lifetimewool

more lambs, better wool, healthy ewes

Implications of Lifetimewool for On-farm Management in South West Victoria

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Executive Summary

The Lifetimewool project (EC298) is a flagship project for AWI and aims to determine the optimal allocation of feed resources and then develop profitable ewe management guidelines for woolgrowers across Australia. The project has included a phase of plot scale research with progeny being born in 2001, 2002 and 2003. This was followed by a paddock scale phase which tested the robustness of the findings from the plot scale trials.

These trials have shown that managing ewes condition score through the reproductive cycle results in;

a. Increased lamb/weaner survival and weaning percentages
b. Increased progeny fleece weight and decreased fibre diameter.
c. Improved ewe health and survival
d. Increased ewe wool production and tensile strength
e. Improved ewe reproduction

The role of the farm modelling component in this project was to:

a. Quantify the value to producers of the information generated in this project.
b. Identify optimum CS targets for producers in five regions in Australia.

Altering the target condition score profile of ewes impacts on wholefarm profitability through a combination of four mechanisms:

a. Impacts on the future production of the surviving progeny
b. Variation in the survival rate of the lambs born
c. Varying production achieved from the ewes including CFW, FD and number of lambs conceived.
d. Varying energy demands of ewes which results in changes in stocking rate and grain feeding

The statistical analysis carried out on the results from the small plot trials has quantified the relationship between the ewe condition at different times in the reproductive cycle and the first 3 of these mechanisms. These biological relationships have been used to quantify the effects of a range of different condition score targets on flock productivity. Quantitative feed budgeting with MIDAS has been used to examine the impacts on stocking rate and supplementary feeding. Combining the flock productivity and the feed budgeting allows the impacts on wholefarm profit to be examined.

This report describes the analysis carried out addressing the above goals and reports on optimum CS targets for producers in south western Victoria.

The Hamilton EverGraze version of MIDAS was selected as the modelling tool for this economic component of the project because it represents the whole flock and it includes a powerful feed budgeting module that optimises animal and pasture management across the whole farm. 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 and 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 while achieving the targets specified for the ewes. The model also accounts for changes in flock structure and the change in ewe energy requirements that result from increasing lambing percentage and the number of ewes pregnant or lactating with singles or twins when ewe nutrition is altered.

Including the biology that has been quantified as part of the Lifetimewool project in economic analyses, alters the outcome about the most profitable nutrition strategy for ewes. The optimum profile identified when including the progeny effects is between $3000 and $38000 more profitable than the profile that was thought to be optimal without Lifetimewool. This range in value for the Lifetimewool information is related to the range of values examined for the increase in survival of progeny achieved from ewes that follow an improved nutrition profile. The optimum profile is robust and the only impact of altering prices or production was on the joining target, the pattern of condition change during pregnancy wasn't affected.

The benefits from the improved ewe nutrition profiles identified in this analysis are less than the benefits that producers can achieve from increasing pasture utilization. This indicates that producers adopting the Lifetimewool findings should do it as part of a package aimed at achieving high rates of pasture utilisation.

The optimum profile for south-west Victoria is:

a. to allow moderate loss of condition after joining, provided the condition can be regained prior to lambing
b. aim for CS2.7 or above at joining

To achieve these targets it will be necessary for producers to increase their rate of supplementary feeding, for some producers it may require a 50% increase in the amount fed. This will be a major disincentive to adoption of the findings of Lifetimewool, however, the return from the extra expenditure is between 50% & 100%.

The most important target is regaining before lambing any condition that was lost after joining. Meeting this target increases the value of production of the flock by approximately $16/CS/ewe. This is more than the benefit of allowing animals to lose condition up to day 90 (approx $4/CS/ewe). Therefore, if condition cannot be regained on green feed during the period day 90 to lambing then it will be more profitable to maintain condition from joining through to lambing.

1. Introduction

The Lifetimewool project (EC298) is a flagship project for AWI and aims to determine the optimal allocation of feed resources and then develop profitable ewe management guidelines for woolgrowers across Australia. The project has included a phase of plot scale research with progeny being born in 2001, 2002 and 2003. This phase allowed very tight control of the nutrition of the ewes and has resulted in relationships between ewe condition score at different times of the year and the clean fleece weight, fibre diameter and survival of the progeny of these ewes. The second phase was paddock scale trials that included larger numbers of ewes but with less control of the condition score targets. This phase tested the robustness of the findings in the plot scale trials.

These trials have shown that managing ewes condition score through the reproductive cycle results in;

a. Increased lamb/weaner survival and weaning percentages
b. Increased progeny fleece weight and decreased fibre diameter.
c. Improved ewe health and survival
d. Increased ewe wool production and tensile strength
e. Improved ewe reproduction

An initial analysis (Young *et al*., 2004b) showed that actively managing ewe's condition can have large positive effects on the profitability of the wool producing enterprise. It can also improve pasture utilisation and stocking rates without detrimentally impacting on ewe and progeny performance.

Altering the target condition score profile of ewe's impacts on wholefarm profitability through a combination of four mechanisms:

a. Impacts on the future production of the surviving progeny
b. Variation in the survival rate of the lambs born
c. Varying production achieved from the ewes including CFW, FD and number of lambs conceived.
d. Varying energy demands of ewes which results in changes in stocking rate and grain feeding

The statistical analysis carried out on the results from the small plot trials has concentrated on developing statistical models that quantify the relationship between the ewe condition at different times in the reproductive cycle and the first 3 of these mechanisms. These biological relationships can then be used to quantify the effects of a range of different condition score targets on flock productivity. Feed budgeting allows the impacts on stocking rate and supplementary feeding to be calculated. Then combining the flock productivity and the feed budgeting allows the impacts on wholefarm profit to be examined.

The role of the farm modelling component in this project was to:

a. Quantify the value to producers of the information generated in this project.
b. Identify optimum CS targets for producers in five regions in Australia.

This report describes the MIDAS analysis carried out addressing the above goals and reports on optimum CS targets for producers in south west Victoria.

2. Methods

2.1 MIDAS

The Hamilton EverGraze version of MIDAS (Young *et al.* 2004a) has been used to calculate the profitability for a range of nutrition profiles for reproducing ewes in the Hamilton district of Victoria. 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 was selected as the modelling tool for the economic component of this project 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 different nutrition strategies for a flock.

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 while achieving the targets specified for the ewes. The model also accounts for changes in flock structure and the change in ewe energy requirements that result from increasing lambing percentage and the number of ewes pregnant or lactating with singles or twins when ewe nutrition is altered.

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 targets for ewe nutrition the metabolisable energy (ME) requirement for the ewes 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.

MIDAS is a steady state model, so an implicit assumption is that any management change has been applied for sufficient time for the impact to have permeated the entire flock. This is important in this analysis because altering the ewe nutrition strategy will take a number of years before the impacts on progeny wool production will have worked through the entire flock. A full investment analysis would account for the interest cost of money and discount the future benefits achieved from altering ewe nutrition now, however, this is not possible within the MIDAS framework and hasn't been included in this analysis. The discounting, has however, been included in the decision tools being developed to complement the MIDAS analysis.

The supplementary feeding rates identified as the most profitable are much higher than are practiced by farmers. A major part of the reason for the difference is that MIDAS works on an average season and doesn't consider variation between seasons. To represent this lower profit expectation and reduce the level of supplementary feeding back to commercial reality, the cost of supplement has been artificially increased.

2.2 The model farm

The following section outlines the main assumptions underpinning this analysis and the management of the property for the 'standard' ewe nutrition strategy. Further detail is presented in Appendix 1.

2.2.1 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 2.1). The pasture production profile varies on each LMU (Appendix 1)

Table 2.1: 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.

2.2.2 Animal production system

The analysis is based on a self replacing merino wool producing flock utilising a traditional Victorian fine wool genotype lambing in August/September and shearing in March. Surplus ewes are sold as hoggets off shears in March and wethers are sold at 3 years old after a prem shearing in September. Individual sheep characteristics (Table 2.2) were based on data for the top 25% of wool producers from the South West Monitor Farm Project and the south west region in the Victorian Wool Industry Benchmarking project for the period 2004/05.

Table 2.2: Summary of production assumptions for the sheep flock with a typical nutrition profile. The values represent the ewe flock averages (2, 3, 4 and 5 year old).

Standard reference liveweight (kg)	45
Fleece weight (clean kg/hd)	3.6
Mean fibre diameter (µm)	18.9
Weaning rate (%)	79

2.2.3 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 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.*). More details on the pasture productivity assumptions are presented in Appendix 1.

2.2.4 Farm management

Table 2.3: Production and management parameters for the 'standard' ewe nutrition profile (Join in CS3 and maintain to lambing).

Profit ($/ha)	391
Number of ewes	4900
Stocking rate (DSE/WG ha)[1]	12.4
Supplementary feeding (kg/DSE)	8.7
(t)	108
Flock structure	
% ewes	56
Sale age of CFA ewes	5.5
Sale age of surplus young ewes	hoggets
Sale age of wethers (yrs)	2.5
Lambing (%)	85
Pasture growth (t/ha)	7.8
Pasture utilization (%)	48
Wool income ($/ha)	587
Sale sheep income ($/ha)	133

2.3 LTW statistics & progeny production assumptions

For this analysis the production of the progeny was adjusted depending on the ewe nutrition strategy. The adjustment was calculated using the coefficients (Table 2.4) calculated by the statistical analysis of the Astral Park 2001 and 2002 progeny (Kearney *pers. comm*), see Table 2.5 for the adjustments to production calculated for each nutrition profile. The production adjustment was applied to all age groups of progeny because the weight of evidence supports the progeny effects being permanent (Thompson *pers. comm.*). The production of the ewe component of the flock was also adjusted, because those animals are the progeny of the ewes from the previous generation, and it assumed that the ewe nutrition strategy has been applied historically and the flock has achieved a steady state.

The base levels of production (CFW, FD, staple strength and reproductive rate) for each age group and class of sheep was calculated using the MIDAS simulation model and the calculated value varies with the nutrition strategy of that class of stock (see Table 2.5 for differences in ewe production for each nutrition profile). This simulation model calculates wool cut as a linear function of ME intake, FD as a function of wool growth rate and staple strength as a function of minimum FD and average FD.

[1] Stocking rate calculated using DSE ratings as outlined in the Farm Monitor Project, Dec 2001.

Table 2.4 : Coefficients fitted in the statistical model that explains progeny production from Ewe LW at joining (kg) and LW change (kg) during pregnancy and lactation using the Austral Park 2001 and 2002 progeny.

	CFW (kgs)	FD (μ)	Birth Weight (kgs)	Survival (%)
Constant[2]	2.87	17.34	3.67	-9.64
Ewe LW - Joining	0.010		0.027	
Ewe LW change				
Day 0-90	0.019	-0.031	0.033	
Day 90-lambing	0.019	-0.036	0.045	
Birth class T	-0.143	0.128	-1.12	-0.473
Rearing class TS	-0.274	0.482		
Rearing class T		0.286		
Progeny Female			-0.192	0.586
Birth weight				4.32
Birth weight squared				-0.395

The change in progeny clean fleece weight and fibre diameter measured in the paddock scale experiments was similar to that measured in the plot scale experiments (Behrendt *pers. comm.*). However, the impact of ewe nutrition on progeny survival was greater in the paddock scale experiments than the plot scale experiments and the impact was greater still in the Western Victorian sites than the other sites. For this reason three levels of progeny survival have been examined in this analysis, they are referred to as 'Victorian Paddock', 'Australian Paddock' and 'Plot Scale' (see Table 2.5 for the difference in survival for the 3 scenarios). The 'Australian Paddock' is considered the best bet estimate of the result that most farmers will achieve in their paddocks, however, for farmers in SW Victoria the 'Victorian Paddock' would be a better estimate (Thompson *pers. comm.*). The paddock scale results are considered to be better than the plot scale results because of the larger numbers of animals involved and because the response in survival in the small plot trials was compromised due to the frequent management interventions.

2.4 The CS patterns

Fifteen different nutrition profiles have been evaluated in this analysis. The profiles examined vary in the condition of the ewes at joining and the amount of condition lost to the minimum and then the amount of condition regained from the minimum to lambing (Figure 2.1). There are 3 joining conditions (2.7, 3.0 and 3.3), 3 rates of condition loss to the minimum (no loss, lose 0.25CS and lose 0.5CS) and 2 rates of condition gain to lambing (no gain and gain 0.25CS).

The standard nutrition strategy is the pattern with ewes being mated at CS 3 and maintaining condition through to lambing. The selection of this pattern as the standard doesn't alter the results of the analysis, it simply becomes the pattern that is not altered during the sensitivity analysis on the magnitude of the Lifetimewool impacts.

The selection of the 15 patterns allows comparison of the effects on profitability of varying condition at joining, varying rate of loss of condition after joining and the rate

[2] Constant is value fitted for the genotypes and management evaluated in the LTW small plot trials. For this analysis the constant has been replaced by values calculated in the MIDAS simulation model.

of gain in condition prior to lambing. Each nutrition strategy examined has a similar pattern that varies in one of the above factors. This pairing of patterns allows the cost or benefit of varying the condition score targets of ewes at different times of the reproductive cycle.

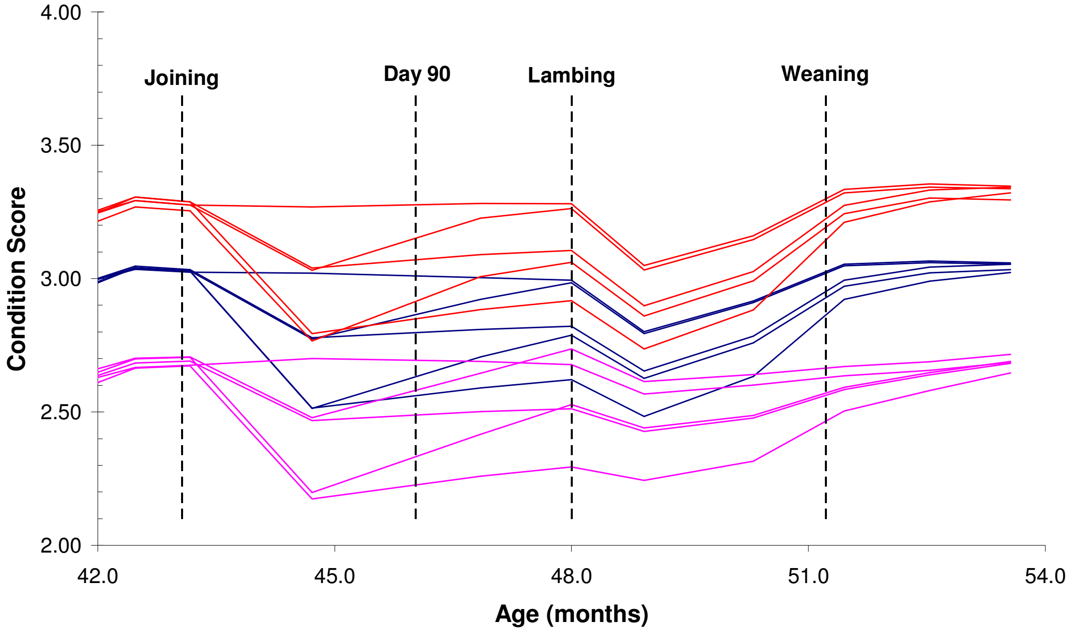

Figure 2.1: The 15 nutrition profiles examined in MIDAS.

For each profile the energy demands and the resulting production of the ewes was simulated using the MIDAS simulation spreadsheet. The production levels of the progeny were adjusted as described in the previous section. Table 2.5 outlines the calculated energy demand of the ewes for the different periods and the estimated change in ewe and progeny production for each of the different profiles.

Starting and finishing at a lower condition requires less energy for the entire year. Comparing the 'CS2.7 maintain to lambing' with 'CS 3 maintain to lambing' the lower CS pattern requires 0.28MJ/d, 0.48MJ/d, 0.94MJ/d and 0.27MJ/d less during the periods joining to day 90, day 90 to lambing, lambing to weaning and weaning to next joining respectively. This is a reduction in the total energy requirement of 178MJ for the year.

Losing condition after joining reduces the energy requirement during that period but increases it in a later period depending on when the condition is regained (either before lambing or from lambing to next joining). Losing 0.25CS and regaining it before lambing requires approximately 28MJ more energy than maintaining weight through the entire period because of the metabolic inefficiency of losing and then gaining condition – that is, gaining condition requires more energy than losing condition generates. However, losing 0.25 CS and not regaining it until after lambing requires approximately 17MJ less energy than maintaining through to lambing. This reduction n energy requirement is because the inefficiency described above is outweighed by the saving in maintenance requirement because the animal is lighter for an extended period. Losing more condition, increases the net saving in energy requirement by approximately 20MJ, losing 0.5CS and regaining 0.25 by lambing only requires 8MJ more energy than maintenance and losing 0.5CS and not regaining until after lambing saves a total of 36MJ.

Starting and finishing at a lower (or higher) condition score also affects ewe wool production, number of lambs conceived, progeny wool production and progeny survival. Ewe wool cut and fibre diameter is closely correlated to energy intake so nutrition targets that require more energy produce more wool that is broader and the number of lambs conceived is proportional to condition at joining. Progeny clean fleece weight, birth weight and survival are closely related to condition of the ewes at lambing, the higher the condition the higher the production. However, progeny fibre diameter is more impacted on by the change in ewe condition from joining to lambing, loss of condition during this period increases the fibre diameter. Each of these progeny measures are fine-tuned depending on whether condition was lost and then regained from joining to lambing or maintained throughout.

Table 2.5: ME required by single bearing ewes through the reproductive cycle to follow each of the 15 different profiles and production of ewes and progeny relative to ewes joined at CS 3 and maintaining condition to lambing.

Joining Condition Score		2.7					3.0					3.3				
Loss to minimum		0	0.25		0.5		0	0.25		0.5		0	0.25		0.5	
Gain to Lambing		0	0.25	0	0.25	0	0	0.25	0	0.25	0	0	0.25	0	0.25	0
ME intake																
Joining to D90	MJ/d	7.84	7.53	7.03	6.69	6.19	8.12	7.81	7.36	7.02	6.57	8.54	8.37	7.81	7.61	7.06
Day 90 to Lamb	MJ/d	9.78	11.07	9.78	11.07	9.79	10.2	11.13	10.2	11.13	10.2	10.67	11.45	10.67	11.45	10.67
Lamb to Wean	MJ/d	14.4	14.37	14.66	14.65	14.94	15.34	15.34	15.58	15.58	15.82	15.69	15.69	15.93	15.93	16.18
Wean to Join	MJ/d	8.09	8.08	8.34	8.34	8.59	8.36	8.36	8.6	8.6	8.84	8.75	8.75	9	8.92	9.24
Ewe Production																
CFW	%	-0.19	-0.14	-0.2	-0.16	-0.22	0	0.03	-0.02	0.01	-0.04	0.15	0.18	0.14	0.16	0.12
FD	µ	-0.32	-0.23	-0.33	-0.22	-0.33	0	0.05	-0.01	0.06	-0.01	0.24	0.3	0.24	0.29	0.25
SS	N/kT	3.2	1.8	2.5	-3.2	-2.6	0.0	-0.6	-0.2	-4.0	-3.7	-1.5	-2.0	-1.7	-3.9	-3.7
Mortality	%	1.6	1.7	2.9	4.6	6.1	0.0	-0.1	0.8	1.3	2.3	-0.6	-0.6	-0.1	0.1	0.7
Preg. Rate	%	-6.8	-6.2	-6.5	-6.2	-6.9	0.0	0.1	0.2	0.1	0.1	5.0	5.0	5.3	4.6	5.3
Progeny Prod'n																
CFW	kg	-0.03	-0.02	-0.06	-0.06	-0.10	0.00	0.00	-0.03	-0.03	-0.07	0.03	0.03	0.00	0.00	-0.03
FD	µ	-0.01	-0.04	0.04	0.02	0.10	0.00	-0.01	0.05	0.05	0.11	-0.02	-0.03	0.03	0.03	0.09
Survival																
Vic. Pad. Scale																
Singles	%	-7.0	-3.9	-11.4	-9.2	-17.8	0.0	0.8	-4.0	-3.6	-9.2	5.3	5.7	1.9	1.9	-2.3
Twins	%	-10.7	-2.7	-15.4	-10.3	-22.6	0.0	4.5	-4.7	-2.3	-11.0	9.3	11.8	4.5	6.1	-1.0
Aust. Pad. Scale																
Singles	%	-3.5	-2.0	-5.7	-4.6	-8.9	0.0	0.4	-2.0	-1.8	-4.6	2.7	2.9	0.9	0.9	-1.2
Twins	%	-5.3	-1.4	-7.7	-5.1	-11.3	0.0	2.2	-2.4	-1.1	-5.5	4.6	5.9	2.3	3.1	-0.5
Plot Scale																
Singles	%	-0.4	-0.2	-0.7	-0.5	-1.0	0.0	0.0	-0.2	-0.2	-0.5	0.3	0.3	0.1	0.1	-0.1
Twins	%	-2.7	-0.7	-3.9	-2.6	-5.6	0.0	1.1	-1.2	-0.6	-2.8	2.3	3.0	1.1	1.5	-0.2

2.5 Standard Prices, Production and Sensitivity Analysis

A range of scenarios have been examined in this analysis in order to test the robustness of the optimal ewe condition targets (Table 2.6). Future prices are uncertain and therefore decisions made about condition targets for ewes will be made allowing for the range of prices that may be received. The results of the Lifetimewool project will be easier to extend and implement if the optimum profile is not affected by market changes. A sensitivity to pasture production and flock structure was also carried out to examine whether the optimum ewe condition targets are altered by these factors.

Table 2.6: Standard price and production levels assumed in this analysis and the range examined in the sensitivity analysis.

	Standard	Sensitivity Levels
Prices		
Wool Price (c/kg sweep the board)		
18µ	1422	+25%, -25%
19µ	1170	
20µ	962	
21µ	845	
FD premium	As above	+25%, -25%
Meat Price ($/hd net)		
Ewe Hgt	34	+25%, -25%
CFA Ewe	32	
Wether	46	
Grain Price ($/t fed out)		
Oats	163	+100%, +25%, -25%
Lupins	222	
Flock Structure		
Sale Age of Wethers	29 months	17mo, 41mo, 53mo
% ewes	56%	66%, 50%, 43%
Time of Lambing	23Aug–26Sept	19 Jul-22Aug
Pasture Production	7.8t/ha	9.8t/ha

Note: Sale sheep price is an average price including ncv's.

3. Results & Discussion

3.1 The implications of Lifetimewool & Optimum targets

To examine the implications of the biology that has been quantified in the Lifetimewool project an analysis was carried out including and excluding the effects of ewe nutrition on progeny fleece value and progeny survival. The comparison of these 2 sets of results provides the potential value of the project.

The most profitable condition score targets for ewes if Lifetimewool effects are ignored is to join ewes in CS2.7, allow ewes to lose 0.5CS and don't regain the condition until after lambing. This is the profile that has the lowest energy requirement and this reduction in energy requirements outweighs the reduction in fleece value of ewes and the reduction in ewe reproductive rate and survival. On paper, following this profile appeared to be $22 830 more profitable than keeping ewes in better condition (Table 3.1).

However, this increase in profit is only achieved if stocking rate is increased (Figure 3.1); at lower stocking rates the advantage of lower energy requirements per ewe only equals the reduction in ewe production. This scenario and these results are consistent with the extension message from consultants and advisers over the last decade.

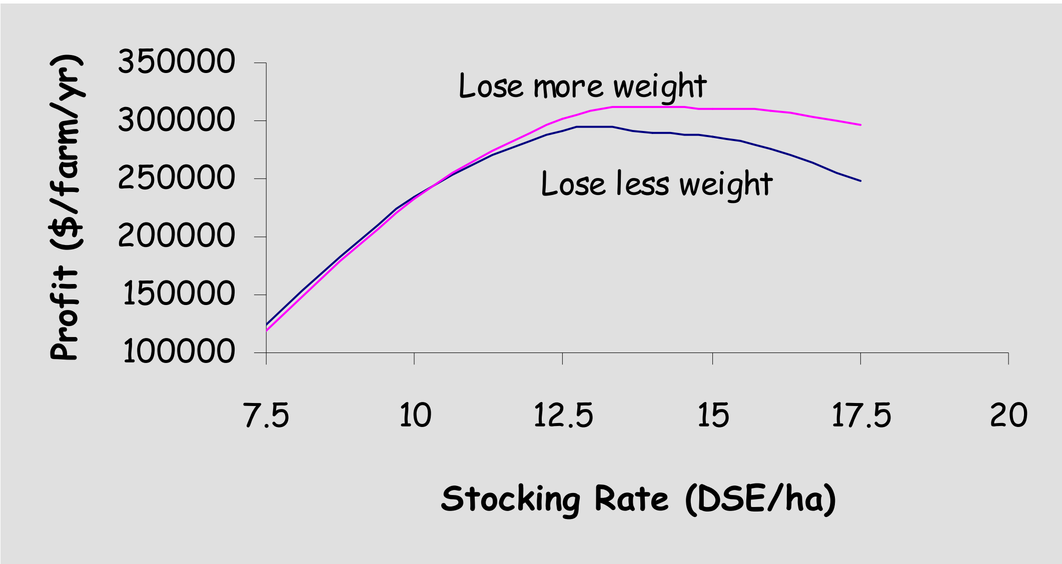

Figure 3.1: The effect of altering stocking rate on farm profit for a farm that has high condition targets for ewes and a farm that has low condition score targets for ewes when ignoring the Lifetimewool effects of ewe condition on progeny fleece production and survival.

When the Lifetimewool relationships are included, the optimum ewe nutrition profile changes. It is more profitable to allow less loss of condition (only 0.25CS) and then regain this condition before lambing. The improved calculations including the Lifetimewool impacts indicate that following the lower profile is actually less profitable by between $3 260/farm (1% of profit or $0.65/ewe) and $38 300/farm (12% of profit or $7.50/ewe) depending on the magnitude of the impact of ewe nutrition on progeny survival (Table 3.1). Further details on other patterns are presented in Appendix 2.

Table 3.1: Differences in profitability ($/yr) for the 1000ha MIDAS farm excluding and including the Lifetimewool effects with the range of progeny survival levels.

Pattern	Excluding	Including		
		Vic Padd	Aust Padd	Plot
Join CS2.7, Lose 0.5CS to D90 & no regain.	+22 830	0	0	0
Join CS2.7, Lose 0.25CS to D90 & regain 0.25CS.	0	+38 300	+12 650	+3 260
Response (% of profit)	7%	12%	4%	1%

Meeting these condition targets requires more energy, but results in higher progeny fleece values and higher progeny survival. In this case the reduction in progeny production for the thinner ewes' results in a benefit from meeting the target condition scores regardless of the stocking rate (Figure 3.2). There is also little difference in the optimum stocking rate for thinner or fatter ewes.

Figure 3.2 also puts the magnitude of the benefits from Lifetimewool into context. If a farmer is growing productive pastures and is achieving high utilization rates there is little scope to increase profit by further increasing stocking rate. Concentrating on ewe condition targets is an avenue for them to increase profit. However, for the farmer that is currently only utilizing a low proportion of their pasture the benefits from monitoring ewes to achieve the condition targets is less than the benefits that could be achieved from increasing pasture utilization.

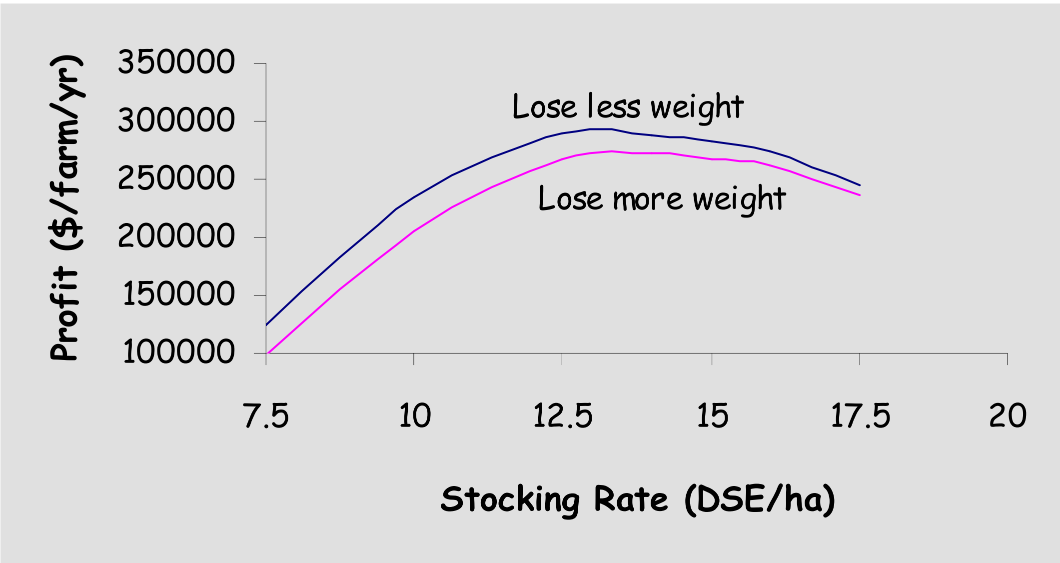

Figure 3.2: The effect of altering stocking rate on farm profit for a farm that has high condition targets for ewes and a farm that has low condition score targets for ewes when including the Lifetimewool effects of ewe condition on progeny fleece production and survival.

The effect of including or excluding the Lifetimewool impacts on farm profit are a combination of the impact of ewe nutrition on progeny fleece value and the impact on progeny survival. The proportion of the effect due to the 2 factors varies with the assumptions about level of progeny survival (Table 3.2). If there is a strong influence of ewe nutrition on progeny survival (as measured in the Victorian paddock sites) then survival is a slightly larger contributor than fleece value, whereas if the impact on survival is based on the small plot trials then the impact on profit is driven by the fleece value.

Table 3.2: The proportion of the difference in profitability from including Lifetimewool due to changes in progeny fleece values and changes in progeny survival for the range of progeny survival levels.

	Vic Padd	Aust. Padd	Plot
Fleece Value	40	55	75
Survival	60	45	25

When the ewe nutrition targets are changed the optimum stocking rate and the optimum level of grain feeding both change. However, the change in grain feeding has double the importance of the change in stocking rate. So, a simple rule of thumb for producers to achieve the Lifetimewool nutrition targets is to maintain their current stocking rates and feed more grain. The grain should be targeted at the period after joining to reduce the rate of loss of condition and also to achieve deferment of pasture at the break of season to allow gain in condition on green feed.

The increase in the amount of supplement that is required will depends on the current management of the ewes. If producers are currently following the nutrition profile that is identified as the optimum when Lifetimewool is ignored, then it is estimated they will need to increase their supplementary feeding by about 50% from 40t/year or 3.5kg/DSE up to 65t/year or 5kg/DSE. This is a substantial increase in supplementary feeding and will act as a disincentive for producers to adopting the Lifetimewool message, however, the return on the money expended is over 75%.

3.2 Cost of missing targets

The optimum ewe condition targets, with standard prices and production, is joining in CS 2.7 and then slow loss of condition after joining, with the condition regained prior to lambing. If this target is not achieved then profit is reduced (see Appendix 2 for details of profitability of each pattern). Figures 3.3, 3.4 & 3.5 show the reduction in profit and the change in the value of production if the ewe condition targets are not achieved either because too much or too little condition is lost or gained at different times. These values are calculated for flocks of the same size (fixed number of DSE) so that changes in value of production are not the result of changing flock size, however, there are some unavoidable errors associated with the calculations because the flock composition changes when lambing percentage varies.

These values provide some insight into the importance of achieving the different targets. Achieving the gain leading up to lambing is the most important target. The reduction in profit from not gaining condition after day 90 ($16 per CS) is much greater than the cost of not losing condition after joining ($4/CS). This indicates that if the condition can't be regained between day 90 and lambing then it is better to maintain the animals.

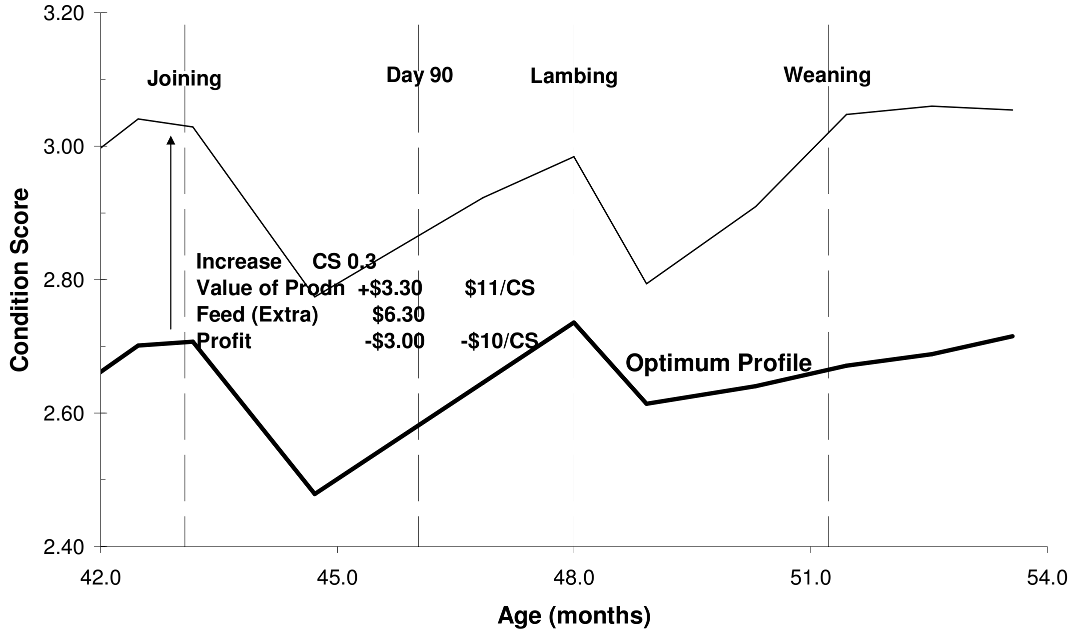

Figure 3.3: Change in value of production, profit and cost of feeding if a sub-optimal profile is followed that is higher condition all year.

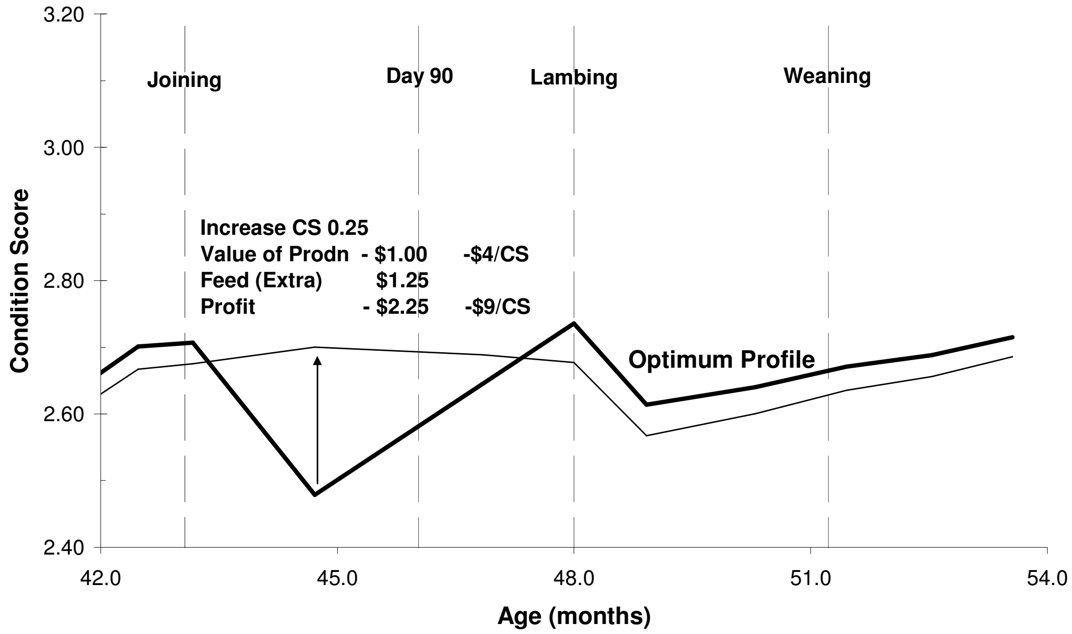

Figure 3.4: Change in value of production, profit and cost of feeding if a sub-optimal profile is followed that is higher at the minimum.

The value of production is the amount that could be spent to increase ewe condition at the different times. The profit values include the cost of providing feed to meet the condition targets in an average year. If the season is not average then the change in value of production and an estimate of cost of feeding could be used to decide if it will be profitable to alter the feeding of the ewes. As a rule of thumb, gaining condition using grain will not be profitable, whereas it can be profitable to reduce or stop loss of condition using grain.

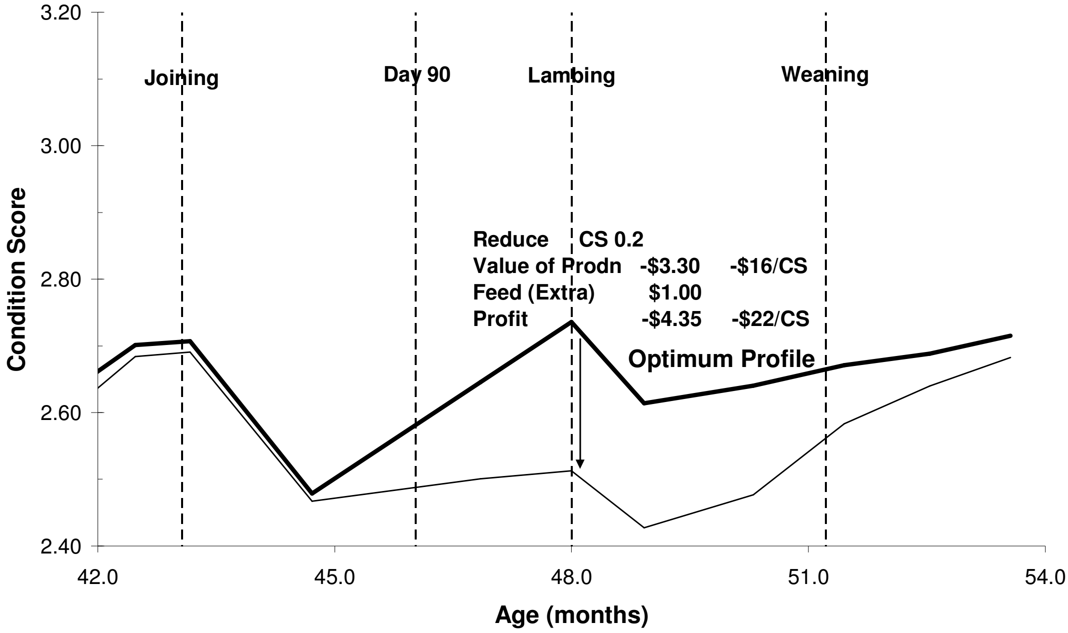

Figure 3.5: Change in value of production, profit and cost of feeding if a sub-optimal profile is followed that is thinner at lambing.

3.3 Sensitivity Analysis

The profitability of the 15 different patterns was examined for the range of scenarios outlined in Table 2.6. The scenarios included changing wool prices in a range +/- 25%, meat price +/- 25%, grain price +100%/-25%, altering time of lambing earlier by 1 month, changing flock structure and increasing pasture productivity.

Increasing the wool price or the premium for fine wool increases the penalty associated with losing condition during gestation (Table 3.4). However, within the range of prices examined the optimum pattern is not affected. When the time of lambing is brought earlier it becomes most profitable to aim to have ewes in CS3.3 at joining and then follow the pattern of slow loss of condition with the condition regained by lambing (Table 3.4). The target condition at joining is increased but the pattern of change during pregnancy and lactation is the same. The original optimum profile starting at CS2.7 is only $4/ha less profitable than the higher profile, so there is little cost associated with not varying the targets in response to changing management.

It appears that the optimum condition targets for ewes are robust and the profile that gave the maximum profit for each scenario was affected little by changing prices, productivity or management. Details of farm profit and production and the impacts of the different scenarios examined in presented in Appendix 3.

Table 3.4: Difference in profit per hectare compared to the optimum pattern for the standard scenario for the 15 different target condition scores for the range of prices productivity and management examined. The most profitable target is highlighted in bold for each scenario.

Joining Condition Score	2.7					3.0					3.3				
Loss to minimum	0	0.25		0.5		0	0.25		0.5		0	0.25		0.5	
Gain to Lambing	0	0.25	0	0.25	0	0	0.25	0	0.25	0	0	0.25	0	0.25	0
Standard	-15	**0**	-8	-4	-13	-19	-8	-30	-24	-56	-27	-19	-47	-41	-69
Prices															
Wool +25%	-10	**0**	-5	-8	-15	-22	-14	-40	-37	-76	-34	-30	-62	-60	-95
-25%	-15	**0**	-11	-6	-16	-15	-3	-26	-20	-54	-22	-13	-42	-37	-67
FD premium +25%	-15	**0**	-9	-8	-19	-27	-16	-43	-39	-71	-39	-32	-61	-57	-86
-25%	-18	**0**	-10	-3	-11	-17	-3	-25	-18	-50	-24	-13	-40	-34	-62
Meat +25%	-13	**0**	-8	-5	-15	-17	-7	-29	-23	-56	-25	-18	-45	-40	-68
-25%	-17	**0**	-9	-3	-10	-21	-8	-31	-24	-55	-30	-19	-48	-41	-70
Grain +100%	-20	**0**	-11	-4	-14	-23	-7	-36	-28	-69	-33	-21	-57	-51	-88
+25%	-18	**0**	-10	-4	-13	-22	-8	-32	-24	-59	-31	-19	-50	-43	-74
-25%	-12	**0**	-7	-4	-13	-17	-8	-28	-23	-52	-24	-18	-43	-39	-65
Flock Structure															
Sell Wethers 17mo	-18	**0**	-8	-5	-14	-24	-10	-36	-30	-70	-35	-25	-58	-53	-88
41mo	-13	**0**	-7	-2	-9	-16	-6	-25	-18	-45	-23	-15	-39	-32	-57
53mo	-12	**0**	-7	0	-8	-14	-4	-21	-14	-39	-20	-12	-33	-27	-49
Time of Lambing															
July/August	-4	0	-3	-1	-6	-1	2	-1	1	-8	2	**4**	-4	-2	-11
Pasture Prodn															
10t/ha	-27	**0**	-18	-3	-22	-29	-8	-22	-6	-40	-22	-7	-28	-15	-62

4. Conclusions

Including the biology that has been quantified as part of the Lifetimewool project in economic analyses alters the outcome about the most profitable nutrition strategy for ewes. The optimum profile identified when including the progeny effects is between $3000 and $38000 more profitable than the profile that was thought to be optimal without Lifetimewool. The range in value of the Lifetimewool information is related to the increase in survival of progeny that will be achieved from ewes that follow and improved nutrition profile. The optimum profile is robust and the impact of altering prices or production was very minor.

The benefits from the improved ewe nutrition profiles identified in this analysis are less than the benefits that producers can achieve from increasing pasture utilization. This indicates that producers adopting the Lifetimewool findings should do it as part of a package aimed at achieving high rates of pasture utilisation.

The optimum profile for south-west Victoria is:

c. to allow moderate loss of condition from joining to day 90, provided the condition can be regained prior to lambing
d. aim for CS2.7 or above at joining

To achieve these targets it will be necessary for producers to increase their rate of supplementary feeding, for some producers it may require a 50% increase in the amount fed. This will be a disincentive to adoption of the findings of Lifetimewool, however, the return from the extra expenditure is over 75%.

The most important target is regaining any condition lost after joining prior to lambing. Meeting this target increases the value of production of the flock by $16/CS/ewe. This is not a high enough value to make it profitable to achieve the target by gaining condition using supplementary feed, so it is more profitable to maintain condition between joining and day 90 if the condition can’t be regained on green feed.

5. References

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 Profitability utilising Perennial Plants in Hamilton, Victoria. Report to EverGraze project. CRC for Management of Dryland Salinity using Perennial Plants. August 2004.

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Appendix 1: Standard Farm Production

Table A1.1: Sheep management program.

	'Wool'
Lambing time	Early Sept
Weaning age	12 weeks
Shearing time	Feb/Mar
Crutching time	Oct
Stock turn off	
- wether lambs	
- ewe lambs	
- ewe hoggets	Mar/Apr
- CFA ewes	Mar/Apr
- adult wethers	Mar/Apr
Lamb slaughter wt (kg)	

Other management comments:

- Animal husbandry
  - Drenching (1 or possibly 2 summer drenches)
  - Jetting (normally spring born lambs jetted at marking or weaning)
- Crutching (contract)
- Shearing (contract)

Pasture productivity assumptions

Table A1.2: Initial growth or germination (kg/ha) of each pasture type on each soil class during the first feed period.

	Ridges	Mid-slopes	Flats
Medium production Perennial Ryegrass	426	426	426
High production Perennial Ryegrass	594	594	594

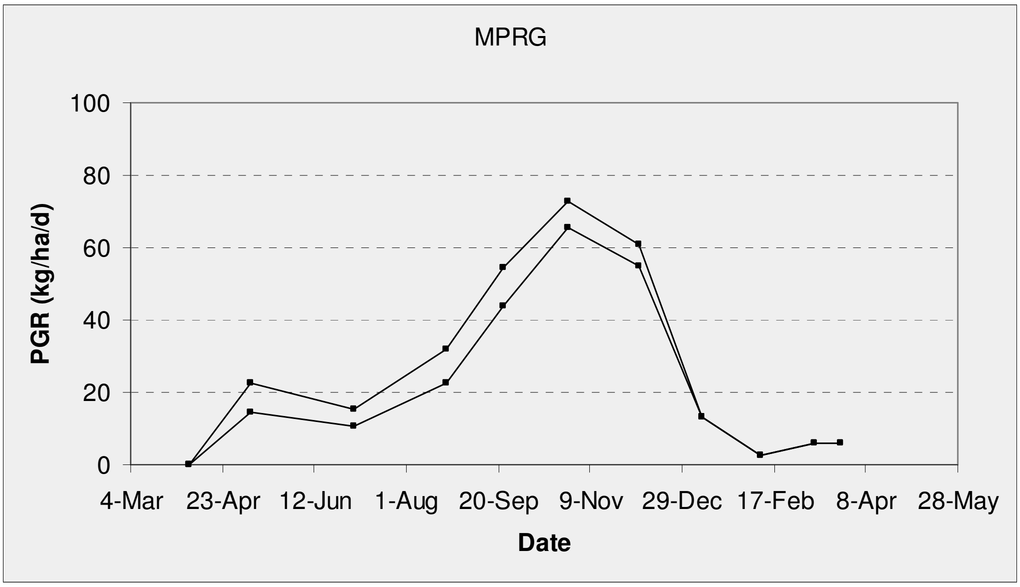

Figure A1.1: MIDAS inputs: Low & High PGR for medium productivity perennial ryegrass pasture in each feed period (1 to 10). Note the low and high PGR relate to the low & high FOO levels in the following graph. The MIDAS optimization algorithm is able to vary grazing intensity which alters FOO which then affects PGR.

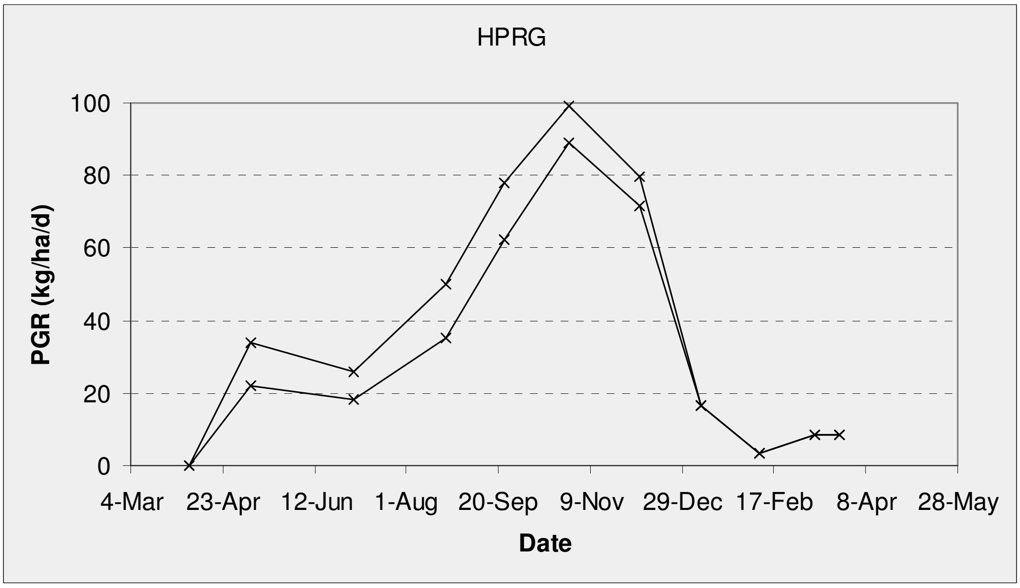

Figure A1.2: MIDAS inputs: Low & High PGR for high productivity perennial ryegrass pasture in each feed period (1 to 10). Note the low and high PGR relate to the low & high FOO levels in the following graph. The MIDAS optimization algorithm is able to vary grazing intensity which alters FOO which then affects PGR.

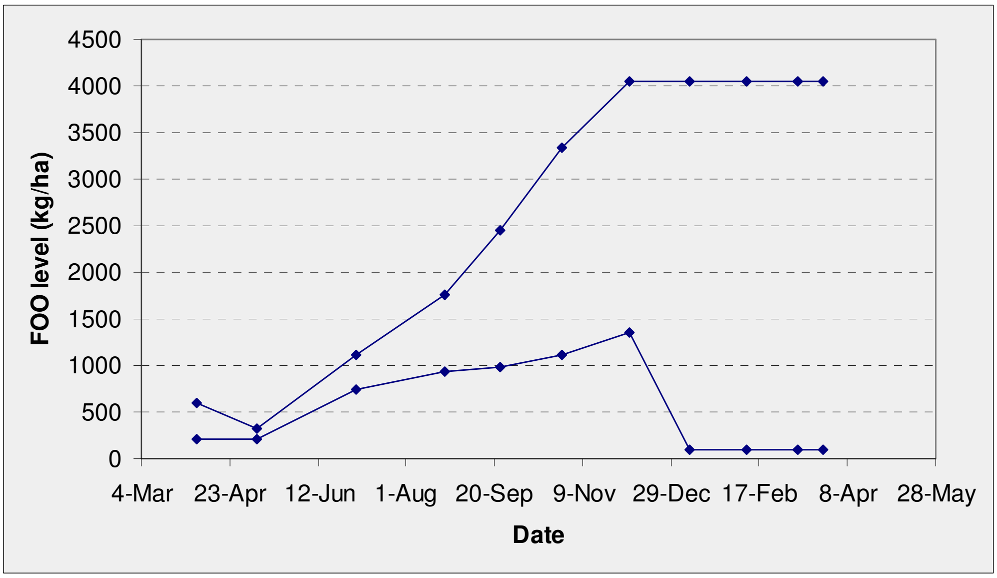

Figure A1.3: MIDAS inputs: FOO levels for the 2 different PGR levels for each pasture type.

Table A1.3: Digestibility of total pasture available in each of the feed periods.

Period of Year	Start of feed period	End of feed period	DMD (%)
1	25-Mar	14-Apr	76
2	15-Apr	31-May	77
3	1-Jun	4-Aug	78
4	5-Aug	8-Sep	77
5	9-Sep	6-Oct	77
6	7-Oct	17-Nov	74
7	18-Nov	22-Dec	71
8	23-Dec	24-Jan	60
9	25-Jan	24-Feb	54
10	25-Feb	24-Mar	51

Appendix 2: Profit & production summary for the 15 patterns

Table A2.1: Stocking rate, value of production, stocking rate and supplementary feeding for flocks with ewes with different target condition scores. The most profitable target is highlighted for each scenario.

Joining Condition Score		2.7					3.0					3.3				
Loss to minimum		0	0.25		0.5		0	0.25		0.5		0	0.25		0.5	
Gain to Lambing		0	0.25	0	0.25	0	0	0.25	0	0.25	0	0	0.25	0	0.25	0
Survival:																
Vic. Pad. Scale																
Profit	$/ha	365.0	**385.4**	367	376	347	369	**383**	354	362	321	367	376	344	351	316
	Δ$/ewe[4]	-3.6	**0.0**	-3.1	-1.8	-6.1	-3.4	**-0.6**	-6.3	-4.8	-11.9	-4.2	-2.1	-8.9	-7.8	-14.3
Value of Prodn[3]	Δ$/ewe[†]	-4.5	**-2.4**	-7.4	-6.9	-13.2	0.0	**1.2**	-3.0	-2.9	-6.5	8.8	9.6	5.6	5.7	2.0
Stocking Rate	DSE/ha	13.1	**12.3**	12.9	12.5	13.0	12.4	**11.8**	12.3	12.0	12.3	12.2	11.6	12.1	11.8	12.1
Supplement	kg/DSE	9.5	**4.7**	6.5	4.3	4.8	8.7	**4.9**	8.4	6.3	10.4	9.9	6.4	11.0	8.7	12.6
	t	124	**57**	84	53	62	108	**58**	103	75	129	121	74	133	102	152
Aust. Pad. Scale																
Profit	$/ha	373.2	**388.2**	379	384	376	369	**381**	358	365	333	361	370	342	347	319
	Δ$/ewe[†]	-2.7	**0.0**	-1.5	-0.8	-2.2	-3.9	**-1.6**	-6.0	-4.9	-10.8	-6.0	-4.3	-9.9	-8.9	-14.4
Value of Prodn[*]	Δ$/ewe[†]	-3.6	**-2.1**	-6.0	-5.9	-9.7	0.0	**0.7**	-2.5	-2.6	-5.4	3.0	3.5	0.7	0.6	-2.1
Stocking Rate	DSE/ha	13.1	**12.3**	13.0	12.6	13.0	12.4	**11.8**	12.3	12.0	12.4	12.1	11.6	12.1	11.8	12.1
Supplement	kg/DSE	9.4	**4.7**	6.5	4.2	4.5	8.7	**4.9**	8.3	6.2	10.0	10.1	6.4	11.1	8.8	12.4
	t	123	**57**	84	52	59	108	**57**	102	75	123	122	74	134	104	151
Plot Scale																
Profit	$/ha	378.4	**390.2**	387	389	387	369	**380**	361	367	340	357	365	340	346	321
	Δ$/ewe[†]	-2.2	**0.0**	-0.6	-0.2	-0.6	-4.3	**-2.3**	-5.9	-4.9	-10.1	-7.1	-5.6	-10.6	-9.7	-14.5
Value of Prodn[*]	Δ$/ewe[†]	-3.0	**-1.9**	-5.1	-5.2	-8.4	0.0	**0.5**	-2.2	-2.4	-4.8	2.0	2.3	-0.1	-0.3	-2.5
Stocking Rate	DSE/ha	13.1	**12.3**	13.0	12.6	13.0	12.4	**11.8**	12.3	12.1	12.4	12.1	11.5	12.1	11.8	12.1
Supplement	kg/DSE	9.3	**4.7**	6.5	4.1	4.4	8.7	**4.8**	8.2	6.2	9.7	10.2	6.4	11.1	8.9	12.4
	t	122	**58**	84	51	57	108	**57**	102	74	120	123	74	134	104	150

[3] Value of Production is calculated from flocks with the same number of DSE.

[4] Change in profit and value of production per ewe compared with the flock with a CS target of 3 at joining and maintaining condition till lambing.

Appendix 3 – Detailed Sensitivity Analysis results

Table A3.1: Profit and production summary for the standard pattern for each of the scenarios examined in the sensitivity analysis.

	Profit	SR	Supplement	
	$/ha	DSE/ha	kg/DSE	Tonnes
Standard	369	12.4	8.7	108
Prices				
Wool +25%	799	16.4	25.7	421
-25%	168	11.3	3.7	41
FD premium +25%	711	16.4	25.7	421
-25%	235	11.3	3.7	41
Meat +25%	398	12.4	8.7	108
-25%	327	12.4	8.7	108
Grain +100%	292	11.3	3.7	41
+25%	357	12.4	8.7	108
-25%	368	12.4	8.7	108
Flock Structure				
Sell Wethers 17mo	355	13.0	7.9	102
41mo	350	11.9	9.6	114
53mo	335	11.6	10.2	118
Time of Lambing				
July/August	-15	12.4	12.3	153
Pasture Prodn				
10t/ha	619	17.8	11.5	205