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MEAT & LIVESTOCK AUSTRALIA

More lambs, more profit

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Introduction

Reproductive efficiency is important to the profitability of all sheep flocks. The goal of each ewe weaning at least one lamb per year seems easily achievable, with plenty of time to regain condition and cycle for the next mating. But looks can be deceiving!

Better weaning rates require continual attention to management in all phases of the breeding calendar.

The opportunities for reproductive wastage between one weaning and the next are many and varied and it is seldom true that improving management in just one of these areas will dramatically improve weaning rates. It is important to effectively manage all phases of the reproductive cycle (or breeding calendar) to achieve and maintain high weaning rates.

More lambs, more profit brings together a complete set of 'best-practice' management strategies to improve sheep reproduction. The key is to select management strategies that improve reproduction with little or no cost. The booklet breaks the breeding calendar into six discreet management periods in order to highlight the critical management techniques and production level targets that boost flock fertility:

- matching management to feed supply
- weaning to joining
- joining
- pregnancy
- lambing
- lambing to weaning.

The economics of improving reproductive performance

The importance of reproduction in sheep flocks is as high now as it has ever been, as sheepmeat prices have increased relatively more than wool prices during the past 10 years. In typical wool flocks, about 30% of income comes from stock sales. In second-cross prime-lamb flocks, lamb sales constitute more than 80% of gross income and about 60% of gross income in dual-purpose flocks.

The underlying profitability of different sheep enterprises, including self-replacing Merino flocks, dual-purpose flocks and specialist prime lamb enterprises, depends on meat and wool prices.

Benchmarking data clearly shows an enormous range in profitability of wool and lamb enterprises. For example, the Victorian South West Farm Monitor project highlights the huge range in profitability. Over the long term, lamb production has been slightly more profitable than wool, but in recent times higher lamb prices have, on average, resulted in lamb enterprises becoming more profitable than wool enterprises. In times of high lamb prices most wool flocks still perform well with high stock prices – it is more important how the enterprise is run. Even so, there is a huge range in profitability as shown in Table 1.

Profitable flocks have a low cost of production, generally sell wool and lamb at a higher price and produce more lamb and wool/ha. In dual purpose and prime lamb flocks weaning percentage is also important.

Table 1: Range of gross margins of sheep enterprises

	$/ha/100mm rainfall		
	Low	Average	High
Wool	14	40	81
Dual purpose	17	72	118
Prime lamb	39	72	107

Source: Victoria Department of Environment and Primary Industries SWFM project 2009–10

This range in enterprise performance is due to a large combination of factors, including stocking rate, reproductive performance, genetics, marketing and management systems. However, it highlights the opportunity to improve farm profitability by adopting a range of management strategies.

Production per hectare

The main influence on enterprise profitability and productivity, regardless of the end product, is the number of ewes joined per hectare. This directly influences lamb and wool production per hectare and is a function of lambing date, stocking rate and nutritional management, including management of ewe condition score and supplementary feeding.

Benchmarking data from a number of sources shows some consistent features of the most profitable wool, prime lamb and dual-purpose enterprises. The most profitable flocks have a low cost of production. They generally sell wool and lamb at a higher price and produce more lamb and wool per hectare. Weaning percentage is also important in dual-purpose and prime lamb flocks (see Table 2).

Table 2: Key performance indicators for sheep enterprises

	Bottom 20%	Average	Top 20%
Wool			
Cost of production ($/kg clean)	10.78	7.50	6.15
Price received ($/kg clean)	9.63	9.77	10.19
Clean wool (kg/ha/100mm)	2.4	3.5	5.5
Stocking rate (DSE/ha)	8.9	9.1	9.1
Dual-purpose			
Cost of production ($/kg dwt)	3.49	2.75	2.22
Price received ($/kg dwt)	4.60	4.78	5.07
Lamb (kg DWT/ha/100mm)	5.7	10.5	13.3
Stocking rate (DSE/ha)	7.0	10.6	14.3
Weaning percentage	79	85	83
Prime lamb			
Cost of production ($/kg dwt)	3.07	3.15	2.92
Price received ($/kg dwt)	4.53	4.81	5.09
Lamb (kg DWT/ha/100mm)	12.5	15.9	21.9
Stocking rate (DSE/ha)	12.3	13.9	19.4
Weaning %	92	119	123

Source: Holmes Sackett AgInsights, Volume 13 2010. For more information contact www.holmessackett.com.au

A financial study of management options that improve reproductive performance showed that increasing flock fertility (conception rate of ewes or survival rate of lambs by 10%) increased the gross margin per hectare of self-replacing wool flocks, prime lamb production and dual-purpose flocks across a range of climatic zones by between 1.5% and 12.1%. The economic response depends on prevailing commodity prices at the time. Table 3 outlines the benefits of increasing reproductive performance by 10%.

*Table 3: Effect of on gross margin of a 10% increase in flock fertility**

Enterprise	Lambing date	Ewes/ha	Change in $/ha gross margin (%)	
			+ 10% conception rate	+ 10% lamb survival rate
High-rainfall wool (all ewes)	Aug	5.3	+1.8	+6.4
High-rainfall wool (sell wethers 3 years old)	Sep	4.5	+2.1	+4.6
Cereal and wool (sell wethers 3 years old)	Sep	3.7	+1.5	+3.6
High-rainfall prime lambs	Jul	5.6	+6.2	+12.1
Cereal and prime lambs	June	4.4	+5.2	+4.7
High-rainfall dual-purpose	Aug	7.2	+4.4	+10.5
Cereal and dual-purpose	Jul	4.0	+2.6	+3.6

*Five-year average prices

Source: MLA/AWI report McEachern et al 2008.

The most important focus is on refining lambing time and stocking rate to optimise wool and meat production per hectare.

The size of the benefit of increasing fertility depends on stocking rate, type of enterprise and lamb and stock prices.

The benefit gained from increasing ewe fertility depends on the cost of the management strategy adopted and the value of progeny produced with the marginal response much greater as lamb prices increase.

Of the management interventions considered in the financial study, feeding to maintain liveweight (to increase conception rates and lamb survival) generated an economic benefit.

Buying replacement ewes can be profitable, although this depends on the cost of replacements and as depreciation costs increase, self-replacing systems will be favoured depending on the genotype of the ewes.

Strategies that were not cost effective included increasing supplementary feeding to increase liveweight (to increase conception rate), feeding during late pregnancy (to improve lamb survival) and providing preferential shelter for twin-bearing ewes (to reduce neonatal lamb losses).

Producers with low stocking rates may achieve high ‘per head’ productivity, but usually are less profitable on a ‘per hectare’ basis. Likewise, feeding ewes large amounts of supplementary feed to maintain condition above condition score 3 is generally less profitable.

It is critical to constantly re-evaluate the cost-benefit of management strategies, production systems and technologies, as responses will vary depending on prevailing conditions at the time.

The economic benefits of running an optimal management system are substantial, especially when stocking rates are moderate to high. The key to achieving these economic benefits include: being able to manage ewe condition score from mating through pregnancy to lambing, then to ensure they reach target condition score at next mating.

Managing condition score of ewes is essential to optimise production and ensure high stocking rates can be run so maximise farm profits.

The optimum condition score profile varies slightly between different climatic zones and enterprises. The penalty of running a sub-optimal system, where ewes are too light or too fat, is reduced profit per hectare (by up to 18% depending on region and management system adopted). Managing the ewe flock, including stocking rate, lambing time and reproductive performance, is the critical aspect to optimise profitability. An additional element to consider is the genetic merit of the breeding flock.

From a maternal perspective, important traits to include as part of the ewe flock's breeding objective to optimise lamb turn-off including selecting Australian Sheep Breeding Values (ASBV) for: net lambs weaned (NLW), growth including yearling weight (YWT) and post weaning weight (PWT), positive fat (which is important in tough times), and selecting for less wrinkle and cleaner points (which improves reproduction without compromising fleece weight).

Management distractions

Increasing ewe size and increasing lamb growth rates will not necessarily increase profit if ewe stocking rates are less than optimal. The profitability of increasing ewe size (larger ewes produce larger lambs, which may meet market specifications better) depends on underlying genetic merit and ewe fertility, which will translate to meat production per hectare with stocking rate. And with less ewes per hectare, ewe depreciation costs are lower, but profitability still depends on the amount and weight of meat (or wool) produced per hectare.

The genetic merit of the maternal ewes is a critical factor determining profitability and lamb turn off or weaning percentage is the most important driver.

Chapter 1: Matching reproduction to feed supply

The timing of lambing significantly impacts the productivity and profitability of any sheep breeding enterprise. Successful lambing is a balance between:

- matching feed demand and pasture supply in order to optimise the number of ewes per hectare and minimise supplementary feeding
- optimising the number of lambs weaned per hectare
- choice of market
- growth rate of lambs and ability to meet market specifications
- seasonality of price to optimise enterprise profitability

Correct and adequate nutrition is essential to achieve high reproductive performance. Each of the breeding calendar segments throughout *More lambs, more profit* will provide a reference to pasture benchmarks and livestock condition scores that ensure nutritional requirements are met. These will be presented in terms of herbage mass (kg DM/ha) and quality (% DM digestibility). In order to reliably meet these pasture benchmarks, the timing of events throughout the breeding calendar must synchronise with the seasonal pasture supply.

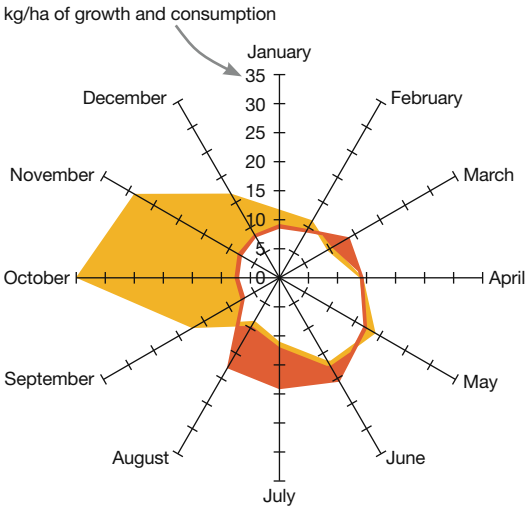
What can you influence?

The time of joining sets the rhythm of the production cycle. It determines when lambing occurs and when certain pasture benchmarks must be met. Apart from selecting pasture species, managing soil fertility and grazing strategies, all of which are manageable, pasture growth is largely determined by the prevailing climatic conditions. In order to meet the desired pasture benchmarks, astute managers will select a joining time that best matches the peak feed requirements of their livestock with the most likely peak in pasture growth. Strategic joining ensures efficient pasture use while still enabling pasture benchmarks to be met.

A working example

A typical model farm producing first-cross lambs in the central west slopes of NSW can be used to illustrate how changing the time of joining impacts on the annual feed budget. The red shading on Figure 1.1 indicates when animal requirements exceed pasture growth and orange shading identifies when pasture growth exceeds animal requirements.

Figure 1.1: Whole-farm pasture growth and intake (March lambing first-cross ewes)



1. Whole-farm pasture growth is the average daily pasture growth per ha derived from a mix of:
   - perennial grass and sub-clover — 20%
   - summer grasses — 10%
   - lucerne and sub-clover — 15%
   - lucerne — 15%
   - annual grass and sub-clover – 30%
   - oats (graze and grain) — 10%

   Source: ProGraze Manual CW Slopes growth curves
2. Intake is the average daily intake per ha of high-quality pasture required by the entire breeding enterprise to achieve target production levels.

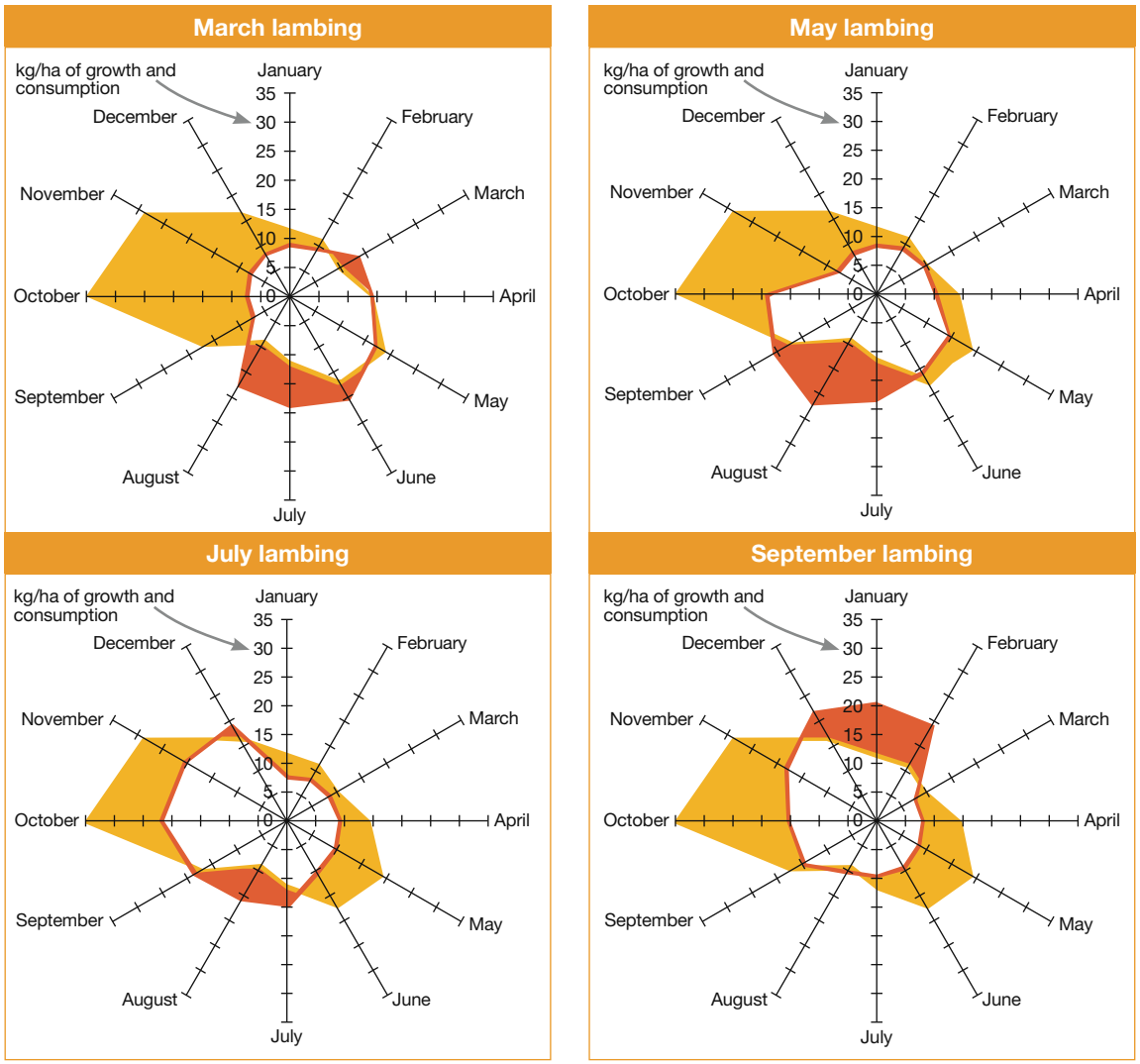
   Source: GrassGro™ simulation
3. First-cross lamb production enterprise with sale at six months and 20kg dressed weight.

Source: ProGraze and GrassGro™ simulation

March lambing in Central West NSW provides a poor match between pasture growth and animal requirements.

A large pasture deficit occurs during autumn and winter, leading to either poor performance or excessive supplementary feeding. A popular solution to this problem is to reduce stocking rates so feed demand is more in balance with autumn feed supply (see Figure 1.2).

Figure 1.2: The feed balance for a variety of lambing dates



Source: ProGraze and GrassGro™ simulation

Choose a joining time to best match pasture supply and animal requirements.

Figure 1.2 shows how the feed balance changes with various lambing dates. A July lambing provides a suitable match between peak pasture production and peak feed requirements and would allow for autumn growth to be saved for winter grazing. Clearly lambing at other times increases feed deficits.

The optimal time for lambing differs between enterprises and localities according to growing season characteristics, breeding season and production goals. It is important to consider the local seasonality of pasture supply and choose a breeding calendar to suit.

Avoid compromising joining time to solve problems with grass seed or to chase markets.

Secondary issues to consider include: weather at lambing, the time of grass seed drop, market peaks and wool tensile strength. Always try to find other ways to combat these problems before compromising the balance between pasture growth and feed requirements.

Setting the optimum time of lambing

While matching the feed demand of ewes and lambs with pasture supply is the most important factor to consider when setting a joining date, several other factors are worth considering.

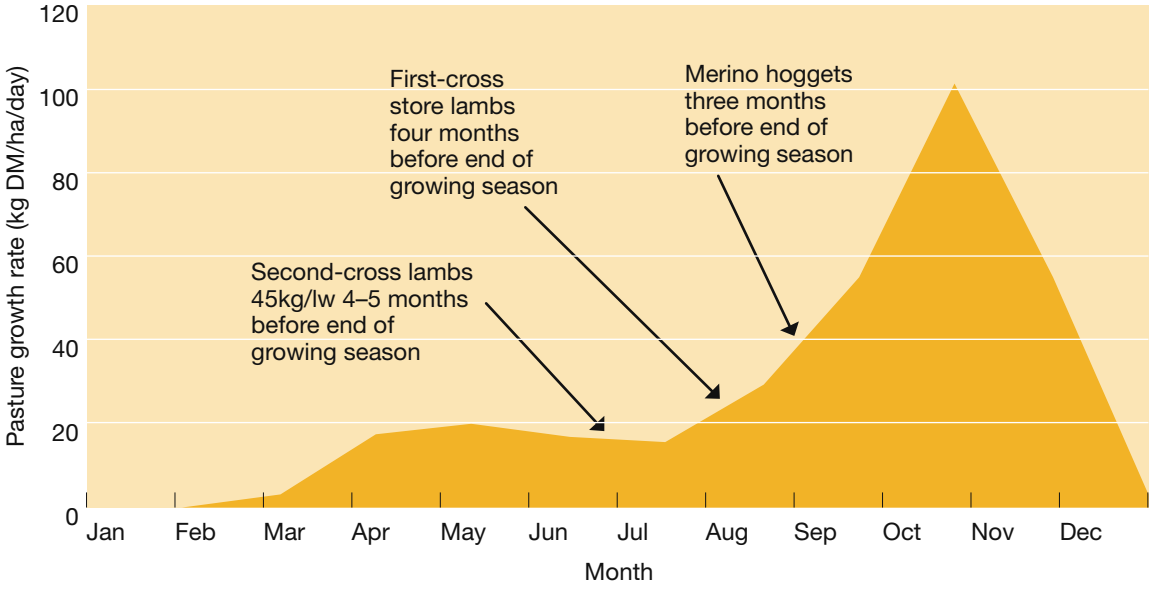
More ewes can be run when lambing coincides with the increase in pasture growth. This is the main reason why later lambing is usually more profitable and stocking rate is the most important profit driver. A production system that enables more ewes per hectare results in more meat and wool production per hectare.

However, as stocking rate increases, risk also increases. Risks include: the financial risk associated with higher feed costs, the risk of pasture degradation if stocking rates are too high and more regular periods of destocking are required to avoid pasture damage.

Another important risk that occurs as stocking rate increases is market risk. In other words, as stocking rate increases, available pasture reduces and lamb growth rates diminish. With this, the chance of meeting target markets within a specified time reduces. Setting the time of lambing to optimise stocking rate while managing these risks is essential. As stocking rate increases a later lambing is preferred.

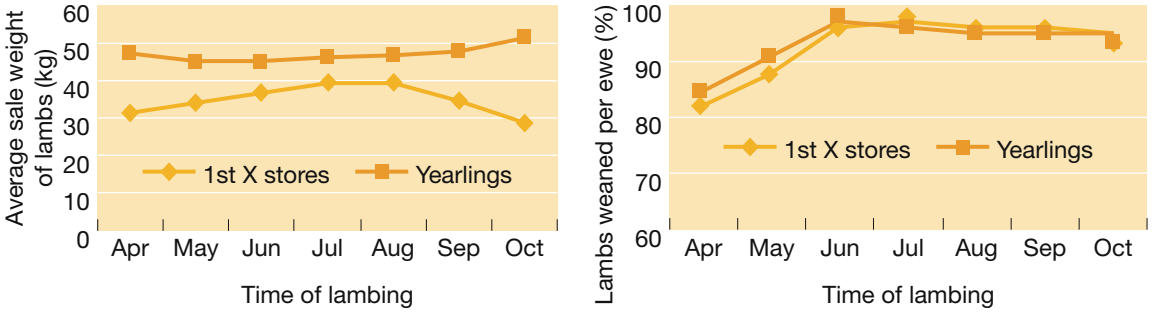
Optimal lambing time is when maximum red meat and wool production is achieved and supplementary feeding minimised. However, this depends heavily on the type of enterprise and the length of the growing season (see Figure 1.3). As a guide, the lower the weight required to turn-off lambs, the later the optimal lambing time. Enterprises that produce store animals can usually set a later lambing date.

Figure 1.3: Guidelines for optimal lambing time for different target markets



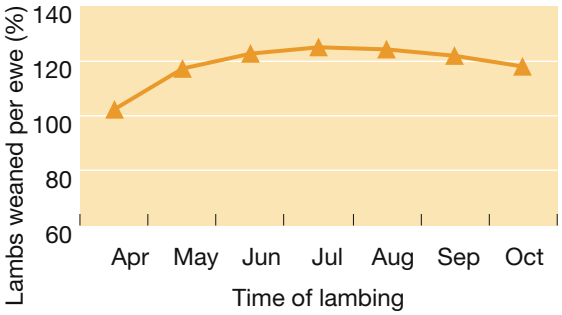
At a given stocking rate, kg meat/ha is the product of the number of lambs weaned per ewe and the average sale weight of lambs. The impact time of lambing has on these two variables is shown in Figure 1.4.

Figure 1.4: Effect of time of lambing on lambs weaned per ewe and the average sale weight of wether lambs for a first-cross store lamb and Merino yearling enterprise, at Rutherglen for a stocking rate of 10 ewes/ha).



(Source: Sheep CRC1 report 1.2.6 Warn et al)

Figure 1.5: Effect of time of lambing on the number of lambs weaned per ewe for a second-cross store lamb enterprise, at Rutherglen for a stocking rate of 10 ewes/ha.



(Source: Sheep CRC1 report 1.2.6 Warn et al)

Although data for Rutherglen is shown, the same trend is apparent for other locations in south-eastern Australia.

Market considerations

Another important factor to consider is optimising the sale value of lambs. While a later lambing will reduce supplementary feeding for ewes and maximise meat production, it can impact on the sale value of lambs. In some situations, maximum meat production may not result in maximum profit. For this reason it is worth considering the seasonality of price and the price premiums/discounts for lambs in different markets. It can be easier to make a more informed decision about maximising profit and minimising risk when these factors have been considered.

There is substantial variation between production systems depending on the type of sheep, nutrition and available pasture base, timing of sale of lambs and management, which can alter the production and financial outcomes. Consider these factors for all flocks when deciding on time of lambing and time of sale of lambs.

Chapter 2: Weaning to joining

Recommendations

- Determine the number, age and genetics of ewes to be retained.
- At weaning, draft and manage ewes according to condition score.
- Manage ewes to achieve a minimum of condition score 3 at joining.
- Select and start to prepare rams at least two months before joining.
- Maiden Merino ewes should weigh at least 40kg, and first-cross maidens and ewe lambs should weigh 45kg or 75–80% of their mature weight at joining to achieve successful conception rates.
- Wean Merino lambs no later than 14 weeks onto short, high-quality pasture with about 1,500–2,000kg green DM/ha.

High conception rates at joining are determined by management of both ewes and rams from the previous weaning period.

The most important determinant of high conception rates is ewe nutrition. There is a strong correlation between ewe condition score and the conception rate. Manage ewes so they are as fat as possible, within the constraints of the seasonal conditions and stocking rates.

Rams need to be fit and able to serve ewes with viable sperm.

This chapter outlines the management issues required for ewes to achieve optimum conception rates in the following sections:

- setting ewe numbers for joining
- managing adult ewes
- managing maidens
- monitoring progress
- managing weaners
- managing rams

Setting ewe numbers for joining

The first decision in the breeding cycle is to calculate how many ewes need to be retained for the next joining and lambing period. This is an important decision because the winter stocking rate will be determined by this decision.

Decide how many ewes to join based on stocking rate, enterprise profitability and age structure.

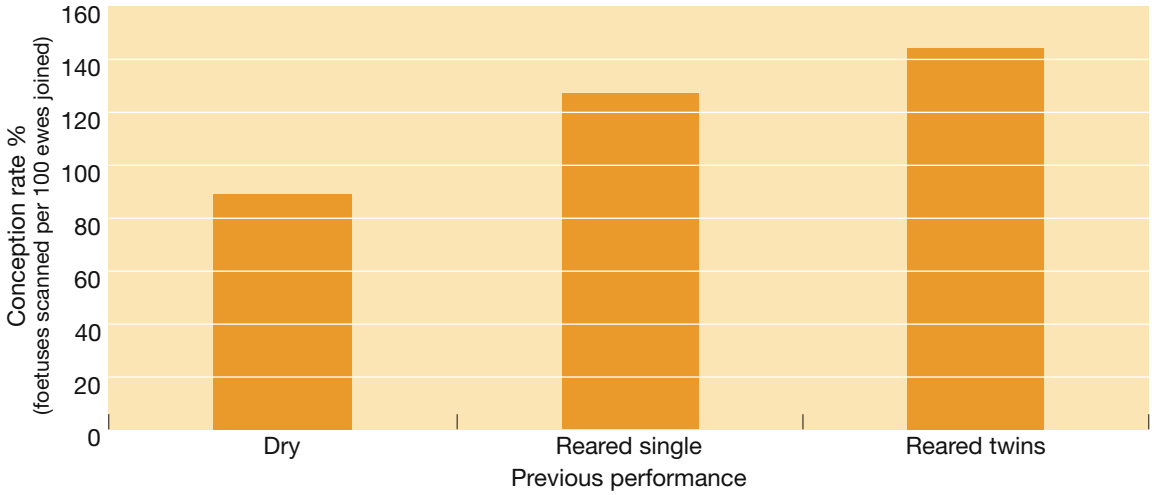
The second decision is the enterprise mix. For a single enterprise, this decision is easy. For a mixed enterprise, base the mating structure on enterprise profitability and age. A common mistake is to join too many ewes to terminal rams in a Merino enterprise. This will result in too few Merino ewe replacements. As a consequence, ewes will be retained till they are seven years old to maintain stocking rates. The impact will be productivity losses over the whole flock and higher death rates.

Managing adult ewes

Draft ewes on condition score and graze according to their nutritional requirements.

After lambing, ewes can vary in condition score. Twin-rearing ewes will be poorer relative to dry ewes and those that reared single lambs. Even so, Figure 2.1 illustrates that twin-rearing ewes can conceive a higher proportion of twins in subsequent years. This is important information, since focussing limited nutritional resources to lift the condition score of these ewes is likely to pay greater dividends than trying to lift the average condition score across the entire flock.

Figure 2.1: Repeatability of reproductive performance



Source: Lifetime Wool, NSW

Weaning lambs off Merino ewes by no later than 14 weeks after the start of lambing is important for three reasons. Firstly, lambs will receive little nutritional value from the small milk supply by this stage and will be developing a moderate worm burden. Drenching and shifting these lambs to low-worm-risk pastures will ensure they keep growing. Secondly, ewes will be losing weight as they attempt to continue to lactate. Finally ewes need every possible opportunity to gain weight while pasture quality is still reasonable to set up for the next joining period.

Provide preferential feed to ewes below condition score 3 before joining.

Drafting ewes according to condition score at weaning enables differential treatment to be given to ewes of different condition score (Figure 2.2). The lightest ewes (below condition score 3) receive the highest-quality pasture in order to maximise their opportunity to regain condition before joining. Ewes already above condition score 4 should either maintain weight or can be allowed to lose body weight, down to condition score 3.

This approach needs no other input than to draft ewes and allocate them to pastures based on condition score at weaning.

Figure 2.2: Range for ewe condition score throughout the year

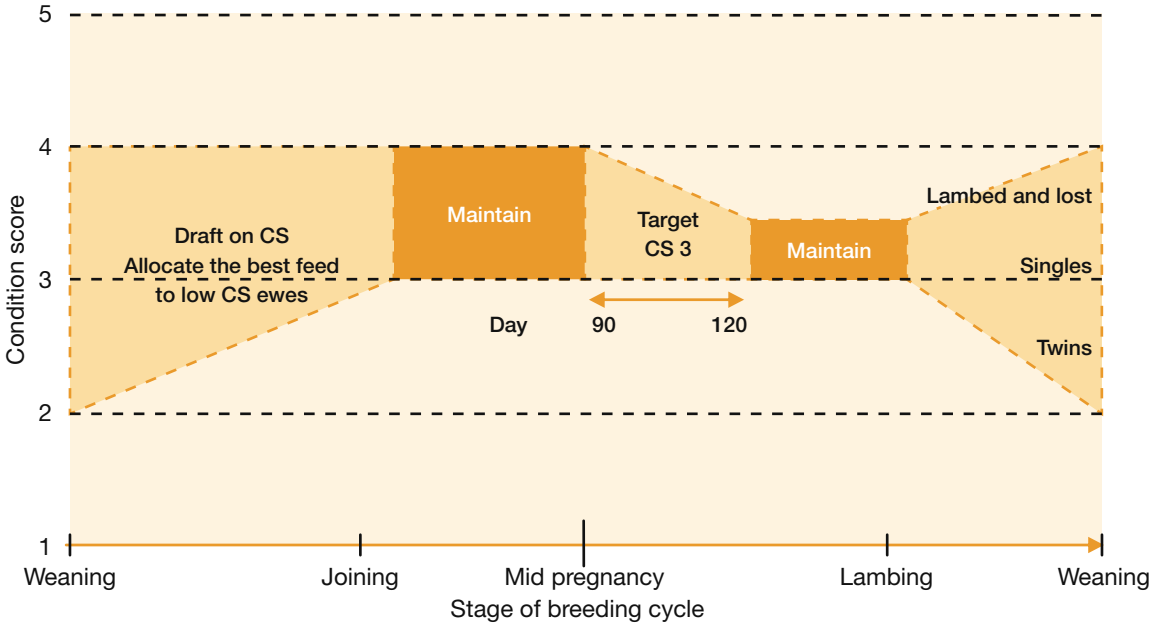


Table 2.1 below, shows that ewes in condition score 4 with unlimited access to dead pasture or stubble, would lose 40g/hd/day while ewes in condition score 2 with unlimited access to lucerne would gain 160g/hd/day. At these rates, ewes in condition score 2 could reach condition score 3 in six weeks, while the ewes in condition score 4 will lose just a quarter of one condition score in the same period.

Table 2.1: Weight change of Merino ewes grazing a variety of summer feed sources

Pasture type	CS 2		CS 4
	Weight change (g/hd/day)	Weeks to regain 1 CS	Weight change (g/hd/day)
Dead annual pasture	16	62	-40
Fresh wheat stubble	17	59	-40
Lucerne	160	6	86
Mature perennial pasture	19	53	-33
Green summer grass/ weeds	51	20	13
Green grass/legume pasture	93	11	38

From GrazFeed DSS

Ewes can be as heavy as possible at joining, but ewes above condition score 4 at lambing are at higher risk of lambing difficulties and deaths (this will be discussed further in Chapter 5).

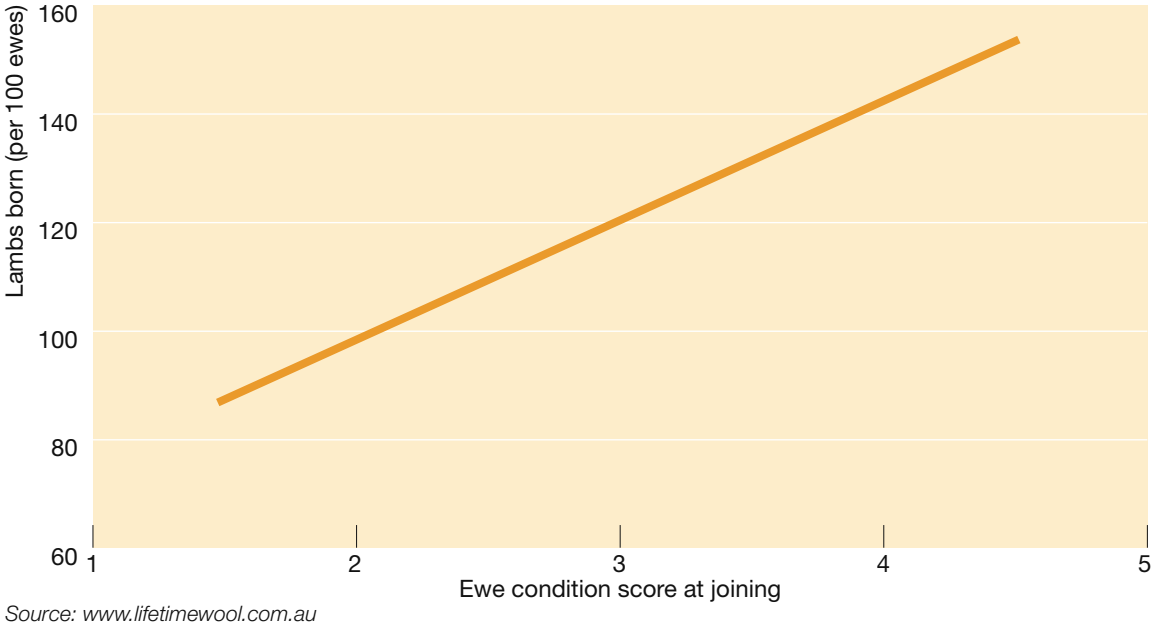
The impact of condition score at joining

One condition score in ewes is equivalent to between 7 to 10kg bodyweight, depending on the frame of the ewes. The response to reproductive rate in Merinos is linear in ewes between condition score 1.5 and 4.5. The *Lifetime Wool* project showed a 20% increase in extra lambs for each condition score at joining (see Figure 2.3). This response varies from 7%–36%, depending on genetics and time of lambing with a greater response with later lambing. Similar responses occur in all breeds.

One condition score in ewes is equivalent to between 7 to 10kg bodyweight.

Higher condition score at joining means higher ovulation rates and less dry ewes.

Figure 2.3: Response in conception rate to condition score at joining



Source: www.lifetimewool.com.au

Bodyweight is the most important determinant of ovulation rate.

Ovulation rate depends largely on ewe bodyweight. It reflects on the wellbeing of the ewe during the weeks of follicular development, but there is some additional impact of nutrition at the time of joining. At the same condition score, ewes that are gaining weight are more likely to have a higher proportion of twins than ewes in the same condition score that are either maintaining or losing weight. The quantity and quality of both pasture and supplements control this effect. Grazing ewes on green feed, rather than dead pastures, and feeding high-quality supplements such lupins leading up to joining can improve conception rates, though the response is highly variable.

Critical bodyweights for joining in drought years

During drought, it may not be cost-effective to maintain ewes in condition score 3 for joining. Rather, there is a critical minimum bodyweight below which there will be a higher percentage of dries and a lower twinning rate. It is important to ensure ewes are above this weight.

Critical bodyweights are about 40kg for medium-wool Merinos and 45kg for first-cross ewes. Note these guidelines are for minimum bodyweights, so the average bodyweight of a mob will typically be 5kg heavier. During drought, draft off the lightest ewes and feed them as a separate management group.

Bodyweight varies with frame size and it is useful to think of condition score 2 as a critical lower level for successful joining. The effect is exacerbated when ewes are joined outside their breeding season.

Impact of weaning

The impact of weaning on ewe recovery is often overlooked. After 14 weeks of age, lambs on Merino ewes get little benefit from milk compared with their intake of pasture. Weaning before 14 weeks is more important if there is insufficient or poor quality pasture, or high worm burdens. Every day weaning is delayed reduces the opportunity for ewes to regain body condition before joining.

Figure 2.4 shows that weaning 14 weeks from the start of lambing allows 17 weeks recovery before the next joining. To regain one condition score in 17 weeks requires an average weight gain of less than 60g/hd/day per day. With a 20-week weaning, ewes only have 11 weeks to recover and will need to gain an average of 90g/hd/day.

Weaning at 14 weeks leaves maximum time for ewes to regain condition score before the next joining.

Figure 2.4 The effect of weaning on ewe recovery time

Joining ↓ 6 weeks	Start of lambing ↓		Weaning ↓
Pregnancy		Lactation	Recovery time
21 weeks		**14 weeks**	**17 weeks**

Joining ↓ 6 weeks	Start of lambing ↓		Weaning ↓
Pregnancy		Lactation	Recovery time
21 weeks		**20 weeks**	**11 weeks**

When adequate pasture is available and worm control is sufficient, there is no penalty leaving lambs on first-cross ewes for a longer period.

Weaning early should be based on:

- allocating better pasture resources to ewes and lambs so ewes gain more weight before joining, and achieve higher reproductive rates, or lambs increase in value through heavier liveweight
- drenching lambs and moving them to low-worm-risk paddocks to ensure higher growth rates

Allocate the best pastures to the lowest condition score ewes to raise their condition score for joining.

Optimal weaning management ensures there is green pasture available for ewes. High-quality pasture is the best option to increase ewe condition score after weaning and since ewes can lose up to two condition scores during lactation, time weaning to ensure ewes have adequate time to regain condition before joining (see Table 2.1).

Supplementary feeding to regain weight is seldom cost-effective (see Table 2.2). For animals only able to maintain weight on pasture alone it would cost around $8 per head in order to lift condition score from 2 to 3. This would cost $809 per 100 ewes in order to gain the potential for an extra 12 lambs born. Each lamb would need to clear at least $67 in value after all other costs had been taken into account before feeding to gain one condition score would come close to breaking even.

Feeding supplements to maintain bodyweight for joining is more cost effective than feeding to regain bodyweight.

*Table 2.2: The cost over 70 days of regaining or maintaining condition score by feeding grain**

	Cost of feed required to regain condition score over 70 days			
Performance at pasture	Maintenance	0.5 condition score	1 condition score	1.5 condition scores
+ 50 g/h/d	Nil	Nil	$5.12	$9.88
Maintenance	Nil	$4.16	$8.09	$11.66
- 50 g/h/d	$2.14	$5.95	$9.28	$12.50
- 100 g/h/d	$3.69	$7.14	$10.12	$13.09

**Grain MJ/D 13 MJ/kgDM costed at $170 per tonne.*
Using GrazFeed

By contrast, feeding to prevent loss of weight can be more cost-effective. An animal losing 100g/day grazing pasture can be supplemented to achieve maintenance for as little as $3.69. Extra lambs need only clear $30 in order to make this exercise profitable.

As a guide, the cost of additional weight at joining:

- may be free if it comes from surplus spring feed
- may require 7kg grain per kilogram of liveweight gain on dry pasture
- may require 3kg grain to maintain a kilogram of liveweight on dry pasture

Usually it is not cost-effective to supplement to increase weight, but supplementary feeding to maintain liveweight at condition score 3 is cost-effective and allocating quality feed for light ewes is free.

Managing maiden ewes

Set and meet progressive body weight targets to ensure maidens reach their reproductive potential.

In most flocks, maiden ewes are the biggest age group and contribute significantly to overall flock profitability. Reaching bodyweight targets as weaners and hoggets ensures maiden ewes can reach an acceptable bodyweight for their first joining at 18 months.

Table 2.3: Bodyweight targets to reach joining weight for maiden ewes

Age	Medium Merino (50kg adult)	First-cross (60kg adult)	% of adult weight
5 months	25kg	30kg	50%
12 months	32kg	38kg	60-65%
Joining	40kg	45kg	75-80%

On many properties maiden ewes will be much heavier. Progressively monitoring bodyweight keeps track of maiden ewe performance and by comparing between years, bodyweight targets can be fine-tuned.

Age at first joining

Body weight targets must still be met to join maidens at younger ages.

Crossbred ewes, and less commonly large-framed Merino ewes, can be joined successfully as young as seven months to lamb at one year old. Success will depend on meeting the minimum bodyweight targets for joining at this young age. Ewes joined at this age require high levels of nutrition during their first pregnancy and lactation to avoid growth checks. Ideally, ewe lambs should be at least 45kg at joining to be successful, with high nutrition post joining to ensure they continue to grow. Scanning will identify dry ewes, which can still be sold as lambs or grown out for later joining.

Culling

Aged ewes need greater care to achieve good lambing performance.

Retaining older ewes can help increase total sheep numbers. Cull ewes with faulty mouths or udders, disease or economic wool faults. The remaining ewes should breed satisfactorily until seven years of age. Death rates in older ewes can be excessive if condition score targets are not maintained and they are particularly vulnerable to hypocalcaemia and pregnancy toxaemia. Only consider retaining older ewes if sheep numbers need to increase.

Monitoring your progress

Use a tagged indicator group to monitor the progress of the mob.

Weighing and condition scoring an indicator group from each mob is a useful technique. The critical times to monitor are at weaning, no later than a month before joining and also in conjunction with other husbandry activities. This develops the basis for sound nutritional management during the pre-joining period. Table 2.4 shows the number of monitor animals required to accurately estimate the average condition score of a mob. Select these animals at random and identify with an ear tag so the same animals can be weighed each time.

Table 2.4: Suggested size for condition score monitor group

Total mob size	Number to be weighed
100	30
500	40
1,000	50

Provide safe non-toxic pastures

Avoid grazing ewes on potentially toxic pastures leading up to and during joining. For example, high endophyte perennial ryegrass pastures can reduce weight gain and conception rates. Trials in Victoria indicate that toxic, high endophyte, pastures can cause lower conception rates and reduce lambing performance by up to 20%, even without visible ryegrass staggers.

Historically, grazing ewes on sub-clover pastures (with cultivars such as Yarloop, Dinninup, Dwalganup, Tallarook and Geraldton) containing high levels of phyto-oestrogens caused serious infertility. Two syndromes were recognised – short-term infertility, where ewes joined on green clover pastures failed to conceive in addition to having high levels of uterine prolapse and lambing difficulties. If ewes continued grazing toxic pastures for several years, permanent infertility developed and a pattern of reducing fertility with age developed. The only long-term solution to this syndrome was to avoid grazing young ewes on toxic pastures and replace toxic pastures with new, safe cultivars. A less common syndrome occurs in lucerne, white clover and medic pastures affected with fungal diseases that produce coumestrol, another phyto-oestrogen. Fungal disease is more likely to develop during spring if pastures are left ungrazed and become rank. This syndrome is usually not severe and has no permanent effects.

Consult your animal health adviser to investigate problems if you suspect toxic pastures may be causing ewe infertility.

Weaner management

Give weaners the best quality feed available.

The growth rate of weaned lambs destined either for sale or as replacements, strongly influences enterprise performance. While it is important for ewes to regain weight lost during lactation, weaners are the highest priority for pasture resources during summer and autumn when feed quality is often poor.

Nutrition

Ensure weaner paddocks have adequate levels of high-quality pasture at weaning. For optimum growth post weaning, allocate weaners to pastures with between 1,500–2,000kg of green DM/ha, no more than 15cm tall, at least 70% digestible, with a legume content above 30%. Lesser pastures may suffice depending on the target weight gains, but if maximum growth rates are needed then supplements will be required. This is particularly so when pasture matures and hays off. At this time the digestibility and protein levels decline rapidly.

Monitor weaner liveweight every four to six weeks when pasture quality is poor to ensure survival rates above 95%. Light weaners (below 18–20kg) are most at risk of dying as they have few fat reserves. Supplement Merino weaners to ensure growth rates between 0.5–1.0kg/month and to minimise death rates. Manage light weaners separately to allow them to reach 20kg as quickly as possible. Weaners over 25–30kg only need to grow slowly or maintain weight while pasture quality is poor.

Health

Weaning paddocks should be well fenced and have good water and shelter with high quality pasture.

Ensure weaning paddocks are well fenced, contain adequate shelter, clean water and short, high-quality pasture. Avoid paddocks containing harmful grass seeds, which can pierce the skin and eyes causing serious loss of condition through irritation and blindness. Consider winter cleaning or spray topping barley grass pastures, particularly along fence lines, around trees and along laneways. Careful planning is essential to ensure lambs do not graze pasture heavily contaminated with worm larvae. This will involve strategic grazing with cattle or healthy adult dry sheep with low worm egg counts for at least six months before introducing weaners in order to ensure pasture has low larvae contamination.

Lambs should be drenched at weaning and worm egg counts monitored every four to six weeks to determine the need for extra drenches

Drench lambs at weaning with an effective drench (based on worm egg count reduction tests carried out every two to three years) and monitor worm egg counts every four to six weeks to determine if additional drenching is required. Often a move to another weaning paddock during winter is beneficial for productivity, as worm populations build up quickly on weaning paddocks. This is more easily achieved where lambs are set stocked, though even where weaners are rotated through several paddocks, moving to a second low-risk area six months after weaning is highly desirable, especially in high-rainfall regions where worm larvae populations will build up on pasture over several months where young sheep continually graze.

Shearing

Although the economics of shearing weaners is doubtful, it is sometimes carried out for the following reasons:

- All sheep may be routinely shorn at the annual shearing.
- There may be a need to reduce grass seed contamination (although wigging may be enough to keep grass seeds out of eyes).
- Shearing carryover lambs to ensure their wool length is not too long. Time shearing at least six–eight weeks before sale to avoid discounted skin values.
- Carryover lambs entering a feedlot are sometimes shorn to improve their appearance, eliminate the risk of flystrike, improve access to feed and water at troughs and take advantage of a brief increase in growth rate.
- An even-up shearing may be required to provide a valid basis for comparison of hogget fleece measurements.

Consider the effect of cold weather when deciding to shear weaners.

Managing rams

Pay particular attention to your rams in the two months preceding joining.

It is important to maintain ram condition and health throughout the year, but pay particular attention in the two months preceding joining.

Viable sperm starts developing 49 days before mating. In a six-week joining, all the sperm used by the ram will have started to develop before the first day of joining. A decline in ram nutrition or health during this period means the ram is not fully effective during joining.

It is important to buy replacement rams at least two months before joining to allow enough time for pre-joining preparation. Only buy replacement rams from studs that can demonstrate they are free of ovine brucellosis.

The effect of overheating

Provide shade in the ram and joining paddocks.

Sperm development can be severely disrupted by excessive heat. The scrotum regulates the temperature of the testicles at about five degrees lower than core body temperature. A rise in temperature due to excessive heat, disease or infection can be enough to destroy the store of viable sperm. Pay particular attention to preventing flystrike in rams due to the fever it causes.

Shear rams at least two months before joining.

Rams shorn within two months of joining may suffer an increase in body temperature during hot weather and this can lead to temporary infertility. Where possible, time shearing so rams will have two to five months of wool at joining. Provide plenty of shade in the ram paddock. These strategies will insulate rams against the effects of high temperatures without impeding mating.

Merinos appear more tolerant to high temperatures than other breeds and some strains of Merinos are more tolerant than others. Rams with wrinkles are less able to handle high temperatures than plain rams. Shearing two months before joining eliminates any risk of shearing cuts becoming infected and causing infertility.

Nutritional effects

Feed lupins for two months prior to joining to increase sperm production.

Testical size varies greatly depending on the level of nutrition. Keep rams in condition score 3 for most of the year and increase their nutrition in the two months leading up to joining.

Research has shown feeding lupins for two months before joining can increase testicle size and sperm output. This strategy is only necessary when rams are mated at very low percentages and especially for out-of-season mating.

Highly active rams will lose weight during mating. Ensure rams approach condition score 4 at joining to ensure adequate body reserves for the duration of joining. However, be mindful over fat rams have lower serving capacity and reduced sperm viability.

If ewes are fed during joining, introduce rams to the same ration before joining to avoid acidosis and fever.

Ram inspection

Check the five T's two months prior to joining.

Inspect rams for breeding soundness two months before and at joining for defects that could impair their performance.

The five tees — teeth, toes, testes, tossle and torso:

- Check rams' mouths to ensure they are sound and able to graze effectively
- Check rams' feet and legs to ensure they are mobile and able to serve ewes effectively, carry out any necessary foot paring carefully and at least two months before joining to avoid lameness
- Check rams' testes for size (at least 28cm scrotal circumference) and defects, such as swelling, lumps or softness. Identify abnormalities, such as Ovine Brucellosis, contact a veterinarian to plan eradication
- Check to see there is no penis damage or abnormality that would prevent rams serving the ewes
- Ensure ram condition score is 3.5–4 at joining
- Vaccinate rams with 6-in-1 and jet to prevent flystrike.

Campylobacter

Campylobacter abortion can cause significant reproductive wastage. While not very widespread, the consequences can be severe, with up to 50% of ewes aborting during late pregnancy, though losses are generally not this severe.

Outbreaks are difficult to predict, though intensive rotational grazing systems and heavy grain feeding of ewes both increases the risk of spreading the bacteria (*Campylobacter fetus* spp. *fetus* and *Campylobacter fetus* spp. *jejuni*) and potentially causes abortions.

Trading and buying new ewes also increases the risk of exposing naive non-immune sheep to carrier ewes. Once exposed, ewes develop immunity and some producers with a history of problems in ewes manage the disease by exposing maiden ewes well before joining to ensure they are protected during pregnancy.

More recently, a specific Campylobacter vaccine has provided an option for producers with high-risk flocks to prevent abortions. Initially two doses of vaccine are required at least three weeks apart before joining, with an annual booster to provide the best immunity. Consider the cost–benefit of the vaccine in line with the risk of disease.

Chapter 3: Joining

Recommendations

- Join during the breeding season for best results.
- Join for 42 days in the breeding season, or if using teasers, join for seven weeks outside breeding season.
- Maintain ewes in condition score 3 leading up to and during joining.
- Join maiden ewes separately from older ewes, with a higher percentage of older, more experienced rams.
- Split older ewes into separate joining groups if bodyweight and condition score varies by more than 15kg and ewes are below condition score 2. Join lower-condition score ewes to a higher percentage of rams.
- Utilise the 'ram effect' if joining outside the main breeding season.
- Ram percentage will vary according to the paddock in which sheep are joined, but 1% plus 1 is a useful guide.
- Use ram harnesses to monitor ram activity during joining.
- Identify possible lambing paddocks at joining

A successful joining optimises conception rate, embryo implantation and survival and provides strong early development of the placenta, ensuring the potential for high lamb birthweights and survival.

Factors determining the potential lambing percentage from joining to early pregnancy include:

- ewe and ram fertility
- ewe ovulation rates
- successful embryo establishment

If any of these factors are compromised, the potential lambing percentage will be reduced. Good management at other stages of the cycle will help realise this potential but cannot improve the potential lambing.

Breeding season

The length of the breeding season in sheep is regulated by day length, with shortening day length encouraging the onset of the breeding season.

During their breeding season, ewes normally cycle every 17 days. When a ewe is not cycling she is said to be in 'anoestrus' or the non-breeding season.

Breeding season varies between sheep breeds.

Seasonality of breeding varies between sheep breeds. Merino, Dorset and Dorset x Merino ewes are less affected by season (they join successfully nearly all year round) compared with Border Leicester or Border Leicester cross ewes. However, these first-cross ewes are less seasonal than pure Border Leicester ewes, which have a pronounced anoestrus.

British breeds (for example Border Leicester) start anoestrus during June–July in the Southern hemisphere. For Merinos, the downturn in cycling activity occurs a little later and is not as pronounced as British breeds.

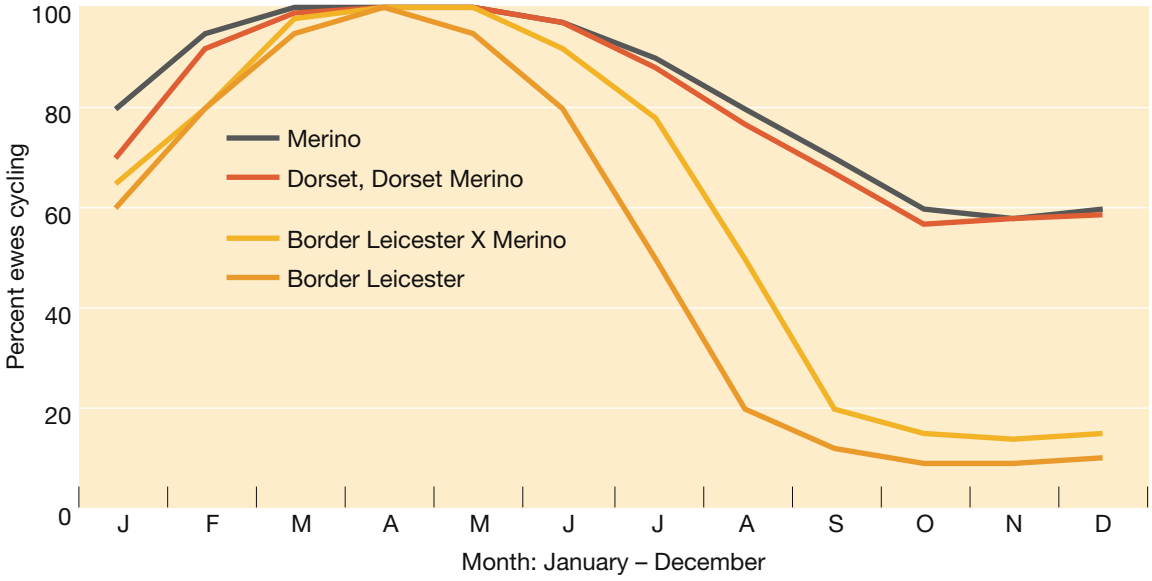
Lactational anoestrus is a period of low fertility, commonly occurring for 60 days after lambing. Shearing within two weeks of joining can disrupt cycling activity, so avoid shearing at this time.

Avoid shearing within two weeks of joining.

Figure 3.1 presents an indicative pattern of oestrus activity. Only four breeds or crossbreeds are shown, other breeds of sheep will have their own breeding season. An understanding of these breeding seasons is important in order to decide on the time of joining.

Joining first cross ewes in spring will result in lower fertility.

Figure 3.1: Indicative pattern of natural oestrus activity of common sheep breeds at different times of the year



Nutrition is the most important factor determining the number of ewes that become pregnant and the number of lambs conceived per ewe. The impact of nutrition on conception is discussed in Chapter 2.

Ewes should be condition score 3 at joining.

Puberty is the stage when a young ewe is mature enough to ovulate and become pregnant. It is dependant on bodyweight and age but usually occurs during autumn. Recommended minimum joining weights for maiden ewes are outlined in Table 2.3.

Ewe lambs can be successfully mated at seven months as long as they reach 45kg in autumn and growth is not restricted.

Fertility vs fecundity

Two terms often referred to are fertility and fecundity. Fertility refers to the proportion of ewes getting pregnant, while fecundity is the ability of a ewe to have multiple lambs in any given pregnancy. Conception rate combines these concepts and is expressed as the number of foetuses (lambs) per ewe joined.

Number of weaned lambs is affected by fertility and fecundity, but is also a function of lamb survival (see Table 3.1).

Table 3.1: The interaction between fertility, fecundity and lamb survival

Fertility is affected by	Fecundity is the result of	Lamb survival depends on
Age at puberty	Ovulation rate	Lamb viability
Breeding season	Embryo survival	Rearing ability
Post partum interval	Breed	Environment
Ewe bodyweight	Breeding season	Predation
		Birthweight
		Ewe nutrition

Ovulation rate sets the upper limit to the potential number of lambs.

Ovulation is the production of an egg, or eggs, from the ovary of the ewe and occurs in a well-defined cycle pattern, with the ovulation rate being lower at the start of the breeding season.

Ovulation rate sets the upper limit to the number of lambs produced per ewe per pregnancy. It is affected by stage of breeding season, breed, genetics, age and nutrition.

Figure 2.3 shows the effect of condition score at joining on the conception rate if ewes are joined during the breeding season. Ewes in a higher condition score at joining have both a higher ovulation rate than leaner ewes and are more likely to conceive. An increase of one condition score at joining will increase lambing potential by up to 20%.

Joining length

Join for 5 weeks or up to seven weeks before February.

Join rams with adult ewes for two 17-day cycles (five weeks). If joining before February, or joining mobs in large paddocks, extend the joining period to up to seven weeks (two cycles plus two weeks) to ensure ewes have ample opportunity to get into lamb.

The 2–4% of extra lambs produced by extended joining in Merino flocks can delay important management events, including weaning, which can contribute to weaner management problems.

Join maiden ewes separately.

Maiden ewes have shorter, less obvious heat periods and lower ram seeking ability than older ewes. The probability of oestrus detection and multiple services are decreased when maiden ewes are joined in a mob containing older ewes so join maidens with experienced rams separately from older ewes.

Ram effect

The ram pheromone effect can be used to stimulate oestrus in ewes joined outside the breeding season (spring to mid summer). The major benefit of successfully using the ram effect is to have a high proportion of ewes getting in lamb over a short period of time resulting in a more compact lambing. During spring, introducing rams or teasers (vasectomised rams) to ewes that have had no contact with rams during late winter–early spring will induce most ewes to start cycling. This is known as the 'ram effect'. For the ram effect to work ewes must not be within one kilometre (sight, sound or smell) of rams or goat bucks, including neighbours' for at least one month before joining starts.

The ram effect is the introduction of rams causing ewes to start cycling.

Keep rams at least one kilometre away from ewes prior to joining out of season.

Ewes that are constantly in contact with rams (running in adjacent paddocks) usually have a longer anoestrus period than ewes that have not been in contact. This can be a significant problem when attempting to join first-cross ewes during spring. Merino, Poll Dorset and Dorset cross ewes are less affected by the constant presence of rams and join readily during spring.

Ewe response to the ram effect is a major determinant of the number of ewes that will cycle during spring and so the success of spring joining.

Merino ewes can be stimulated to start cycling by introducing a ram (or teaser) whereas British breeds will only respond to the ram if introduced within six weeks of the normal start of the breeding season.

For out-of-season breeding, introduce teasers to ewes 14 days before joining. This will stimulate ewes to start cycling when rams are introduced, leading to more compact joining and lambing. Where a ram effect occurs, most ewes will come on heat 17 or 25 days after first introducing the ram or teaser. Join rams with ewes for two cycles after using teasers.

Ram harnesses can be used to monitor joining and pregnancy scanning will show if the joining was successful. The ram effect is not necessary after February, when ewes should be cycling well.

Ram percentage

A ram to ewe percentage for joining of 1% plus one ram per mob should be adequate for mature ewes if management and joining paddock conditions are ideal. For example, five rams to a mob of 400 ewes. If the joining paddock is not ideal, such as in pastoral regions, increase the ram to ewe percentage. More rams are also needed for maiden ewes who have a shorter oestrus cycle. Join at a ram to ewe percentage of 1.5% for maiden ewes and 2% for ewe lambs.

Use a minimum ram percentage of 1% plus one per mob.

Inexperienced rams and maiden ewes are both sexually inexperienced and if joined together lower lambing percentages can result. Inexperienced rams need to be joined to mature ewes for at least three weeks before they become efficient, effective workers.

Join maiden ewes to older experienced rams.

Healthy, active rams with at least one season of experience are best

for maiden ewes. Spread maiden rams around the joining mobs with mature and experienced rams (at a ratio of two old rams per young ram) or alternatively join to mature ewes at a ram percentage of at least 2%.

Mob size

Mob and paddock size determine the opportunity for contact between rams and cycling ewes, and so the opportunity for rams to get ewes pregnant.

The more obstacles within a joining paddock that can reduce contact between ewes and rams, the higher the percentage of rams required.

Joining ewes in smaller paddocks will increase ram/ewe contact, though this depends on property layout and paddock subdivision.

Join in small paddocks to increase ram/ewe contact.

Monitoring joining

Using ram harnesses at joining identifies cycling ewes and working rams. It can also assist in splitting ewes into lambing groups if mobs are monitored regularly and ewes are separated as they are joined.

Aside from harnesses, there is no other reliable way to determine if rams are working during joining. Ultrasound scanning only determines the potential lambing percentage post joining.

Take care to ensure harnesses are fitted correctly and inspect the harnesses regularly during joining.

Selecting lambing paddocks

Selecting lambing paddocks at joining leaves plenty of time to prepare them for lambing. Give priority to paddocks that protect livestock from wind and rain, and have the potential for high-quality pasture at lambing. Allocate paddocks on the basis of carrying capacity, making sure paddocks are not overstocked, otherwise pasture availability will fall and lamb growth targets will be missed, unless the season is favourable. Use appropriate management, to ensure suitable herbage mass and quality has accumulated by lambing (see Chapter 5).

Chapter 4: Pregnancy

Recommendations

- Aim to maintain ewes at condition score three throughout pregnancy (refer to regional *Lifetime Wool* recommendations).
- Scan ewes to detect multiple pregnancies about 100 days after the start of joining.
- Draft ewes into mobs based on scanning results and manage accordingly.
- Manage any ewes at condition score four and five to lose at least half a condition score between day 90 to 118.
- Supplementary feed to avoid serious weight loss.
- Vaccinate 2–6 weeks before lambing — time with other procedures.
- Control predators if necessary.
- Prepare paddocks for lambing that provide shelter and sufficient high-quality pasture.

Foetal growth

During early pregnancy ewes require no additional nutritional requirements above those for normal maintenance. Avoid rapid weight gain or loss during joining, which can reduce embryo survival.

Avoid rapid weight gain, or loss, in early pregnancy.

About 40 days after conception, the placenta starts to grow and continues rapid growth until about day 95. Foetal growth becomes noticeable from day 90 to lambing. Figure 4.1 shows foetal lamb growth during pregnancy and demonstrates that most of the foetal growth occurs in the last four to six weeks of pregnancy.

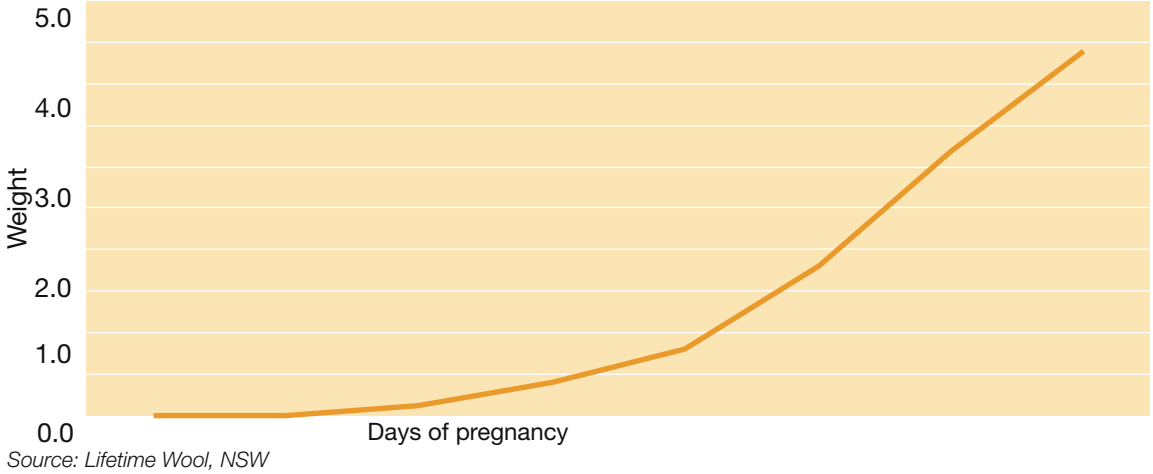
During the final stages of pregnancy, pastures and supplements need to be highly digestible to ensure sufficient nutrient intake to meet the demands for growth of the placenta and foetus.

At lambing ewes need at least double their normal maintenance requirement.

Lamb birthweight is affected by gender, litter size, placental development, ewe condition, sire and dam genetics, gestation length and nutrition during pregnancy. The average birthweight of singles is heavier than twins, but the target average birthweight of twin lambs is more than 4kg.

Aim for a birthweight of 4kg in twins.

Figure 4.1: Foetal lamb growth



Source: Lifetime Wool, NSW

Pregnancy scanning

Scan ewes so single and twin-bearing ewes can be managed separately.

Pregnancy diagnosis, using ultrasound is a practical procedure to identify empty, single-bearing and multiple-bearing ewes. Scanning can aid better allocation of pasture and supplements, increase management options and monitor reproductive performance. By identifying ewes carrying more than one lamb, additional management can be adopted to ensure higher survival rates of twins.

Pregnancy scanning is most cost-effective when heavy supplementary feeding is required, so feed can be allocated appropriately, especially if there are many dry ewes present. Occasionally if empty ewes are valuable, scanning to sell them into premium markets can be a profitable exercise.

Carry out scanning 100 days from the start of joining to allow late-lambing ewes to be accurately identified. A short joining period enhances accurate detection of multiple pregnancies. Separate scanned ewes into dry, single and multiple lambing groups.

Ewe nutrition during pregnancy

Manage ewe condition score for optimal production and profit.

Nutritional management increases in importance along with stocking rates. Overfeeding is expensive and not profitable and underfeeding results in low reproduction rates, poor lamb survival, lower progeny fleece values and higher risk of ewe deaths. *Lifetime Wool* guidelines for managing ewe nutrition, in moderate to high stocking rate enterprises, are aimed at improving feed resource allocation while avoiding production losses and helping to optimise lamb survival and minimise ewe losses.

Table 4.1 provides the guidelines for ewe condition score from the *Lifetime Wool* project for southern Australia.

Table 4.1 Lifetime Wool optimal nutrition guidelines

	Joining	Mid pregnancy	Lambing+	Lactation+ and weaning
Late winter–spring lambing	CS 2.6–3.0	CS 2.6–2.7* FOO 800	CS 2.6-3.0 FOO 1,200 kg/ DM/ha HM 900 kg/DM/ha	FOO >1,800-2,000 HM >1,500
May lambing	CS 2.7–3.0	CS2.6-2.7**	CS 2.6-2.7 FOO 800	FOO >1,500-2,000

* *If feed isn't available during late pregnancy to boost ewe condition the next best option is to maintain body condition during pregnancy, except the southern slopes of NSW where guidelines suggest condition score loss is acceptable and ewes can be maintained in CS 2.3.*

** *May-lambing flocks cannot afford to increase condition score during late pregnancy because available pasture is invariably poor and they will start lambing on short pasture.*

Twin-bearing ewes require more pasture and should be 0.3 of a condition score higher at lambing.

\+ *Twin-bearing ewes require 1800kg DM/ha to ensure they regain lost condition and should be about 0.3 CS higher than single ewes at lambing*

CS = Condition score FOO = Feed On Offer (measured in kg/dry matter/ha is a measure of total pasture available to ground level), HM = Herbage mass (kg DM/ha).

Single-bearing ewes need between 700–900kg green DM/ha and twin-bearing ewes need 1,000–1,200kg green DM/ha during mid pregnancy.

The condition score guidelines shown in Table 4.1 are based on a flock average. Do not allow any individual ewe to fall below condition score 2, otherwise the risk of ewe death increases dramatically.

Ewes should not be allowed to fall below CS 2 as the risk of mortality is very high.

Optimal condition score guidelines vary between regions. Generally condition score 3 is optimal at joining. Ewes lambing later during winter and spring can afford to lose about 0.3 condition score as long as they pick it up during late pregnancy on pasture, otherwise keep them at condition score 3 throughout pregnancy.

In autumn lambing flocks there is rarely enough pasture for ewes to increase condition score during late pregnancy so the best option is to retain weight through pregnancy rather than letting ewes lose weight and hope to regain it during late pregnancy. In such situations, joining in better condition allows opportunities for condition score loss but prevents the risk of ewe mortalities.

Supplementary feeding to increase ewe condition score during pregnancy is rarely profitable. If necessary, target feed to maintain ewe condition score or, if possible, allocate ewes to better pastures to increase condition score during late pregnancy.

The least cost option to meet condition score targets and maximise profit is to match lambing time to pasture availability.

In drought years, when the cost of supplementary feeding is particularly high, consider allowing ewes to fall to condition score 2.5, but maintain their health. The health risks increase dramatically if ewes fall to condition score 2.

Management of ewes at condition score 4 and above

Ewes that are condition score 4–5 at day 100 (from the start of joining) are usually too fat for lambing. To reduce lamb losses due to birth injury, manage ewes to lose half a condition score during the month after scanning. Achieve this by grazing on pasture with herbage mass of 500kg green DM/ha and thereafter on pasture levels recommended in Table 4.1. Only restrict the nutrition of over fat ewes if you know their stage of pregnancy. This four-week mid-pregnancy management strategy produces normal lamb birthweights and gestation length. It is imperative that fat ewes do not get pushed on the recommended short pasture during late pregnancy as the risk of pregnancy toxaemia will be high.

Restricting nutrition of over fat ewes in the month after scanning can safely reduce their condition score for lambing.

Condition score 4 and 5 ewes have a reduced feed intake during late pregnancy, which reduces the amount of energy for the lambing process. These ewes also experience a hormonal imbalance that affects their ability to lamb and delays the production of colostrum.

Fat ewes managed to reduce condition score during mid pregnancy will have higher intakes before lambing and minimal lambing problems. While this strategy can be useful, there are additional management inputs required to identify the age of pregnancy and between-ewe differences in initial condition score and weight loss. Using harnessed rams at joining will identify when in the joining period a ewe conceived, which helps determine the number of days she has been pregnant.

Controlling condition score during mid pregnancy will:

- reduce risk of pregnancy toxaemia
- reduce lambing difficulties
- save feed
- increase lamb birthweights and survival
- provide flexibility if the season fails

Supplements

If there is insufficient pasture to maintain or increase ewe condition during pregnancy it will be necessary to provide a high-energy supplement to avoid production losses. Cereal grains are usually the cheapest form of energy if feeding is required. Fodder, such as silage or hay, can be adequate, but it is essential to test feed quality to quantify the value of feed (MJ/kg DM). Supplements with an energy level less than 9.0MJ/kg DM are not adequate to maintain ewe weight.

Using a program such as GrazFeed can help determine the correct level of feeding. GrazFeed will also help to quantify the production levels and the cost of a chosen feeding strategy.

Vaccination and other treatments before lambing

Vaccinate ewes two to six weeks before lambing commences.

Vaccinating ewes 2–6 weeks before lambing, confers passive immunity on their lambs through the colostrum. This passive immunity lasts only 6–8 weeks and a full vaccination program for lambs is advisable at marking.

Some vaccines also contain selenium to combat white muscle disease in selenium-deficient areas or Vitamin B12 for cobalt deficiencies. If selenium, cobalt or other trace elements are not deficient, supplementing is not cost-effective or necessary.

Give lambs their first vaccination at marking, then a follow-up (booster) at weaning. A 6-in-1 vaccination as a minimum is recommended for ewes or 5-in-1 for terminal lambs.

In high-rainfall regions (>600mm rainfall), pre-lamb drenching can reduce ewe deaths and minimise production losses in ewes and lambs during lambing. Base the need for this drench on worm egg counts, ewe condition and pasture availability, paddock history and management. Seek advice from a veterinarian to deterine the need for pre-lamb drenching.

Predator control

Control predators such as feral pigs, crows and wild dogs at least six weeks before lambing starts (see Table 4.2). Start controlling foxes with baits two to three months before lambing. Lay more baits a month before lambing to remove any new foxes that have taken up local residence. Regardless of lambing date, routine fox control during August/September will be needed to remove newborn cubs.

More information about controlling predators can be found on the Invasive Animals CRC website www.ferals.org.au

The Maremma – the guardian dog for sheep.

Table 4.2: Predator risk and suggested action

Predator	Problem or risk	Action
Feral pigs	Kill lambs Disrupt lambing	Baiting (PIGOUT®), fencing, shooting, trapping
Foxes	Kill viable and non-viable lambs Disrupt lambing	Baiting (FOXOFF®), fencing, shooting, guard dogs, alpacas
Crows	Injure and kill lambs Injure ewes	Trap and relocate – seek advice on this action. Ensure ewes are in adequate nutrition so have good mothering bond
Wild dogs	Kill ewes and lambs	Baiting, fencing, shooting, guard dogs, alpacas

Shearing and crutching

Avoid shearing ewes 6–8 weeks before lambing as it increases the nutritional requirements of the ewe. Clean-shorn animals use more energy to maintain core body temperature and feed requirements can increase by 30% during winter.

Avoid shearing six to eight weeks prior to lambing.

Crutching three to four weeks before lambing will clean around the udder, assist the newborn lamb to find the teats and ensure the lamb suckles colostrum as soon as possible after birth.

Crutch ewes three to four weeks before lambing starts.

Avoid crutching or shearing within the last month of pregnancy as this dramatically increases the risk of hypocalcaemia or pregnancy toxaemia. If ewes must be handled in late pregnancy, handle them in small mobs to limit the time off feed.

Pregnancy toxaemia

Pregnancy toxaemia is a disorder of fat metabolism characterised by elevated levels of ketones in the blood. Pregnancy toxaemia is the outward sign that the pregnant ewe has been suffering from nutritional stress for some time and is now critically stressed.

Multiple-bearing older ewes during late pregnancy have the highest nutritional demands and are most at risk of pregnancy toxaemia. If several ewes are affected in a mob, this is a clear indication ewe nutrition must improve quickly. Failure to provide adequate pasture or supplements may result in pre-lambing ewe losses, lambing problems and lamb losses, reduced milk production and lamb growth.

Chapter 5: Lambing

Recommendations

- Give priority to ewes with multiple lambs for paddocks with best shelter and quality feed.
- Put multiple-bearing ewes into lambing paddocks one week before lambing starts.
- The ideal mob sizes for lambing are:
  - multiple-bearing ewes < 250 ewes
  - single-bearing ewes 400–500 ewes
  - maiden ewes 250–400 ewes
- Avoid high stocking rates with twin-bearing ewes.
- Provide ewes with adequate pasture or supplementary feeding may be required.
- Feed supplements between 2–4pm to minimise disturbance to the lambing flock.
- Ewes in poor condition produce low birthweight lambs.
- Lambs less than 4kg are at risk of starvation, mismothering and hypothermia.

Lamb losses

Research has shown that typically 30% of lambs born die during the first three days of life. There are many reasons lambs die, the relative importance of which can vary from year to year. However, lamb survival is closely related to lamb birthweight which, in turn, is closely related to ewe nutrition. Lamb losses can be reduced by managing mobs to minimise the effects of weather, controlling predators and by providing adequate nutrition to lambing ewes (see Table 5.1).

Preparing the ewe, and her environment, for lambing can have a major impact on lamb survival.

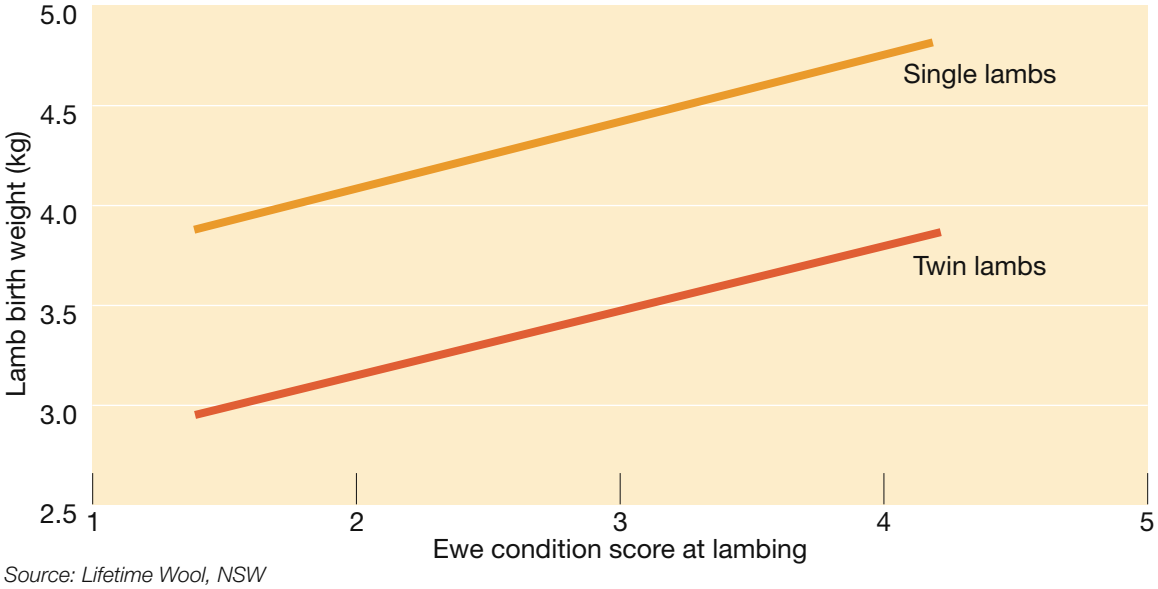
A low lamb loss–high survival outcome is the result of managing the whole system. This starts at weaning and continues through joining and pregnancy to lambing. A common feature in lamb loss profiles is that both very heavy and light weight lambs die, which is largely due to management. Fortunately the overall number of lambs in these weight classes is usually low.

Target survival rates of lambs from Merino ewes should be above 90% for singles and 70% for twins and in first-cross ewes and maternal breeds, lamb survival should be 90% for singles and 80% for twins.

Condition score 3 at lambing and adequate nutrition will reduce the risk of starvation, mismothering and hypothermia and ensure a good start to lactation.

The optimum birthweight for maximum lamb survival is between 4.5–5.5kg. Ewe condition score is closely related to lamb birthweight (see Figure 5.1).

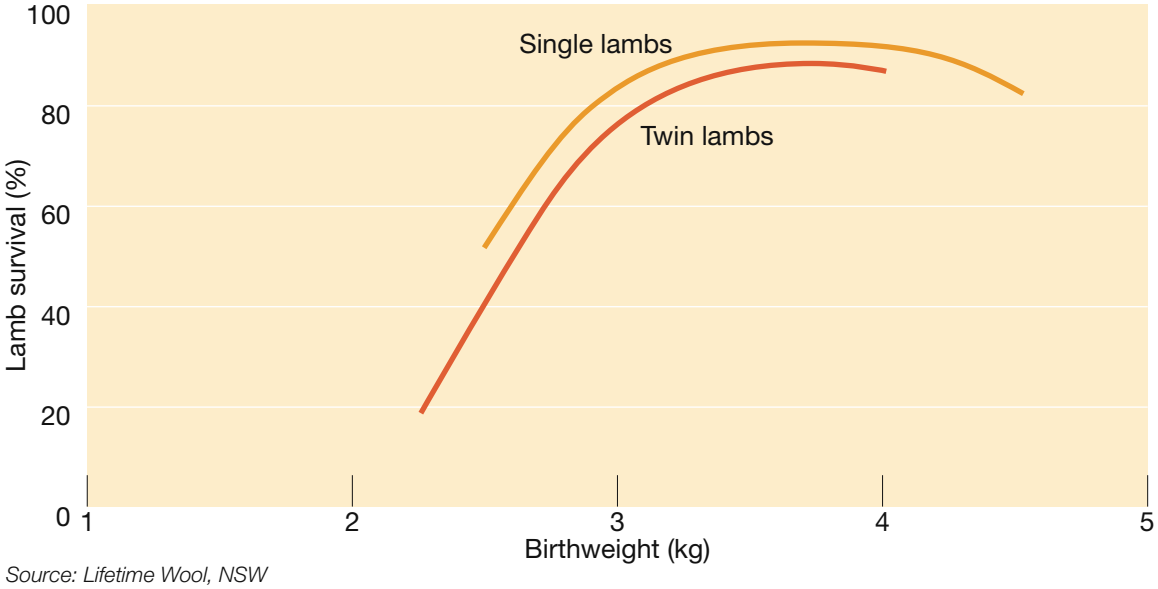
Figure 5.1: Relationship of ewe condition score and birthweight



Source: Lifetime Wool, NSW

A decrease of one condition score will reduce birthweight by 0.4–0.5kg in single and twin lambs. As a guide, when lamb birthweight drops below 4.0kg survival decreases sharply (Figure 5.2). Hypothermia is a serious risk as lamb birthweight decreases.

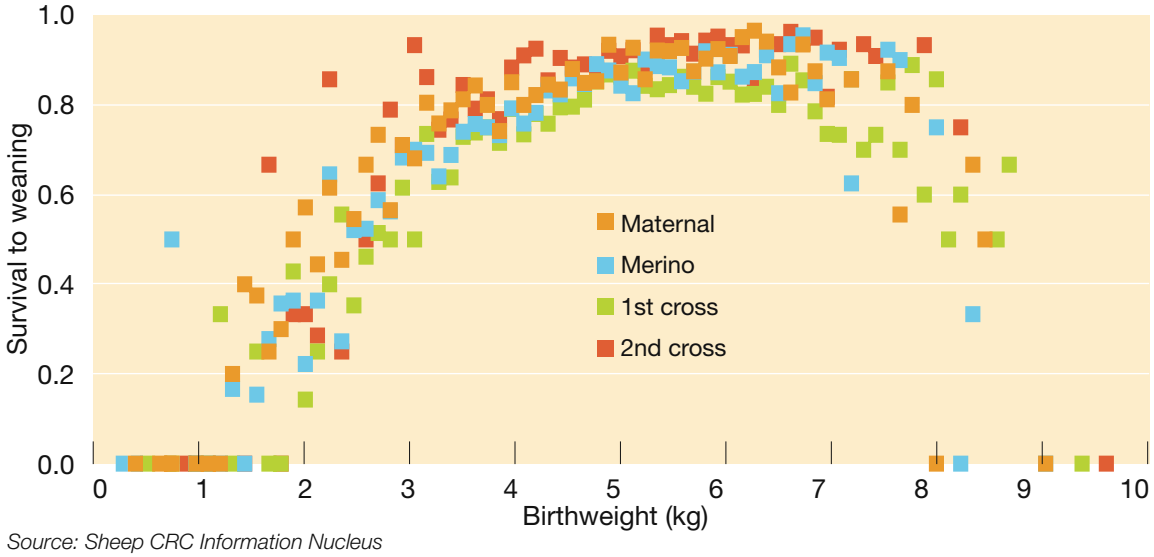
Figure 5.2: Relationship between lamb birthweight and survival



Source: Lifetime Wool, NSW

Lamb survival research by the Sheep CRC shows that peak survival is when lamb birthweight is 4-6kgs with different breeds, including Merinos, maternal breeds, first and second-cross lambs showing similar patterns. (Figure 5.3).

Figure 5.3: Lamb survival vs birthweight for different breeds

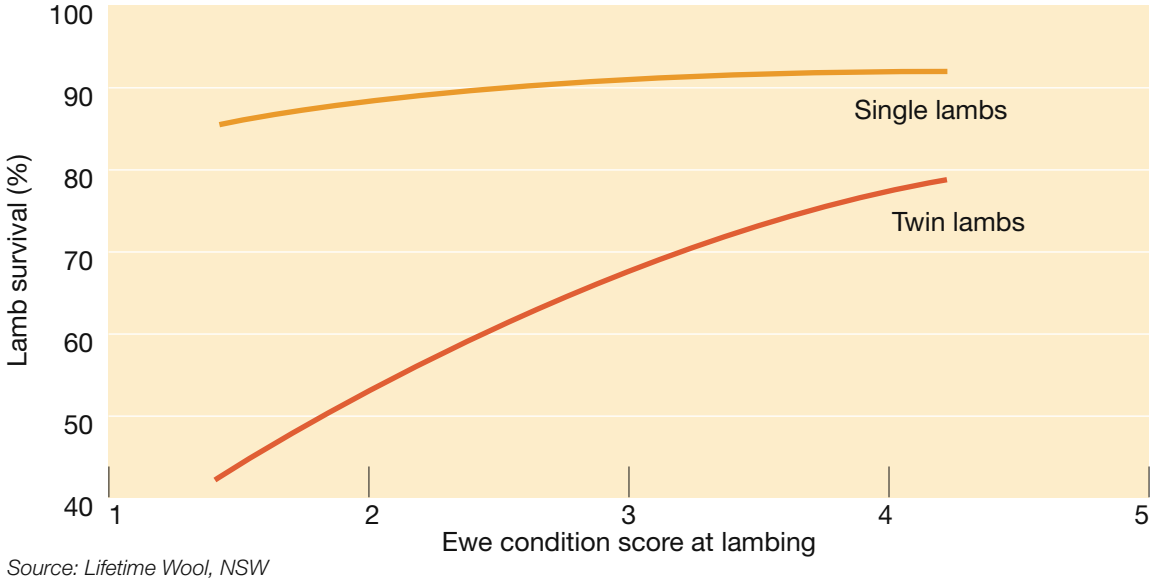


Source: Sheep CRC Information Nucleus

To achieve good lamb survival, aim to lamb singles in condition score 3 and twin bearing ewes in condition score 3.5.

To achieve satisfactory lamb survival, aim to have single-bearing ewes in condition score 3 and twin-bearing ewes in condition score 3.5 at lambing (see Figure 5.4). This is especially important in cold, windy environments.

Figure 5.4: Relationship between ewe condition score and lamb survival



Source: Lifetime Wool, NSW

Poor ewe nutrition and low condition score at lambing not only results in low birthweight lambs, but impacts on ewe maternal instinct, which contributes to the cocktail of causes for lamb deaths – the combination of starvation, mismothering and hypothermia.

Poor ewe nutrition delays the onset of milk production, therefore colostrum, for up to four hours. This delay is most common in twin-bearing ewes and often results in one lamb dying or being orphaned. Lambing supervision procedures, pirating, and blocked or poorly-structured teats are among the list of other causes of starvation and mismothering.

Table 5.1 Source of lamb losses

Loss category	Cause	Remedy
Birth injury/ stillborn	Brain bruising, dystocia, malpresentation, prolonged labour Lamb birthweight >5.5kg	• Manage ewe condition score • Prevent rough handling • Select rams on birthweight ASBV's and lambing ease ASBV's, especially with maidens or select low birthweight breeds to join with maidens if problems exist
Starvation/ mismothering	Deaths 1–2 days after birth and evidence of starvation (no milk clot in lamb stomach and kidney fat red on autopsy) Poor ewe nutrition is the common cause Delayed lactation	• Ensure adequate ewe nutrition (condition score and feed available and feed quality) to ensure optimal lamb birthweight for twins and singles • Cull ewes with poor teats/udder • Inspection procedures • Supplementation techniques • Minimise ewe density
Primary predation	Mutilation by birds, dogs, foxes or pigs	• Identify predator • Develop a control program, Strategic baiting. Synchronise predator control with neighbours • Selection of lambing paddock
Exposure/ hypothermia/ hyperthermia	Chill/cold stress especially in lambs <3.5kg at birth Heat stress	• Ensure adequate ewe nutrition (condition score and feed available) to ensure optimal lamb birthweight for twins and singles • Selection of lambing paddock to reduce wind speed through shelter – strategic wind breaks, perennial grasses • Topography and fencing

Lamb losses caused by hyperthermia (high temperatures) can occur. Hyperthermia is associated with high ambient temperatures leading to dehydration. Maternal hyperthermia has been demonstrated in Queensland where ambient temperatures exceed 36ºC and shade is limited. The effect reduces lamb birthweight and consequently survival.

Provide shelter to avoid exposure losses.

Birth trauma

Over fat ewes have more lambing problems.

During birth the foetus is expelled through the cervix and vagina by muscular contractions of the uterus. Problems can occur with mal-presentation or foeto-pelvic disproportion. The effects of such trauma can be seen post mortem where there is a varying degree of bruising damage to the brain and spinal cord or more commonly with swelling around the head and tongue. This results in cranial bruising and in some cases suffocation of the lamb.

The most common cause of birth trauma is due to high birthweight, especially in combination with reduced pelvic canal size due to fat accumulation in the ewe. Over fat ewes or ewes joined to rams that produce lambs with high birthweights produce lambs typically weighing more than 5.5kg. Ewes producing these lambs are at higher risk of dystocia and dying.

The recommended pasture availability levels and management of the over fat ewe are covered in Chapter 4.

Ram selection, especially for maiden ewes, or meat breed rams joined to small-framed Merinos can impact on lamb survival. Genetic strategies to minimise the risk of ewes producing excessively large lambs include selecting sires with moderate birth weight ASBVs, lower gestation length ASBVs and higher lambing ease ASBVs.

Colostrum

Intake of colostrum as soon as possible after birth is critical to lamb survival.

The first milk found in the udder after lambing is colostrum. It is full of immunoglobulins that protect lambs from infection during the first few weeks of life and provide a rapid source of energy for lambs soon after birth.

Initially colostrum is a thick, opaque liquid that is difficult to express from the udder. In the days following lambing, the colostrum changes colour from yellow to cream and then to white, and the viscosity reduces from thick to a liquid similar to milk.

The production and characteristics of colostrum depend on the feed quality for the 10 days leading up to lambing, irrespective of ewe condition score. Poor nutrition in the 10 days before lambing tends to reduce colostrum production.

Ewes in condition score 2 or less tend to produce thick colostrum that is difficult for the lamb to suck. This is especially serious for twin-bearing ewes because they are already under nutritional stress and will have two lambs competing for a small amount of milk. This is a common cause of starvation and mismothering in twin lambs.

Adequate nutrition just before lambing will both increase the amount of colostrum and make it less viscous, which makes it easier for the lamb to extract it from the udder, boosting lamb survival.

Lamb predation

Common predators include foxes, eagles, feral pigs, crows and dogs. Predation can account for up to 5–10% of lamb losses, but is usually of secondary importance compared with starvation, mismothering and hypothermia.

Often the losses are not immediately apparent and for this reason pre-emptive action is recommended. This may involve:

- changing the lambing paddock
- fencing
- trapping and poisoning
- guard animals
- providing alternative feed for the predators
- a combination of all these options

Foxes are a common predator, not only of lambs but also of native animals and birds. Foxes have a potential role in exotic and endemic disease transfer.

Predation can be either primary — where the predator takes a lamb that would otherwise have survived —or secondary — where the lamb taken was already dead or likely to die of other causes (for example, an abandoned lamb, injured at birth etc).

On average, more than 15–30% of lambs die naturally and these lambs are candidates for secondary predation. Unfortunately sheep producers often assume this is primary predation, precluding actions that could prevent the true cause of death.

Healthy foxes are rarely aggressive (apart from sport kills) and are opportunistic scavengers. Their diet includes rabbits, carrion, lambs, mice, insects, plants, berries, birds, lizards, other non-vertebrates, but placenta, when available, is not always eaten. This food basket will vary with season and may influence the need for a fox to become a primary predator of lambs.

Primary predation can be important, but not necessarily in every flock or every year. The key to effective predator control is to identify the predator and the necessary steps required to limit their impact. Community fox baiting programs are an example of strategic control.

Coordinated fox baiting programs help control this predator.

Checklist for features and cause of lamb death in newborn lambs

The list below outlines the features and cause of death of newborn lambs. Use this list in conjunction with your veterinarian to determine the cause of death of newborn lambs.

Table 5.2: Summary of features and causes of death of newborn lambs

Feature	Comment
Body weight < 3.5kg	At risk of exposure and hypothermia
Body weight > 5.5kg	At risk of dystocia (difficult birth)
Birth stain has been cleaned	Mismothering
Pads still on feet	Hasn't walked
Skin on lamb's neck, chest and back show bruising and/or teeth marks	Primary predation – dead lambs will not have bruising
Lungs float in water	If lungs float the lamb has breathed if they sink, the lamb died before birth
Milk clot in stomach	Lamb has suckled
Kidney fat red	Fat mobilised – lamb in nutritional deficit
Kidney fat brown	Fat hasn't been mobilised — death at or soon after birth
Kidney fat white	Fat replenished
Swollen tongue, head and neck	Dystocia (difficult birth)
Genetic malformation	Various features incompatible with life
Thyroid weight > 0.4 gram/kg birthweight	Goitre — iodine deficiency

The common features of lambs that die of starvation, mismothering or hypothermia include: low birthweight, red kidney fat, and no milk clot.

Ewe nutrition post lambing

Post lambing nutrition is important if lambs are to reach satisfactory weaning weights. Peak lactation occurs about 30 days after lambing. Ewes normally metabolise body fat to produce milk and the extent of weight loss during lactation will depend on ewe condition score at lambing and availability of high-quality pasture during lactation. Table 5.3 illustrates the recommended quantities of feed for different regions based on the Lifetime Wool project

Table 5.3: Recommended condition score and FOO or herbage mass (kg DM green/ha) at the commencement of lambing

	Lambing[+]	Lactation[+] and weaning
Late winter spring lambing	CS 2.6-3.0 FOO 1,500 HM 900	FOO >1,800-2,000 HM >1,500
May lambing	CS 2.6-2.7 FOO 800	FOO >1,500-2,000

FOO: Feed on offer; HM: Herbage mass

[+] *Twin lambing ewes require 1,800kg DM/ha to ensure they regain lost condition and should be about 0.3 CS higher than single ewes at lambing*

Supplements

If supplements are fed during lambing, ewes will require training three weeks before lambing to become accustomed to being disturbed. Locate the feeding site so it can be seen from all parts of the paddock and feed in the early afternoon to minimise disturbance of lambing ewes.

Lambing on forage crops

When ewes lamb on forage crops, such as such as oats, barley and winter wheat, birthweights are normal but in many cases a proportion of the ewes need assistance to lamb. This assistance usually only involves gentle traction.

The cause of this issue is not known, but it is possibly due to hypocalcaemia. Lambs, dry sheep and ewes in early pregnancy exhibit excellent growth rates when grazing forage crops, but it may be advantageous to avoid grazing ewes with a high risk of hypocalcaemia on these crops, especially if previously fed grain for long periods.

Grazing wheat has low magnesium and high potassium levels and lamb growth rates have increased by up to 25% in trials by supplementing equal proportions of Causmag (MgO) and salt in a lick.

In addition to the nutritional challenges, crops taller than 30cm can lead to mismothering especially ewes with multiple births.

Managing lambing

Ensure ewes with multiple lambs are given priority for shelter, supplements and quality forage, and are in their lambing paddock about one week before lambing.

Ideal lambing paddocks have effective shelter, which reduces wind speed to less than 8km/h (a gentle breeze) at lamb height. This is best achieved by:

- allocating paddocks with a northerly aspect, which protect stock from cold southerly or westerly winds, to lambing ewes
- planting strategic windbreaks of trees and tall perennial grasses
- avoiding exposed topography

Provide plenty of shelter and privacy for twin-bearing ewes.

Night campsites need to be well drained, well sheltered and situated on the best aspect of the hill (fence off exposed sites, such as the top of hill).

The best time to inspect or feed lambing ewes is between 2 and 4pm.

Ensure the amount of pasture available at lambing is consistent with the levels in Table 5.3. If pasture is inadequate, then provide a supplement. Ideally, feed supplements every second day between 2–4pm (to minimise flock disturbance), with feeding sites visible and accessible from all sections in the paddock. Feed test supplements before use, especially if fodder is used rather than concentrates, to ensure feeding rates are sufficient.

If necessary carry out paddock inspections between 2–4pm when it is warmer and social behaviour of the ewes and lambs is more relaxed.

Smaller lambing mob size is preferable. Recommended targets are:

- multiple-bearing ewes < 250 ewes
- single-bearing ewes 400–500 ewes
- maiden ewes 250–400 ewes

If possible, place twin-bearing ewes in smaller paddocks. The logistics of implementing this will depend on the physical layout and paddock sizes on individual properties.

A ewe density of less than 18 ewes/ha is recommended but ewes also need room at the sheep camp to spread out. Larger mob sizes and stocking densities are likely to create more mismothering and lamb losses.

Chapter 6: Lambing to weaning

Recommendations

- Ewes should be in condition score three at lambing.
- Ensure pastures build up to 1,500 to 2,000kg green DM/ha by weaning. Twin-bearing ewes should graze 1,800kg DM/ha for optimum productivity.
- Allocate the best paddocks (feed availability and shelter) to twin-bearing ewes.
- Follow best-practice recommendations for lamb marking.
- Graze with cattle or dry sheep to prepare low-worm-burden weaning paddocks with between 1,500 and 2,000kg DM/ha of high-quality green pasture.
- Lambs from Merino ewes gain nothing from weaning later than 14 weeks from the start of lambing.
- Start preparing weaning paddocks the previous summer.

Lamb survival and growth depends on milk production, health management and nutrition. This chapter breaks management issues into the following sections:

- ewe nutrition
- lamb marking
- lamb losses after marking
- when to wean
- early weaning

Ewe nutrition

Milk production has a large impact on lamb survival and growth. Nutrition and condition score at lambing determines whether a ewe will reach her potential for milk production.

Ewe condition score at lambing

Ewe body reserves at lambing determine the potential milk production throughout lactation. This is one reason to ensure pre-lambing nutrition is adequate to maintain ewes at condition score three to the point of lambing. Twin-bearing ewes should lamb in a condition score about 0.3 of a condition score above single-bearing ewes.

Pasture targets

Allocate the best pasture to the twin bearing ewes.

Allocate pasture availability and quality to ewes so lambs achieve production targets. As a guide, a herbage mass of more than 900kg green DM/ha is required at the start of lambing, which should increase to 1,500–2,000kg green DM/ha by the end of lambing.

Aim to lamb twin-bearing ewes onto 1,800kg DM/ha. Autumn-lambing ewes will rarely achieve these guidelines unless the autumn break has been favourable. This is an important reason why early-lambing flocks run lower stocking rates. In this circumstance, supplementary feeding is more likely to be necessary.

Feed quality is also important — ideally pasture digestibility will be above 70% and legume content at least 20%. Table 6.1 shows the impact on lamb growth rates of lambing single and twin-bearing ewes on different pastures.

Table 6.1: Predicted average lamb liveweight and change in ewe condition score at marking for ewes lambing at either CS 2 or 3 on a range of pastures*

	kgDM (green)/ ha	Lambing at CS 3		Lambing at CS 2	
		Lamb liveweight at marking	Fall in ewe condition score	Lamb liveweight at marking	Fall in ewe condition score
Singles	800	11.2	0.5	10.5	0.3
	1,000	11.7	0.3	11.1	0.1
	1,200	12.1	0.2	11.6	Nil
Twins	1,000	8.9	0.8	8.1	0.5
	1,200	9.2	0.7	8.5	0.4
	1,500	9.4	0.5	8.8	0.3

** Seven weeks from the start of lambing*

Lamb marking

Successful lamb marking requires care, planning, careful hygiene and a suitable site. The following matrix lists the key practices for successful lamb marking and maximising weaning percentages.

Follow recognised best practise at marking to minimise lamb losses.

Age of lambs • Mark before six weeks of age (one week after the end of lambing) • Older lambs may suffer excessive bleeding • Mark twice during an extended lambing to avoid marking lambs significantly older than six weeks	**Site and Yards** • Use portable yards in the lambing paddock • Drop lambs on clean ground outside yards • Use a new site each year to reduce infection
Time of marking • Mild weather • Start early and finish by mid-afternoon	**Disinfection of instruments** • Use sharp, disinfected instruments • Boil for at least five minutes before each day • Dip instruments in disinfectant between lambs
Flystrike control • Apply chemicals to prevent flystrike on marking and mulesing wounds during 'at-risk' period • Products such as Clik™ and Extinosad™ are effective at controlling flystrike in mulesed lambs	**Vaccination** • Vaccinate ewes before lambing with 6 in 1 • Lambs should be vaccinated twice 6 weeks apart with 6-in-1 or 5-in-1 if they are terminal lambs • Use scabby mouth vaccine if the disease is causing problems or to target live-sheep trade
Mustering and drafting • Avoid long periods off pasture • Allow lambs to cool down before marking • Draft small numbers at a time • Lambs held together can smother	**Catching and handling lambs** • Lambs should be caught around the body • Using cradles can reduce labour and time • Dropping lambs onto their feet reduces the risk of wound infection
Mothering up • Restrict ewes and lambs together in holding paddocks for an hour after marking to allow mothering up • Provide water in the yards to reduce the risk of ewes deserting lambs when they are let out	**Castration** • Preferably, castrate lambs before they are six weeks old • Keep knives sharp so wounds heal rapidly. • Elastrator rings on large lambs can be conducive to flystrike and infection
Tail docking • For faster healing, cut the tail at the bone joints • Dock at the third palpable joint to minimise both breech strike and cancer of the vulva • Lambs appear to suffer less and mother up more quickly when using a gas knife • Stretch the bare skin on the underside of the tail to ensure the wound heals with no wool-bearing skin on the underside	

Lamb losses from marking

Losses can occur at any time from mustering until several weeks after marking. Knowing when losses occur narrows down the list of possible causes (see Table 6.2).

Determine the cause and timing of lamb loss to identify opportunities for improvement.

Losses within 24 hours of marking are usually due to mismothering of young lambs. Shock or haemorrhage can also cause death and occurs more commonly in older wether lambs. Losses are worst in flocks with an extended lambing and a single marking.

Losses from one to five days after marking are usually due to wound infection, flystrike or starvation from mismothering.

Wound infections are usually a result of dirty instruments or dirty yards and are also more likely when ewes don't receive a vaccination booster before lambing.

Mismothering and starvation may result from:

- lambs being in poor condition and too weak to stay with the mob
- lambs being marked too young (less than a week)
- dry ewes drawing wet ewes away from their lambs when released from the marking yards
- lambs being left by ewes when marking yards are too far from water and they have been off water too long
- driving lambs long distances straight after marking
- cold, wet or windy weather, which quickly chills lambs
- prolonging lamb marking by combining it with shearing or crutching
- too many ewes and lambs in one mob

Losses beyond five days are usually a result of flystrike or other wound infections. Losses around lamb marking are usually a lot lower than losses around birth.

Table 6.2: Reasons for lamb loss around marking time

Before marking	At marking	Within 24 hours of marking	Within one week of marking	More than 1 week of marking
Mismothering	Rough handling	Haemorrhage	Starvation	Tetanus
Flystrike	Poor techniques	Mismothering	Wound infections	Arthritis
Enterotoxaemia	Poor facilities		Flystrike	Wound infections
Overcrowding				Flystrike
Overheating				Eperythrozoonosis

When to wean

Wean lambs from Merino ewes no later than 14 weeks from the start of lambing. They can be weaned as early as eight weeks provided they have reached a minimum liveweight of 8kg. Early weaning can be used in poor seasons to improve feed use efficiency and to limit weight loss in the ewes before the next joining.

Ideally wean Merino lambs no later than 14 weeks from the start of lambing.

Lambs from first-cross ewes can be retained on their mothers for longer than 14 weeks when adequate pasture is available and worm control is sufficient. Base weaning decisions about lambs from first-cross ewes on:

- allocating pasture resources to ewes and lambs so either ewes will more gain weight before joining and achieve higher reproductive rates, or lambs will increase in value due to heavier liveweight.
- drenching and removing lambs to low-worm-risk paddocks to ensure higher growth rates.

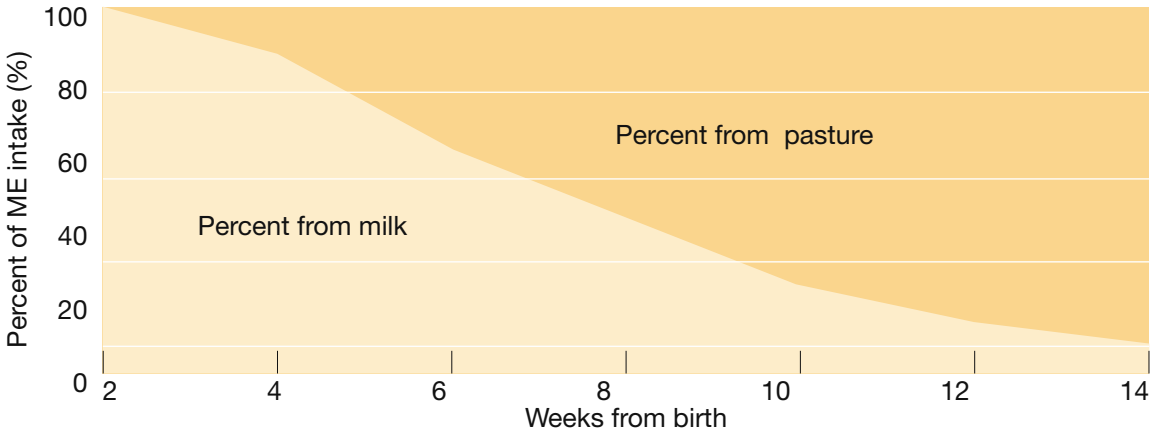
Allocate the best paddocks to the lowest condition score ewes in order to raise their condition score for joining.

Lamb nutrition

Figure 6.1 shows that milk is the major part of the diet until lambs are eight weeks old. Lambs start to eat small amounts of pasture from about two weeks after birth, but by eight weeks pasture overtakes milk as the largest component of the diet.

By 14 weeks after lambing, milk contributes less than 10% of total dietary energy intake and lambs gain little nutritional benefit from remaining with their mothers.

Figure 6.1: Relative energy intake of pasture and milk for Merino lambs



Source: GrazFeed

Milk contributes less than 10% of the nutrition of a 14-week-old Merino lamb.

Similar trials show that ewe weight gain (and subsequent conception rates at next mating) and wool production are penalised if lambs are not weaned from ewes by 14 weeks and the impact is greatest during seasons with restricted feed.

Lambs do not grow any better when weaned later.

Table 6.3: Effect of weaning on Merino lamb weight gain

	Total weight gain from birth to 12 weeks of age (kg)	Total weight gain from birth to 18 weeks of age (kg)
14 week weaning	14.70	17.38
20 week weaning	14.45	16.63

Source: Glen Innes 1990

Early weaning

Weaning as early as 8 weeks can be very efficient when hand feeding rates are high.

Consider weaning early when pasture availability and quality is poor and the requirement for supplements is high. It is more efficient to feed a weaned lamb than it is to feed a ewe to produce sufficient milk. Early weaning can reduce feed bills substantially.

Train lambs to feed with their mothers.

Always start feeding lambs with their mothers. This will help lambs make the transition to full hand feeding more readily. Training to feed (imprint feeding) even in good seasons will ensure better acceptance of future hand feeding. Three to four feeds of 100 g per ewe, fed every second day of the week before weaning, should be sufficient when ewes have prior experience grain feeding.

Very young lambs need great care as their rumen is less developed and they are inexperienced in eating pasture or being hand fed. Provide access to either highly digestible pastures or high-quality hay and concentrates high in energy and protein.

Worm risk

Prepare low worm pastures for weaning.

Lactation reduces the ewe's natural resistance to internal parasites and they are likely to shed more worm eggs onto the lambing paddocks. Lambs also have low natural resistance to worms but despite this, worm burdens do not appear to affect the growth of lambs until 12–15 weeks of age because of their heavy reliance on milk. Weaning by 12–14 weeks, and treating with an effective drench onto 'clean' paddocks, greatly reduces the risk of a worm-induced growth check.

Weaning paddock preparation

Wean onto 1500–2,000kg DM/ha of highly digestible green herbage.

Start to prepare 'clean' weaning paddocks at least six to nine months earlier, or the previous summer in advance of weaning. It takes at least six months for worm larvae infestation of pasture to reduce to safe levels. Grazing with cattle or healthy adult dry sheep actively reduces the number of worm larvae on pasture and ensures fresh pasture growth in the period before weaning.

Prepare a fodder budget to decide when to rest weaning paddocks to allow fresh pasture growth to accumulate to between 1,500–2,000kg DM/ha. It is also critical for weaning paddocks to have a low risk of causing grass seed infestation in lambs, high quality pasture and excellent water quality and access.

Recommended resources

A pocket guide to ASBVs – Australian sheep breeding values
www.mla.com.au/asbvguide

A producers' guide to sheep husbandry
www.mla.com.au/sheephusbandryguide

Feed demand calculator
www.mla.com.au/feeddemand

Lambing planner
www.mla.com.au/lambingplanner

Making More From Sheep
www.makingmorefromsheep.com.au

Rainfall to pasture growth outlook tool
www.mla.com.au/rpgot

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