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Report on

the value of providing shelter to

increase the survival of twin lambs

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Background

The environmental conditions in SW Victoria during the lambing period can be extreme and this leads to low lamb survival especially for twin born lambs. Survival levels as low as 30% have been observed. These low levels of survival reduce flock productivity and improvements in survival offer potential to increase profitability.

Reviews of the provision of shelter for new born lambs (Bird *et. al*. 1984, Pollard 2006) have presented data that has shown shelter can reduce the perinatal mortality of lambs and the Future Farm Industries CRC has been further evaluating the use of shelter areas to increase the survival of twin born merino lambs. Ewes carrying twin lambs are identified by scanning and are moved into the shelter areas for the lambing period. The mortality of the twin merino lambs was halved in this research that compared lambing in shelter areas versus exposed paddocks. This raised the question of whether the provision of shelter areas is a cost effective method for increasing twin lamb survival.

The shelter examined by the CRC was provided by rows of grass hedges with a pasture inter-row. This is a relatively inexpensive system to establish and maintain. The system also has a low opportunity cost in lost grazing because the hedge row and the inter-row pasture area are both grazed by the lambing ewes and can also be grazed at other times of the year. Having a low cost will increase farmers willingness to adopt the system if it is profitable.

The profitability of establishing shelter areas depends on the costs associated with establishing & maintaining the shelter areas and the benefits achieved from higher survival. The costs incurred are proportional to the area of shelter required and this depends on the stocking density on the shelter area during the lambing period and the number of twin bearing ewes in the flock. The benefit achieved is dependant on the number of extra lambs weaned and the value of an extra lamb. The number of extra lambs weaned depends on the number of twin bearing ewes in the flock and the increase in survival that can be achieved by lambing in shelter areas. The value of the extra lambs weaned is complex to calculate because many factors need to be taken into account. When the extra lambs result from improving the survival of twin born lambs the factors include:

- the impact of raising twin lambs on the wool production of the ewe
- the reduction in productivity of a lamb raised as a twin compared to being raised as a single
- the extra energy required by a ewe lactating with twins versus a single or being dry

These factors are included in the MIDAS model and MIDAS has been used previously to calculate the value of increasing lambing percentage (Morrison & Young 1991) and to calculate the value of increasing lamb or weaner survival (Browne & Young 2008).

This paper reports on a analysis carried out using a combination of the MIDAS model with an investment analysis to examine the profitability of establishing hedge rows to provide shelter.

The Analysis

The analysis was carried out in 2 parts. The first component was using MIDAS to value the benefits from improving survival of twin born lambs. The second component was an investment analysis that included the cost of the hedge rows and the MIDAS calculated benefits.

The MIDAS Analysis

The profitability of improving the survival of twin lambs in the Hamilton district of Victoria was calculated using the Hamilton EverGraze version of MIDAS (Young *et al.* 2004). MIDAS is a computer model used to assess the impact of change in a farming system. It describes the biological relationships of a representative farm. This information is used to estimate the profitability of particular enterprises or management strategies. MIDAS is an appropriate tool because it represents the whole flock and it includes a powerful feed budgeting module that optimises animal and pasture management across the whole farm. This makes MIDAS an efficient tool to examine the profitability when the survival of lambs is altered.

MIDAS calculates the profitability of the whole flock based on the productivity of each class of stock and commodity prices and the farm carrying capacity calculated in the detailed feed budget. Being an optimizing model it calculates the optimum stocking rate and optimum rate of grain feeding that will maximize profitability. The model also accounts for changes in flock structure and the change in ewe energy requirements and production that result from increasing lambing percentage and the number of ewes pregnant or lactating with singles or twins.

The feed budgeting module in MIDAS is based on the energy requirement and intake capacity equations of the Australian Feeding Standards (SCA 1990), these are also the basis of the GrazFeed model. The feed year is divided into 10 periods and the feed budget is calculated for each period. With different ewe feed requirements and different flock structures the metabolisable energy (ME) requirement for the flock can vary for each of the 10 periods. The model then calculates whether the most profitable way to achieve the required nutrition for the flock is by adjusting stocking rate, adjusting grain feeding or adjusting the grazing management of pastures and varying the severity of grazing at different times of the year to alter the pasture production profile.

The model farm

The following section outlines the main assumptions underpinning this analysis.

Land management units

The model represents a ‘typical’ farm in the Hamilton region in south west Victoria. The total area of the farm is 1000ha and is comprised of 3 land management units (LMUs; Table 1). The pasture production profile varies on each LMU.

Table 1: Description and area of each LMU on the model farm

Land Management Unit	Area (ha)	Description
Ridges	200	Well drained gravely soils at tops of hills.
Mid slopes	600	Moderately drained loams in the mid slopes
Flats	200	Clay soils in lower slopes that are often waterlogged.

Animal production system

The analysis was carried out for both:

1. a self-replacing merino flock and
2. a dual purpose flock mating merino ewes to a terminal sire, selling all progeny as prime lambs and buying replacement ewes.

The merino flock is producing wool from a medium wool genotype lambing in August/September and shearing in March. Surplus ewes are sold as hoggets off shears in March. Wethers are sold either off shears as hoggets or as store lambs. The dual purpose flock uses the same genotype lambing in July and turning off finished crossbred lambs.

Pasture production

The pasture production is based on a moderately productive perennial ryegrass and sub-clover stand typical of pastures on farms based on top 20% of the SW Victoria monitor farm project. This pasture is grown on all land management units. The growth rate of the pasture has been based on simulations using the GrassGro model with climate data from the Hamilton weather station (Steve Clark *pers comm.*).

Sensitivity analysis

The analysis carried out with the MIDAS model involved altering the mortality of the twin lambs based on them being provided shelter at birth. Two level were examined a 25% reduction and a 50% reduction.

A range of production scenarios where examined in a sensitivity analysis which varied the proportion of ewes carrying twins, the survival level of the twin lambs without shelter and the price of wool and sale sheep (See Table 2).

Table 2: Value used in the sensitivity analysis carried out with MIDAS.

	Standard level	Range examined
Proportion of ewes carrying twin	30	10 , 30 & 50
Survival of twins without shelter	50	30, 50 & 70
Price of Wool & Sale sheep	Wool 750 c/kg MI Ewes $30/hd, Prime Lamb $2.70/kg.	-25%, std & +25%

The weaning percentage achieved varies depending on the proportion of ewes carrying twins and the survival of the twin born lambs (Table 3).

Table 3: Indicative weaning percentage for the range of production levels compared in the MIDAS analysis. The actual weaning percentage is affected by the level of nutrition provided to the ewes which can vary depending on prices and other variables. Values calculated based on 8% dry ewes and 85% survival of single born lambs.

Proportion of ewes with twins	Survival of twins w/o shelter	Reduction in Mortality		
		0% - No shelter	25%	50%
10%	30%	76	79	86
	50%	80	82	85
	70%	84	85	87
30%	30%	71	81	92
	50%	85	90	98
	70%	95	99	104
50%	30%	66	83	101
	50%	86	98	111
	70%	106	113	121

The Investment Analysis

A discounted cashflow analysis was done to evaluate investing in hedge rows to achieve the improvement in twin lamb survival. The results calculated include

1. the equivalent annual profit or loss (annuity) resulting from implementing the system, expressed either as $/ewe or $/ha of hedge.
2. the number of years required to breakeven

Appendix 1 provides details of the management required to establish and maintain the shelter area. For this analysis it was assumed that there was an initial cost associated with establishment, an opportunity cost of lost grazing in the establishment year and an annual maintenance cost associated with applying ProGibb. The rows of Tall Wheat grass in the shelter areas are expected to have a life of at least 15 yrs although the inter-row species may need to be resown within this time. This cost of resowing the inter-row is not included in the analysis because it would have been incurred even in the absence of the hedge rows.

The area of hedge rows required depends on the number of ewes carrying twins and the stocking rate at which the twin bearing ewes are carried during lambing. The sensitivity analysis levels examined are outlined in Table 4.

Table 4: Value used in the sensitivity analysis carried out in the discounted cashflow.

	Standard level	Range examined
Establishment Cost ($/ha)	250	150, 250 & 350
Stocking rate (twin ewes/ha)	30	20, 30 & 40

Other assumptions made in the analysis are:

1. Gross margin per DSE = $30/DSE
2. Life of hedge rows = 15 years
3. Cost of scanning = 70c/hd. 50% of this cost is to be recouped from increased survival.
4. Extra inputs on hedge row area = 2g/ha of ProGibb = $20/ha.
5. Lost grazing during the establishment year = 2 DSE/ha
6. Discount rate = 4% real

Using the above assumptions the annual establishment cost when amortised over the life of the hedge rows is $0.27 per ewe. This value is small because for a typical flock only 1 ha of hedge rows is required for ever 100 ewes mated.

Results & Discussion

MIDAS

The MIDAS results are the benefits that accrue to the flock if the survival of the twin born lambs can be increased. These values (Tables 5 – 9) do not include the costs associated with establishing and maintaining the hedge rows.

Merino wool flock selling wethers at 18 months.

The value of reducing mortality is highest when twin conception is high and level of survival of the twins without intervention is low (Table 5). If 30% of ewes are pregnant with twins and the survival of the twin born lambs is 50% then a 25% reduction in twin mortality is worth $1.70/ewe. This increases to $7/ewe if 50% of the ewes are carrying twins, survival is only 30% and a 50% reduction in twin mortality is achieved.

Table 5: Benefits ($/ewe) from a 25% and 50% reduction in mortality at different levels of twin conception and survival.

Proportion of ewes with twins	Survival of twins w/o shelter	Reduction in Mortality	
		25%	50%
10%	30%	0.90	2.25
	50%	1.00	1.95
	70%	0.60	1.15
30%	30%	2.30	4.75
	50%	1.70	3.45
	70%	1.00	2.00
50%	30%	3.40	7.00
	50%	2.50	5.00
	70%	1.40	2.90

For a merino wool flock increasing wool prices has little impact on the value of reduced mortality of twin born lambs (Table 6).

Table 6: Benefit ($/ewe) from a 25% and 50% reduction in mortality at different levels of twin conception and survival, at high wool prices.

Proportion of ewes with twins	Survival of twins w/o shelter	Reduction in Mortality	
		25%	50%
10%	30%	0.90	2.25
	50%	1.00	2.00
	70%	0.60	1.20
30%	30%	2.35	4.75
	50%	1.80	3.60
	70%	1.10	2.15
50%	30%	3.45	7.10
	50%	2.65	5.25
	70%	1.50	3.00

Merino ewes mated to a terminal sire selling lambs at 5-6 months (specialist x-bred)

The same pattern is seen when a dual purpose flock is analysed, however the values are higher than for the wool flock (Table 7). If 30% of ewes are pregnant with twins and the survival of the twin born lambs is 50% then a 25% reduction in twin mortality is worth $2.50/ewe. This increases to $12/ewe if 50% of the ewes are carrying twins, survival is only 30% and a 50% reduction in twin mortality is achieved.

Table 7: Benefit ($/ewe) from a 25% and 50% reduction in mortality at different levels of twin conception and survival.

Proportion of ewes with twins	Survival of twins w/o shelter	Reduction in Mortality	
		25%	50%
10%	30%	1.15	2.25
	50%	0.85	1.65
	70%	0.50	1.00
30%	30%	3.55	7.00
	50%	2.50	5.00
	70%	1.50	3.00
50%	30%	6.15	12.05
	50%	4.30	8.50
	70%	2.55	5.00

Higher and lower meat prices increase and decrease the value of reducing mortality respectively (Tables 8 and 9).

Table 8: Benefit ($/ewe) from a 25% and 50% reduction in mortality at different levels of twin conception and survival at high meat prices.

Proportion of ewes with twins	Survival of twins w/o shelter	Reduction in Mortality	
		25%	50%
10%	30%	1.45	3.00
	50%	1.10	2.30
	70%	0.70	1.50
30%	30%	4.60	9.15
	50%	3.35	6.70
	70%	2.05	4.10
50%	30%	7.85	15.55
	50%	5.62	11.15
	70%	3.34	6.47

Table 9: Benefit ($/ewe) from a 25% and 50% reduction in mortality at different levels of twin conception and survival at low meat prices.

Proportion of ewes with twins	Survival of twins w/o shelter	Reduction in Mortality	
		25%	50%
10%	30%	0.80	1.65
	50%	0.60	1.20
	70%	0.36	0.70
30%	30%	2.60	5.10
	50%	1.80	3.65
	70%	1.10	2.15
50%	30%	4.50	8.80
	50%	3.10	6.15
	70%	1.80	3.65

Investment Analysis

The results of the investment analysis (Tables 10 – 17) build on the MIDAS results and include the costs of establishing and maintaining the shelter areas. The average annual benefit (annuity) from investing in establishing hedge rows and utilising the area as shelter during lambing for twin born lambs is $2.55/ewe for a flock mated to merino rams and $4.00/ewe for a flock mated to a terminal breed. This is for a flock that has 30% of ewes carrying twins, there is 50% survival of the twin lambs in the absence of shelter and providing shelter will reduce mortality by 50%. Altering the prolificacy of the flock, the survival level of the twin born lambs or the reduction in mortality achieved from the shelter alters the annuity (Table 10 & 11). Table 12 & 13 presents the same information as an annuity per hectare of shelter established. When the proportion of ewes carrying twins is increased there is a smaller increase in the annuity per hectare than per ewe because the area of shelter required increases. Tables 14 & 15 presents the period required to breakeven and this provides an idea of the impact of the investment on farm cashflow.

Table 10: The annuity ($/ewe) achieved from investing in hedge rows for shelter for a merino wool flock (merino ewe & merino sire) at different levels of twin conception and survival.

Proportion of ewes with twins	Survival of twins w/o shelter	Reduction in Mortality	
		25%	50%
10%	30%	0.45	1.65
	50%	0.50	1.35
	70%	0.10	0.65
	30%	1.50	3.75

30%	50% 70%	1.00 0.35	2.55 1.25
50%	30% 50% 70%	2.35 1.50 0.50	5.60 3.75 1.80

Table 11: The annuity ($/ewe) achieved from investing in hedge rows for shelter for a dual purpose flock (merino ewe, terminal sire) at different levels of twin conception and survival.

Proportion of ewes with twins	Survival of twins w/o shelter	Reduction in Mortality	
		25%	50%
10%	30% 50% 70%	0.65 0.35 0.05	1.65 1.10 0.50
30%	30% 50% 70%	2.65 1.70 0.80	5.80 4.00 2.20
50%	30% 50% 70%	4.85 3.15 1.55	10.25 7.00 3.80

Table 12: The annuity ($/ha of shelter) achieved from investing in hedge rows for shelter for a merino wool flock (merino ewe & merino sire) at different levels of twin conception and survival.

Proportion of ewes with twins	Survival of twins w/o shelter	Reduction in Mortality	
		25%	50%
10%	30% 50% 70%	130 145 35	495 410 195
30%	30% 50% 70%	150 100 35	375 255 125
50%	30% 50% 70%	140 90 30	335 225 110

Table 13: The annuity ($/ha of shelter) achieved from investing in hedge rows for shelter for a dual purpose flock (merino ewe, terminal sire) at different levels of twin conception and survival.

Proportion of ewes with twins	Survival of twins w/o shelter	Reduction in Mortality	
		25%	50%
10%	30% 50% 70%	190 105 15	500 330 155
30%	30% 50% 70%	265 170 80	580 400 220
50%	30% 50% 70%	290 190 95	615 420 230

Table 14: The period required to breakeven (years) from investing in hedge rows for shelter for a merino wool flock (merino ewe & merino sire) at different levels of twin conception and survival.

Proportion of ewes with twins	Survival of twins w/o shelter	Reduction in Mortality	
		25%	50%
10%	30% 50%	3 3	2 2

	70%	6	3
30%	30%	3	2
	50%	4	2
	70%	7	3
50%	30%	3	2
	50%	4	3
	70%	7	4

Table 15: The period required to breakeven (years) from investing in hedge rows for shelter for a dual purpose flock (merino ewe, terminal sire) at different levels of twin conception and survival.

Proportion of ewes with twins	Survival of twins w/o shelter	Reduction in Mortality	
		25%	50%
10%	30%	3	2
	50%	4	2
	70%	9	3
30%	30%	2	2
	50%	3	2
	70%	4	3
50%	30%	2	2
	50%	3	2
	70%	4	3

The most important variable determining the return from investing in shelter is the level of reduction in mortality of the twin born lambs (Table 10-15). If providing shelter reduces mortality by 50% then it is highly profitable in every scenario of price, proportion of ewes carry twins and survival level without shelter. If only a 25% reduction is achieved then providing shelter is still profitable however the increase is small when the survival without shelter is low. Price scenario has a small impact on the return from investing in shelter, however, as shown in the MIDAS results the impacts are relatively small and are less important than the changes in the survival level of twins.

The cost of establishment are relatively unimportant in the calculation of profitability because they are small compared with the potential benefits per ewe. Hence the impact of altering the cost of establishment is mainly on the farm cashflow rather than overall profitability. The impact of varying establishment costs from $150 up to $350/ha is less than $0.30/ewe/yr (Table 16).

Table 16: The annuity ($/ewe) achieved from investing in hedge rows for shelter for a merino wool flock (merino ewe & merino sire) at different costs of establishment and different levels of twin conception and survival.

Proportion of ewes with twins	Survival of twins w/o shelter	Cost of Establishment ($/ha)		
		$150	$250	$350
10%	30%	1.70	1.70	1.60
	50%	1.40	1.40	1.30
	70%	0.70	0.70	0.60
30%	30%	3.80	3.70	3.60
	50%	2.60	2.60	2.50
	70%	1.30	1.20	1.20
50%	30%	5.70	5.60	5.50
	50%	3.90	3.80	3.60
	70%	1.90	1.80	1.70

Conclusions

The main factor that determines whether it will be profitable to invest in shelter is the reduction in mortality that will be achieved. This analysis shows that if a 50% reduction can be achieved then for most scenarios of price and productivity it will be profitable, however, if only a 25% reduction can be achieved then there are some scenarios that the money invested in establishing the hedge rows will not be recouped. It is important for individual producer to have an idea of the reduction in mortality that is likely on their farm.

There is a range of information that would help producers decide on the change in survival likely from using hedge rows on their properties

1. Further research into the survival of lambs in hedge rows and relating it to the conditions prevailing during lambing.
2. Desktop assessments of climatic conditions in different regions at different times. This will allow a risk assessment to be made for different times of lambing in different regioins.
3. Individual producers can monitor the level of mortality of twins in their own flocks if they scan and separate twin bearing mobs and measure the number of lambs weaned.

Until that information is available, producers will need to estimate their level of losses and the likely improvement from providing shelter. That estimate along with this analysis will help a decision making regarding the profitability of shelter.

A range of assumptions have been made in this analysis that may not hold in specific circumstances. Circumstances that would increase the profitability of establishing hedge rows are

1. A pasture is degraded and requires renovating. In this situation the extra cost of including hedge rows of Tall Wheat Grass could be as low as $20/ha. This reduces the period required to breakeven down to 2 or 3 years in all production and price scenarios because of the cashflow saving.
2. Ewes are being scanned in the current system so the cost of scanning doesn't need to be recouped from twin survival. If this is the case then there is a saving in the cost of scanning of $0.35/ewe/year

This analysis hasn't quantified all of the benefits associated with improving survival, the benefits not included are small, although included them would add to the benefits of providing shelter. These benefits not quantified are:

1. selection pressure on genetically important traits can be increased if weaning percentage is increased
2. the micro-climate in the inter-row is improved and this may lead to greater growth rates of pasture and/or the lambs leading to higher farm stocking rate and earlier turn-off of the lambs.
3. the reduction in mortality is an improved animal welfare outcome.

A spreadsheet is available that allows specific situations to be analysed so advisers and producers can tailor the analysis to their specific situation if desired and examine a wider range of scenarios than have been presented in this report.

References

Bird, P.R., Lynch, J.J. and Obst, J.M. (1984) Effect of Sheltr on Plant and Animal Production. *Animal Production in Australia* **15:270-273**

Browne, N. and Young, J.M. (2008). The Value of Achieving an Increase in Weaner Survival. Report to the Sheep CRC. March 2008.

Morrison, D. A. and Young, J. (1991) The value of increasing lambing percentages. *Australian Journal of Agricultural Research* **42: 227-241.**

Pollard, J.C. (2006). Shelter for lambing sheep in New Zealand: a review. *New Zealand Journal of Agricultural Research* **49:395-404.**

Standing Committee on Agriculture (1990). Feed standards for Australian Livestock – Ruminants. CSIRO Publishing.

Young, J.M., Bathgate, A.D., Saul, G. and Clark, S. (2004a). MIDAS Insights on Profitably utilising Perennial Plants in Hamilton, Victoria. Report to EverGraze project. CRC for Management of Dryland Salinity using Perennial Plants. August 2004.

Appendix 1

Assumptions for shelter costing – from Geoff Saul.

- Select well drained area with natural existing protection, aim is to enhance existing shelter rather than create shelter in exposed hillside
- Hedges and pasture are sown in late winter, hedges 1m wide sown every 10-20 m to fit with other farm operations, ie boom spray width, drill width, mowing etc
- Sow hedges first then sow inter-hedge area so 10%?? higher sowing cost than just sowing standard pasture, estimated cost of resowing \$230/ha + 10% = \$250/ha.
- Tall Wheat grass is used for hedges sown at 10 kg/ha.
- Inter-hedge area sown to persistent perennial ie phalaris or ryegrass, or regenerating annual if appropriate.
- Pasture lasts for 10 plus year, given rotational grazing this is realistic
- Year 1
    - Don't graze from sowing (September Hamilton) to end January
    - Cut inter-hedge area for hay end November, sale value of hay \$150/tonne, say 3t/ha, alternatively intermittent grazing in October and November but paddock must be spelled from grazing from Dec 1 to Jan 30. Cost of "lost" grazing in November-Jan low as excess feed at this time.
    - Rotationally graze over summer to allow sheep to consume Tall Wheat Grass, expect that stocking rates will be no different to other paddocks
- Year 2 onwards
    - Rotationally graze to autumn break
    - Lock up paddock as from May 1st
    - Apply fertiliser June 50kg/ha N plus as for other paddocks, if cut for hay and not fed back on the area, need to replace nutrients
    - Use for lambing ewes from August 1st for 4-6 weeks
        - Assuming normal pasture growth, expect 2500-3000 kg/ha FOO on August 1 and could carry up to 30 ewes/ha. See attached EverGraze Action for more details.
        - Assume no reduction in pasture growth across the hedge area. Ewes will gaze the TWG as roughage and also the hedge provides some protection and should increase pasture growth in the inter-hedge area so make up for any "loss" of growth in the hedge
    - Shut up at the end of lambing and cut for hay, from year 2 onwards forage conservation is the best use in spring as high yields can be expected and high forage quality as the hedges are a well managed area. ie say 5t/ha yield.
    - Don't graze until late January when hedge has grown up and seed heads are present. Rotationally graze hay aftermath and seed heads during February – April removing stock when hedges start to be eaten. Expect same overall stocking rate as rest of farm though could argue that forage quality is higher.