Australian Feeding Standards (Freer et al. 2007 and as updated in Freer et al. 2012).
3. Relationships describing lamb mortality and its connection with the level of ewe nutrition and the chill index at lambing were sourced from the LifetimeWool (LTW) project (Oldham et al. 2011) and the GrazPlan suite of models (Freer et al. 2012).
4. The relationship between ewe and lamb mortality due to dystocia was sourced from the GrazPlan suite of models (Freer et al. 2012).
5. The impact of nutrition on the fleece production of ewes was based on the wool production relationships from the GrazPlan suite of models. These included the impact of energy intake but not protein.
6. The impact of birth type/rear type (BTRT) and dam nutrition on the lifetime productivity of the progeny was sourced from the LTW project (Thompson et al. 2011).
7. Perinatal ewe mortality was estimated in the LTW project from CS of the ewe at the point of lambing and this has been used in this analysis. The GrazPlan models estimate mortality of twin-bearing ewes from pregnancy toxaemia in the last six weeks of gestation from maternal liveweight (LW) loss over this period and these relationships have been used in this analysis.
8. The weaner survival relationships used in AFO is a combination of the relationships derived by Campbell (2006) and those used in GrazPlan.
9. Response in subsequent flock reproductive rate from culling once- or twice-empty ewes was derived from the Passenger vs. Performers research project (Hatcher et al. 2018) which had analysed Merino research flocks.
10. The effect of altering paddock allocation at lambing was based on calculations using the lamb survival equations in the GrazPlan models that include relationships for both 'wool' and 'meat' sheep and the effect of altering chill, and the mob size research of Lockwood et al. (2020).

Summer rainfall region

The summer rainfall analysis was carried out using a gross margin approach as a model similar to the AFO does not exist for this region.

The Armidale, NSW region was used for the analysis. It is a 750–800mm summer rainfall region with a six-month growing season. The times of lambing evaluated in this region were 1 August, 1 September and 20 September which represents the spread in the producers that were surveyed. Not all lambing times were investigated for all the flocks in the summer rainfall region.

The gross margin analysis did not have sufficient analysis capacity to optimise the management of the empty and multiple-bearing ewes, so the optimum identified in the modelling analysis was used. There were fewer scenarios evaluated for time of lambing, reproduction rate of the flocks and prices because the modelling analysis indicated that profitability was not greatly affected.

The important production assumptions to calculate the profitability of pregnancy scanning were as follows:

1. The gross margin analysis was carried out assuming that the agreement between scanning and the lambing outcome was 100%.
2. Feed budgeting to represent the effect of differential management on supplementary feeding and stocking was done using expert input and discussion with individual farmers.
3. Relationships describing lamb mortality and its connection with ewe nutrition and chill index at lambing were sourced from the GrazPlan suite of models (Freer et al. 2012).
4. Impact of BTRT and dam nutrition on the lifetime productivity of the progeny. The source of these relationships was the LifetimeWool project (Thompson et al. 2011).
5. Response in subsequent flock reproductive rate from culling once- or twice-empty ewes. The values used in the analysis were derived from the Passenger vs. Performers research project (Hatcher et al. 2018) which had analysed Merino research flocks.
6. The effect of altering paddock allocation at lambing was based on calculations using the lamb survival equations in the GrazPlan models that include relationships for both 'wool' and 'meat' sheep and the effect of altering chill (Lockwood et al. 2020).
7. The differences in lifetime reproduction of the replacement born as singles or multiples was based on unpublished results of the Lifetime Maternals project.

The cost of scanning

The cost of scanning included both the cost of the contractor and the labour cost associated with mustering and pushing the ewes through the scanning crate (Table 2). If all labour was provided by casual labour, the labour cost varied between $0.31/ewe if scanning pregnancy status only and $0.40/ewe when scanning for multiples.

Table 2: The assumptions used for the cost of contracting (source of contract cost: Cousins Merino Services)

	Scanning for pregnancy status	Scanning for multiples
The contractor		
Contract cost ($/hd)	$0.50	$0.75
Travel ($/hd)	$0.02	$0.02
Throughput (hd/day)	3000	2000
Farmer provided labour		
Yard work – labour units	2	2
Cost per hd*	$0.17	$0.26
Mustering*	$0.06	$0.06
Other costs		
R&M on infrastructure & fuel	$0.08	$0.08
Total cost ($/hd)	**$0.83**	**$1.17**

*assuming that all labour is hired

Calculating the value of scanning

- The analysis compared farm profit between a flock that was not scanned versus a flock that was scanned (either for pregnancy status or multiples).
- If the flock was not scanned, all ewes were assigned the same nutritional profile during pregnancy and lactation. Lamb mortality was estimated using a common chill index across all ewes.
- If the flock was scanned for pregnancy status only, the nutritional profile of pregnant ewes was optimised separately to empty ewes between scanning and the next joining. The sale time of empty ewes was optimised and included options to sell at scanning or at the following shearing.
- If the flock was scanned for litter size, the nutritional profiles of the single- and multiple-bearing ewes were optimised separately. Multiple-bearing ewes were also allocated to better lambing paddocks than single-bearing ewes. The proportion of single and twin-born progeny selected as replacements was adjusted to account for the expected difference in lifetime wool value and lifetime reproduction.

Results

Scanning for multiples

Scanning for multiples and implementing best practice management was profitable across all regions, breeds and times of lambing in the analysis. The average profit in winter rainfall regions was $5.75/head (Table 3). This represents an approximate 400% return on the expenditure for contract costs and the extra on-farm labour associated with the scanning operation. Scanning for multiples was similarly profitable in the summer rainfall region, returning an average profit of $4.44/head (Table 3).

In winter rainfall regions, the value of scanning was higher for flocks that were lambing in autumn and slightly less for flocks lambing in spring. This is because the early lambing flocks are scanning and identifying the empty ewes prior to the main feed shortage, which increases the value of adjusting their nutritional management or from selling at scanning.

The lower value of scanning associated with later lambing does not equate to lower profit overall. Often the later lambing flocks are the most profitable, but there is less benefit from pregnancy scanning.

Table 3: The increase in farm profit from scanning for multiples and implementing optimum management ($/ewe scanned) for each of the regions, flock types and times of lambing in the winter and summer rainfall analyses.

Breed type	The value of scanning for multiples ($/ewe)		
	Time of lambing		
	Autumn	Winter	Spring
Winter rainfall regions			
Hamilton, VIC region			
Merino	$7.20	$10.60	$3.80
Merino-Terminal	$6.40	$8.80	$6.00
Maternal	$7.50	$8.80	$5.40
Darkan, WA region			
Merino	$7.80	$2.80	$5.50
Merino-Terminal	$9.80	$5.20	$3.70
Maternal	$5.80	$4.00	$4.20
Cunderdin, WA region			
Merino	$4.60	$4.60	$1.20
Merino-Terminal	$5.20	$4.70	$1.90
Maternal	$8.40	$3.50	$6.50
Total average value of scanning for multiples – winter rainfall regions			**$5.75**
Summer rainfall region			
	Time of lambing		
Armidale, NSW region	**1-Aug**	**1-Sep**	**20-Sep**
Merino			$3.85
Merino-Terminal		$7.52	$7.06
Maternal	$2.01	$1.74	
Total average value of scanning for multiples – summer rainfall regions			**$4.44**
Total average value of scanning for multiples			**$5.55**

Table 4: The increase in farm profit from scanning for pregnancy status and implementing optimum management ($/ewe scanned) for each of the regions, flock types and times of lambing in the winter and summer rainfall analyses.

Breed type	The value of scanning for pregnancy status ($/ewe)		
	Time of lambing		
	Autumn	Winter	Spring
Winter rainfall regions			
Hamilton, VIC region			
Merino	$6.30	$5.70	$1.30
Merino-Terminal	$5.20	$4.10	$0.00
Maternal	$7.10	$7.70	$2.90
Darkan, WA region			
Merino	$4.10	-$1.50	$1.50
Merino-Terminal	$4.60	$0.90	-$1.50
Maternal	$4.80	$3.00	$0.90
Cunderdin, WA region			
Merino	$2.50	$1.20	-$0.30
Merino-Terminal	$2.00	$1.00	-$0.90
Maternal	$7.50	$3.30	$3.00
Total average value of scanning for pregnancy status – winter rainfall regions			**$2.83**
Summer rainfall region			
	Time of lambing		
Armidale, NSW region	**1-Aug**	**1-Sep**	**20-Sep**
Merino			$1.16
Merino-Terminal		$1.86	$1.78
Maternal	$1.64	$1.57	
Total average value of scanning for pregnancy status – summer rainfall regions			**$1.60**
Total average value of scanning for multiples			**$2.65**

Scanning for pregnancy status

Scanning for only pregnancy status was about half as profitable as scanning for multiples. The average return on scanning for pregnancy status was $2.83/head in the winter rainfall regions (Table 4) and $1.60/head in the summer rainfall region (Table 4).

Scanning for pregnancy status was not profitable in some regions and flocks where it occurred after the main feed deficit. In these cases, the reproduction and feed benefits achieved were less than the cost outlay for scanning and the reduction in the wool production potential of the flock.

These results suggest that scanning for only pregnancy status is a good starting point for farmers who are gaining experience with scanning, but that it should be used as a stepping stone to scanning for multiples.

Management changes

To capture the benefits of pregnancy scanning, management changes that utilise the information obtained from scanning must be implemented. These changes include:

- Selling the “passengers” that are scanned empty to improve future reproductive outcomes
- Reducing nutrition to empty ewes and diverting that feed to pregnant ewes
- Increasing nutrition to the multiple-bearing ewes
- Allocating the multiple-bearing ewes to better lambing paddocks
- Including birth type when selecting the replacement breeding ewes.

Table 5: The contribution of each management component to the value of scanning and whether that component is possible based on the level of scanning undertaken.

Management components	Scanning for litter size	Scanning for pregnancy status	Value of management component per ewe
Sell the passengers	✓	✓	$1.85
Feed allocation:			
to pregnant ewes	✓	✓	$0.80
to multiples	✓	X	$1.00
Paddock allocation	✓	X	$0.95
Replacement selection	✓	X	$0.95
Total value per ewe	**$5.55**	**$2.65**	

NB: these figures are based on modelled enterprises in tables 3 and 4.

The biggest contributor to the profitability of scanning (for pregnancy status and multiples) was the sale of passenger ewes to increase the subsequent reproductive performance of the flock. It was optimal to sell once-empty ewes for the flocks that were scanning just prior to the main feed deficit, provided that the weaning percentage was sufficient for the flock to be self-replacing. Selling twice-empty ewes was best for flocks that were not self-replacing or were scanning after the feed deficit.

Capturing the benefit of altering feed allocation requires adjusting the condition score targets for empty, single-bearing and twin-bearing ewes. If the ewes are not scanned, empty ewes will typically be 0.5 CS higher than the single bearing ewes at lambing, and the twin bearing ewes will be 0.5 CS lower. If the ewes are scanned for multiples and optimal nutritional management has been implemented, then:

- Empty ewes should be 0.5–1.0 CS lower than the single-bearing ewes at lambing
- Twin-bearing ewes should be 0.3–0.5 CS higher than single-bearing ewes at lambing.

To capture the potential benefit associated with paddock allocation requires identifying the better lambing paddocks and allocating these to twin-bearing ewes. Twin-bearing ewes have higher energy demand during lactation, so managing these paddocks to achieve higher feed on offer at lambing is also beneficial.

Adjusting the selection of the replacement ewes requires identifying the progeny as either single or twin born and being able to separate on birth type. Twin-born progeny will be selected against if they are not identified because they are smaller than their single-born counterparts. It is expected that biasing the selection towards the twin-born progeny will improve long term profitability, especially for flocks that have more focus on meat production than wool production.

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