final report

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Increasing Merino lambs weaned PIRD WA/01 – Part B, Economic Analysis

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Background

Previous economic analyses of increasing reproductive performance of merino sheep has shown that the value of increasing reproductive performance was in the range of $2-3 per ewe for every 10% percentage point increase in lambing rate (eg Morrison and Young 1991). Therefore these analyses concluded that to achieve profitable increases in reproductive performance, cost per ewe needs to be low or the percentage increase in lamb marking needs to be high. However, these analyse were conducted at times when the wool and lamb prices were lower than present. Also, alternative, innovative approaches to reproductive performance are currently being explored.

The aim of this analysis is to quantify the net benefits of improving lamb marking through increases in reproductive rate (scanning %) & survival, and compare these values with the costs involved and the responses achieved in the on-farm trials in this project.

Method of analysis

The analysis of increasing reproductive performance and survival is complicated by the change in demand for energy as lamb numbers increase. There are a number of ways reproductive performance may be increased, a change in: fertility, prolificacy or survival of lambs, or a combination of these. Each of these affect the energy requirement of the ewe flock over time and hence the cost of supplying that energy. Also, additional lambs will reduce the total feed pool available to ewes so ewe numbers may need to be decreased or additional supplement may be required. These adjustments are an essential element of a credible analysis of improving reproductive performance.

The model

A whole-farm bio-economic model, MIDAS (Model of an Integrated Dryland Agricultural System) was used to determine the increase in profit resulting from altering the weaning percentage of the flock. The version of MIDAS used is representative of farms in the Great Southern region of WA, which average between 500mm and 600mm of annual rainfall.

The model describes a property with 1000ha of arable land with 5 land management units. The model has 10 periods for pasture production, five in the growing season and five in the dry season. The periods differ in the rate of growth and quality of pasture. There are over 20 classes of livestock, characterised by sex, age and the time of sale. Wool growth, fibre diameter, hauter and death rate differ according to nutrition over time.

The model selects the best flock structure and allocates feed accordingly, factoring the trade-off between grazing in one period and production, quality and availability in future periods. The advantage of this method of modelling is that as the demands for energy change the model will adjust grazing pressure, grain feeding, flock structure and management to make best use of available feed over the season.

MIDAS has been applied to a range of sheep production issues throughout southern agricultural regions of Australia, and complements simulation models that represent the biological relationships in more detail but omit some important spatial (between paddock) elements of the problem of optimising whole farm profit from sheep production.

The Analysis

The model was used to quantify the change in profit that would result from changing weaning percentage of a flock and changing the survival of twin lambs. The increase in profit was compared to the costs of the treatments applied and the range of increase achieved on-farm.

The increase in profit was calculated for 2 different lamb price scenarios ($2.40/kg and $3/kg for merino lamb, a premium of 20c/kg is assumed for crossbred lamb) and 3 different flock types. The 3 flocks types examined were:

i. Merino Wool Flock: Merino ewes mated to merino rams. Most female progeny retained as breeders with surplus sold after hogget shearing. Male progeny sold either as shippers or as store lambs.
ii. Merino Prime Lamb Flock: As for the Merino Wool flock except a draft of the wether lambs are finished and sold as prime lamb.
iii. Crossbred Lamb Flock: Merino ewes mated to a terminal sire. Female and male progeny are finished for sale as prime lamb. Replacement ewes are bought in off shears prior to mating at 19 months.

On-farm Costs

The costs of synchronisation totals $1.35/ewe joined (Table 1) and includes:

i. The cost of preparing the teasers
ii. The cost associated with using more rams

Table 1: Cost of synchronising ewes.

Additional costs	$/ewe/joined
Extra rams	1.10
Ram feeding	0.10
Injections for wethers	0.15
Total costs in Trial	**1.35**

Teaser wethers were injected with 8ml of testosterone and used at 3%. The proportion of rams was increased to 3% in these trials as compared with 2% that the majority of the participants were using in their flocks. The additional costs of the rams is:

i. The interest on the capital used to purchase the extra rams.
ii. The drop in value of the extra rams from purchase to sale
iii. The supplement fed to the extra rams

It is assumed that the other costs of running the rams are compensated by their wool income.

The cost of flushing is the value of the extra grain fed to the ewes leading up to joining. In the trials approximately 7.5kg of grain was fed per ewe and the cost was $1.50/ewe joined (Table 2).

Table 2: Cost of flushing ewes in the on-farm component of the trial.

Additional costs	$/ewe/joined
Flushing	1.50

The additional costs of the twin ewe management strategy range between $8 and $14 per twin bearing ewe (Table 3) and includes:

i. The cost of scanning the mated ewes to determine whether they are twin bearing, single bearing or barren and is $0.55 per ewe in the flock. When the scanning cost is calculated per twin bearing ewe the cost is higher and the increase depends on the proportion of twins in the flock.
ii. The twin bearing ewes are drafted and run separately and provided extra feed and shelter.
    a. Additional supplement was fed for a 3 week period prior to lambing through until lambing is completed. This totalled approximately 14kg/hd with a value of $2.80/ewe.
    b. Shelter and feed was provided at lambing in a standing oat crop and the cost of this was calculated at two stocking rates; 15 ewes and 30 ewes per hectare of standing oats.

Table 3: Cost of the lambing components of the on-farm trials. Values are calculated for a range of stocking rates on the fodder crop and a range of proportion of twin bearing ewes in the flock. Units are $/twin bearing ewe.

	Twin ewe management scenario ($/twin bearing ewe)			
Additional costs	**15 – 20%**	**15 – 40%**	**30 – 20%**	**30 – 40%**
Scanning and drafting	2.75	1.40	2.75	1.40
Fodder crop (opp cost)	10.00	10.00	5.00	5.00
Feeding twinning ewes	2.80	2.80	2.80	2.80
Total costs in Trial	**15.55**	**14.20**	**10.55**	**9.20**
Costs already included	1.00	1.00	1.00	1.00
Net cost	**14.55**	**13.20**	**9.55**	**8.20**

Key:

15 – 20%	Fodder crop stocked at 15 ewes/hectare, 20% of ewes carrying twins
15 – 40%	Fodder crop stocked at 15 ewes/hectare, 40% of ewes carrying twins
30 – 20%	Fodder crop stocked at 30 ewes/hectare, 20% of ewes carrying twins
30 – 40%	Fodder crop stocked at 30 ewes/hectare, 40% of ewes carrying twins

The MIDAS calculations of the benefits of higher weaning percentage include the costs of meeting the higher energy demands associated with having extra ewes lactating. Therefore these costs need to be deducted from the trial costs to prevent double counting. The adjusted or net costs are shown at the bottom of Table 3.

The opportunity cost of the fodder crop is the income foregone from the next best alterative use. It is assumed in this analysis that the next best use is to leave the fodder crop ungrazed and harvest the grain for sale. It is also assumed that the grain yield will be reduced by one tonne per hectare when grazed, and the net sale price of the grain is $150 per tonne. Therefore the opportunity cost is $150 per hectare. This is equivalent to $10 per ewe where the stocking rate on the fodder crop is 15 ewes per hectare and $5 per hectare where the stocking rate is 30 ewes per hectare.

There are moderate differences in the cost of managing the twin bearing ewes depending on the stocking rate that can be achieved on the fodder crop and the proportion of the ewes that are carrying twins (Table 3).

The costs presented above (Tables 1, 2 & 3) were also totalled for 4 different packages that farmers might adopt (Table 4). The cost of each package per ewe joined was calculated for the 4 different twin ewe scenarios outlined in Table 3.

Table 4: Cost of the different treatment options. Values are expressed as $/ewe joined and are calculated for a range of stocking rates on the fodder crop and a range of proportion of twin bearing ewes in the flock.

	Twin ewe management			
Management Package	**15 – 20%**	**15 – 40%**	**30 – 20%**	**30 – 40%**
1. Synchronise only	1.35	1.35	1.35	1.35
2. Synchronise & flush	2.85	2.85	2.85	2.85
3. Synchronise & manage twins	4.25	6.60	3.25	4.60
4. Synch., flush & manage twins	5.75	8.15	4.75	6.15

On-farm Responses

The on-farm treatments were split into their components so that each component could be analysed separately to determine if a part of the treatment applied was contributing greater or lesser proportion of the cost and benefits. The components of the treatments were: synchronisation, flushing and managing twin bearing ewes to improve the survival of lambs.

The increase in weaning percentage achieved in the trial that can be attributed to the pre-joining treatments and the lambing treatments was calculated based on the scanning information and the lamb survival information. The increases attributable to the pre-joining treatments are calculated from the change in the number of lambs scanned and the single and twin lamb survival levels. The benefits of the lambing treatments are calculated from the change in single and twin lamb survival and the average proportion of singles and twins scanned.

Table 5: Calculated response in weaning percentage achieved by each farm resulting from altering pre-joining management and the response in lamb survival achieved on each farm resulting from altering management of twin ewes.

		Pre-joining management Weaning % response		Twin ewe management Lamb survival response		Full package
		Synch	**Synch & Flush**	**Fodder crop**	**F.C. & Grain**	**Weaning response**
Farm 1	2004	+6	+11	+26		24
	2005		-32[1]			
	2006					
Farm 2	2004	3	9	-4	-2	20
	2005		6			19
	2006				+10	
Farm 3	2004	+15	+22	-1	+1	-4
	2005		+36		-2	
	2006					
Farm 4	2004	+8	+20			
	2005		+12			+7
	2006					
Average[2]		8.0	16.6	4.0	2.0	13.2
Range[2]		+3 to 15	+6 to 36	-2 to 15	-2 to 10	-4 to 24

[1] Treatment ewes may have affected by poor water quality at joining
[2] Values exclude the group of ewes that may have been affected by poor water.

Results

Pre-joining Management

Figure 1 shows the increase in profit as weaning percentage is increased for a wool flock, at two different lamb prices and a merino prime lamb flock and a crossbred lamb flock at the higher lamb price. Also marked on the graph is the cost of synchronising the ewes and the cost of synchronising and flushing the ewes. These cost lines show the range of response achieved from these treatments on the farms over the 3 years (Table 5). Where the benefit line is above the cost line synchronising or flushing would be profitable and if below it would reduce profit. The difference between the 2 lines is the amount of profit or loss that would be incurred per ewe treated.

The average response achieved in the farmer trials were sufficient to breakeven with the cost of synchronising, or synchronising and flushing, for each of the flock types and for both lamb price scenarios. However, the breakeven response level was not always achieved especially for the merino wool flocks.

For a merino wool flock with a lamb price of $42/hd the best response achieved on-farm would have resulted in a profit of $4.35/ewe (or $13 000/farm for a farm with 3000 ewes) through to the worst response achieved which would have resulted in a loss of $1.65/ewe (or $5 000/farm for a property with 3000 ewes). For a merino prime lamb flock the range was a profit of $10/ewe through to a loss of $1/ewe.

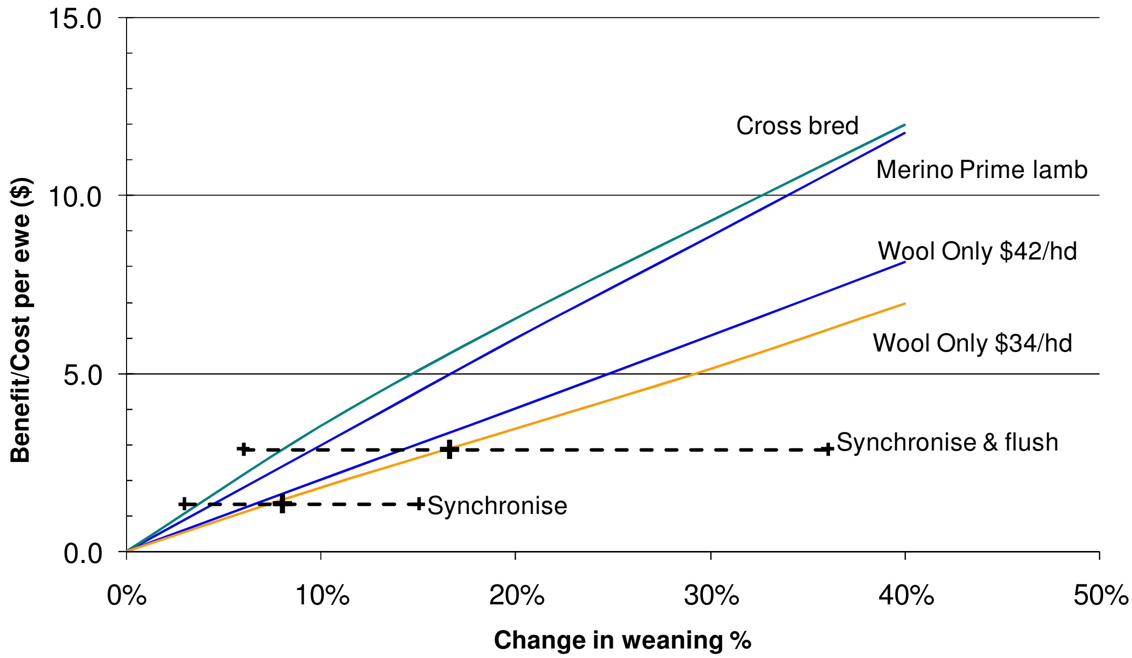

Figure 1: Benefits per ewe joined of increasing lamb weaning percentage and the costs of the treatments applied on farm and the increase in weaning percentage achieved.

Management of Twins

Figure 2 shows that the benefits of increasing survival of twin lambs for three flock types; wool, merino prime lamb and cross bred prime lamb flocks. Also marked on the graph is the cost incurred on-farm in achieving the increased survival. These cost lines show the range of response achieved from these treatments on the farms over the 3 years (Table 5). Where the benefit line is above the cost line managing the twin bearing ewes would be profitable and if below it would reduce profit. The difference between the 2 lines is the amount of profit or loss that would be incurred per ewe treated.

Whilst gains of the magnitude required to break even were achieved on one farm in one year of the trial, there remain management and technical issues that need to be resolved to improve consistency of the results. These were not resolved in the short duration of this project.

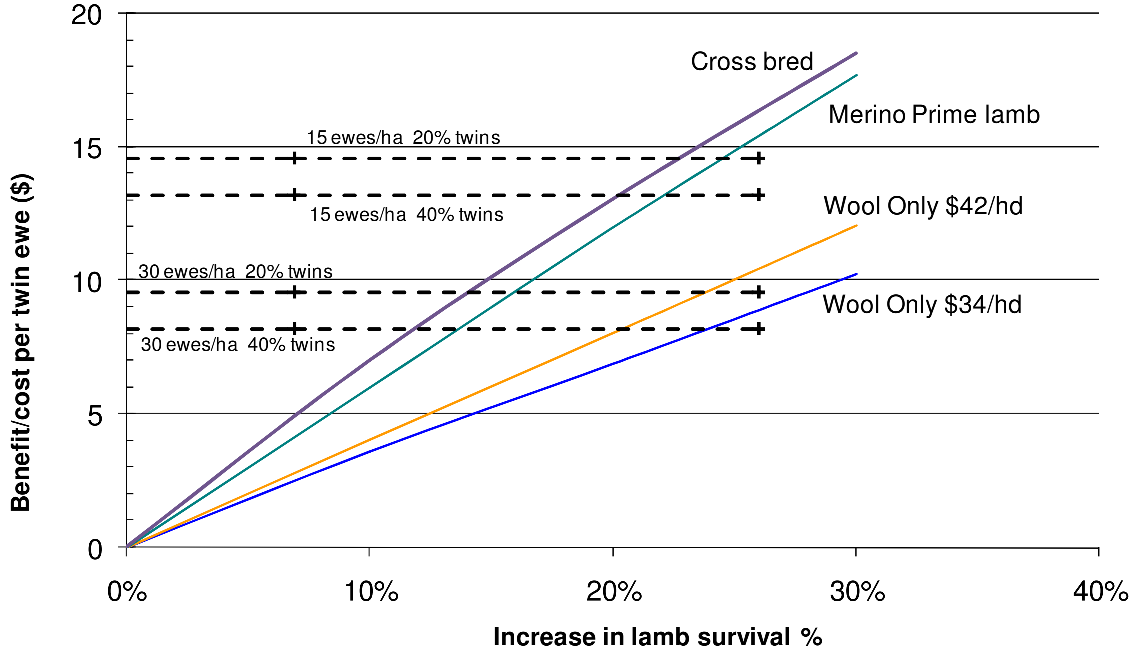

Figure 2: Benefits per twin bearing ewe resulting from improving survival of twin born lambs for different flock types and the costs of the treatments applied on-farm and the increase in twin survival achieved.

The Whole Package

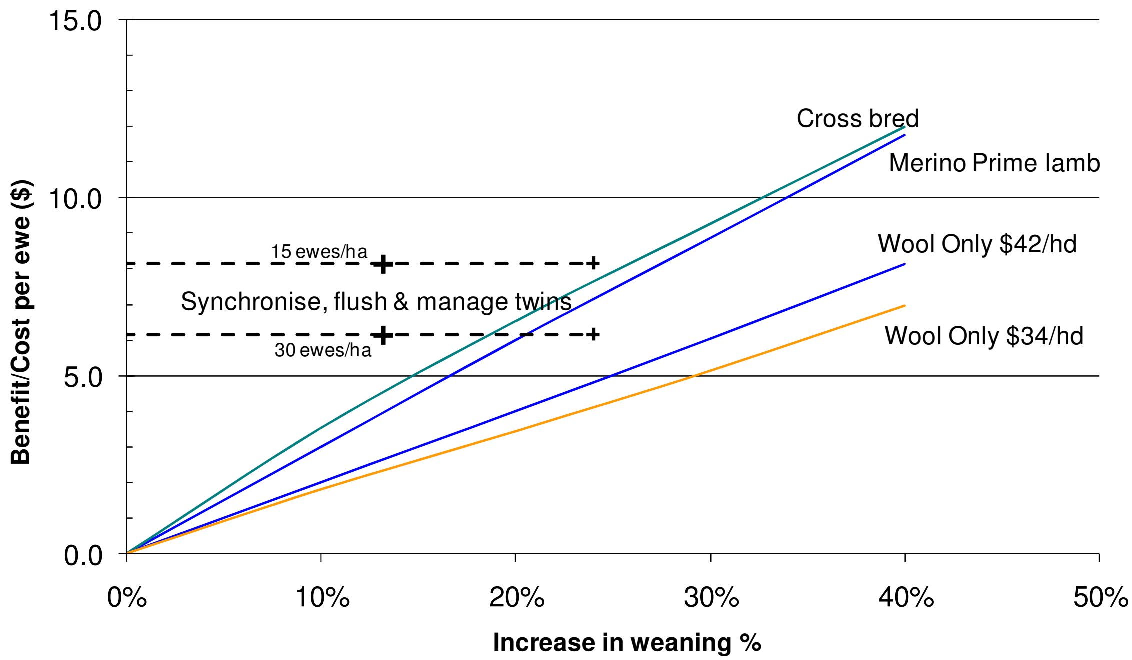

Figure 3: Benefits per ewe joined of increasing lamb weaning percentage through using the full package of synchronising, flushing and managing the twin bearing ewes. The costs of the treatments applied on farm and the increase in weaning percentage achieved is superimposed.

Figure 3 shows the benefit of increasing the weaning percentage of the flock (the same as Figure 1), superimposed on this graph is the cost of the full package implemented on the farms. These cost lines show the range of response achieved to these treatments on the farms over the 3 years (Table 5). Where the benefit line is above the cost line synchronising or flushing would be profitable and if below it would reduce profit. The difference between the 2 lines is the amount of profit or loss that would be incurred per ewe in the flock. The level of response required to make the package profitable for a merino wool flock wasn't achieved by any of the farms during the project. Although 2 farms achieved a level sufficient to breakeven if prime lambs were being produced.

Discussion

In the absence of further work the results of the economic analysis needs to be interpreted with caution. However, this analysis and the on-farm trials show that profitable responses can be achieved by synchronising ewes, flushing at joining and managing twin bearing ewes. A profitable response to flushing was achieved more often than a profit from managing the twin bearing ewes. Further development of the techniques is required to improve the consistency of the responses and develop cheaper systems before a profitable response is assured.

This analysis ignored the extra liveweight of the twin lambs in the twin management treatment. This extra weight could be very valuable for prime lamb flocks selling lambs at a target weight or for merino wool flocks in years where there is a shortage of quality feed in summer/autumn and the lighter lambs require high levels of supplement to survive.

There have been several difficulties in conducting this analyses of the farmer trials:

1. Determining what management would have been applied in the absence of the trial. The estimated costs of treatments assumed that in the absence of the treatment farmers would be applying district practice. However some farmers were already applying some aspects of the treatment to improve lamb marking prior to the trial and these were part of the control. Therefore the costs in Table 1 maybe overestimates of the actual cost to some of the participating farmers, and the break even increase in lamb marking would hence be lower.
2. It is difficult to quantify the differences in the paddock feed supplied to the different treatment groups. In this analysis we have relied on the feed budget within the MIDAS model, the lack of on-farm data means we are unable to validate this feed budget.

A further issue for interpreting the results relates to the consistency of results. The variability was caused by a range of factors, some of which were related to season. As with all farm activities, seasonal variation in rainfall will lead to variable production and this will affect the response achieved in lambing percentage. For example, improving the survival of twin lambs depends critically on providing sufficient shelter. One approach is to run twin bearing ewes on a fodder crop, however if this fails to establish or is established late due to the timing of the season break there may be insufficient shelter. This would reduce lamb survival and reduce the benefits of improved management, or perhaps result in a net loss.

Conclusions

The increases in weaning percentage required to break even with the cost of management are similar to the average increase achieved in the farmer trials. This indicates that on average the producers were breaking even if they applied the treatments. However in some circumstances the increases achieved were greater than the breakeven level and increased profits would have been achieved. Further work is required to determine whether finetuning the management package could lead to profits being achieved consistently. Improving the consistency of achieving a profit is likely to be an important factor in encouraging adoption of the proposed management to increase lambs weaned.

There may also be scope for reducing the costs associated with increasing lamb survival through managing ewes more intensively on the fodder crop or providing shelter on less productive soils.

Further analyses that examine the actual costs of farmers involved in the trial, including additional labour, and the influence of seasonal variation on the benefits of increasing lamb marking would provide additional insights into the economic viability of the treatments examined in this trial.

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