Department of
Primary Industries

Grain and Graze Report June 2005

Managing sheep production from a changing feed base in the Mallee

Victoria
The Place To Be

Published by: The Department of Primary Industries
Walpeup Victoria Australia 3507
June 2005

Authorised by: The Victorian Government, Melbourne
1 Treasury Place, East Melbourne Victoria Australia 3000

ISBN 1 74146 618 0

Acknowledgments
Janice Hyett and Geoff Stratford kindly formatted this document. Kieran Ransom, Gary Hallam and Roy Latta made helpful comments on earlier drafts. Kevin Grayling assisted with data collection and provided records of sheep production at DPI Walpeup.

Find more information about DPI on the internet at: http://www.dpi.vic.gov.au or contact the DPI Customer Service Centre on 136 186

Contents

List of Tables

List of Figures

1. Introduction

There is a large potential for farmers in sheep/cropping regions to improve the production and profitability of their pasture/sheep enterprises while increasing whole-farm returns. This involves:

- Understanding the risks of climate variability on production and costs;
- Matching feed supply and demand to allow optimal stocking rates;
- Flexible management to utilise feed opportunities;
- Understanding the trade-offs between pasture/livestock and cropping to optimise performance; and
- Not least importantly, recognising there is potential to improve.

This report provides information on production of sheep in relation to feed supply specific for the south-east Australian Mallee. The aims of this report were to:

a) Quantify production of sheep from different feed bases, and define variation in production due to climatic conditions;
b) Provide preliminary economic analyses of feed opportunities and highlight profitable management.

This information will assist farmers to make more informed management choices to improve the profitability of sheep in mixed farming systems in the Mallee.

The Mallee region of south-east Australia

This report was compiled using sheep measurements largely recorded in the central Victorian Mallee (primarily Walpeup, average rainfall 340 mm) between 2000 and 2005, and other relevant published information. Potential production levels for lower rainfall parts of the region will vary from the estimates given for the central Victorian Mallee, and optimal stocking rates and management may differ. However, the principles can be applied to mixed sheep/cropping farms throughout the region. Variation between paddocks in one location is likely to be as high or higher than variation in production at different locations within the region.

Pasture production for this report was predicted using GrassGro® version 2.41 based on rainfall data for 1970-2002. General information on nutrition, supplementary feeding and sheep management is available from other DPI publications.

2. The changing feed source

Keypoints
Quantity or quality of paddock feed limits sheep production for most of the year.

The type of paddock feed available for sheep changes through the year.

Crop/pasture management and climate variation influence feed supply.

Understand the limitations of available feed sources to manage sheep and optimise production.

2.1. The potential of different feeds to maintain sheep
The key to managing sheep is optimising the use of available feeds. Paddock feed is usually the cheapest source, but either the quantity or quality of feed may limit sheep production (Fig. 1). In the low-rainfall Mallee, annual pastures only provide live feed for six to seven months in an average year. However, they may also only provide for near maximum sheep growth rates for two months of the year (Fig. 2). This will vary between years depending on climatic conditions, pasture management and the size of the seedbank to drive pasture production.

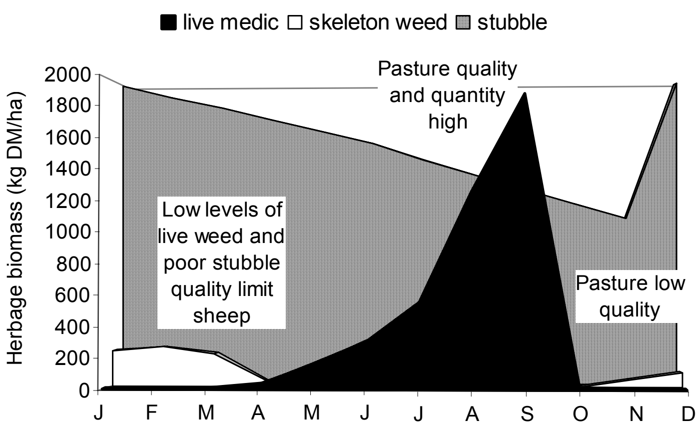


Figure 1. The quantity (kg DM/ha) of different feeds available throughout an average year at Walpeup.

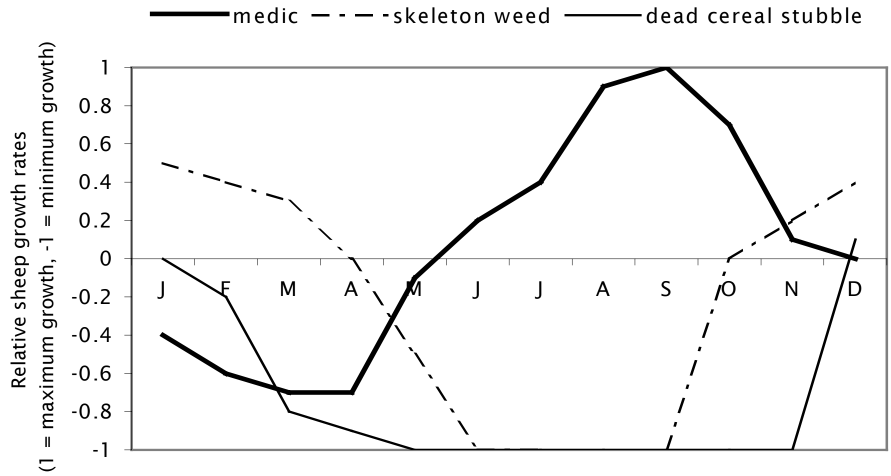


Figure 2. Relative growth rates of unmated ewes grazing different feeds in average years at Walpeup.

Figure 2 indicates the potential for different feeds in an average year to meet the requirements of unmated ewes, with 0 being maintenance of liveweight, maximum gains at 1 (on a relative scale of –1 to 1) and maximum weight loss at –1. Lambs, pregnant or lactating ewes need feed of a higher quality. The figure shows that near maximum growth rates will only be achieved in unmated ewes when grazing annual pasture in August to October. When grazing dead pasture or stubble, ewes have very high rates of weight loss that would not be suitable for any length of time. Sheep eat any accessible grain within a few weeks of grazing stubbles, after which they will rapidly lose weight unless live weeds are present. There is usually more spilt grain in pulse stubbles (lupin, pea etc) than in cereals, and the larger grain is easier for sheep to find, so pulse stubbles can be a cheap summer feed to achieve high growth rates in sheep. However, most Mallee farmers below 340 mm annual rainfall do not grow these crops.

In an average year, skeleton weed allows ewes to maintain or gain weight over summer/autumn. However, the presence of summer weeds will be influenced by cropping/weed control practices. Summer rains may increase the quantity of live weeds and promote early pasture growth, so that near maximum sheep growth rates can be achieved from March through the entire growing season. However, toxic summer weeds (caltrop, heliotrope) may also restrict the paddocks that can be safely grazed.

For all classes of sheep, supplementary/opportunity feeding may be required to fill periods of low paddock feed quality or quantity in some years. However, whether this is cost efficient depends on the class of sheep, stocking rate, the rate of weight gain or loss if not fed, whether or not sheep or lambs need to reach a target weight, and the cost of feed relative to the value from feeding.

Cropping practices can further restrict the patterns of feed availability and potential growth shown in Figures 1 and 2. Sheep enterprise, management and stocking rate need to be matched to the changing feed supply. Management can only be optimised if the risks and potential of feed supply are understood.

3. Annual pasture production and climatic variability

Key points
The quantity of pasture produced varies widely between years due to rainfall.

The northern Victorian Mallee produces less pasture and has a shorter growing season than the central Mallee.

Annual medic may fail to establish after sowing in 20 per cent of years due to insufficient rainfall. There is a higher risk of failure in the northern Mallee.

Pastures regenerating from adequate soil reserves of seed reduce the costs of production and the risks due to climate variability.

3.1. Climatic variation in the quantity of pasture produced
Pasture production varies widely between years due to varying rainfall. This risk in feed supply is a major consideration when setting stocking rates and managing sheep. However, setting stocking rates to the years of lowest pasture production leads to inefficient use of pasture in average and better years.

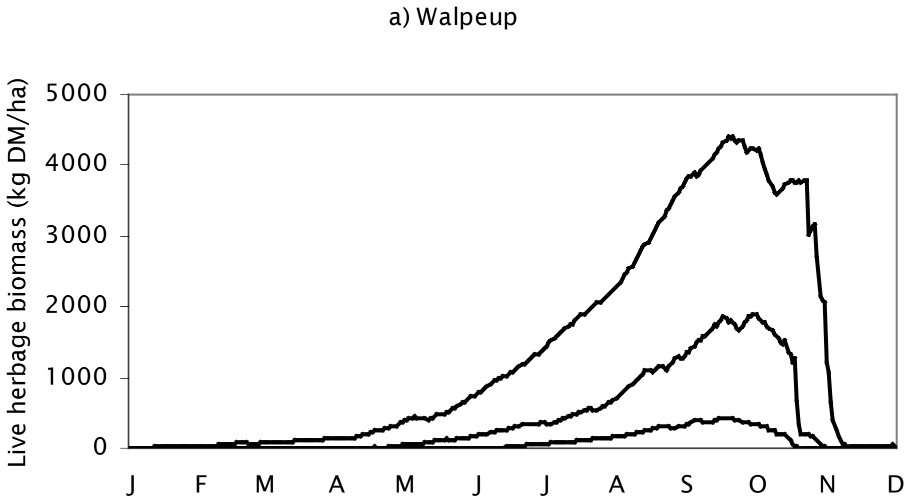
The northern Victorian Mallee experiences lower rainfall than the central Mallee, resulting in lower production and a shorter growing season. Pasture production is similar, under the same soil and management conditions, between the eastern and western Mallee along the same rainfall bands. Figure 3 shows the lower production at Werrimull compared with Walpeup in a poor, average and good year for a medic pasture.

3.2. Risk of establishment failure for annual medic pastures
Commercially-purchased annual medic seed is scarified which means 70 to 90 per cent germinates when sown, which leaves insufficient seed in the ground to establish a pasture the following year if seed is not set. This means pastures have to be re-sown. Occasional failure of medic to set seed in the years after initial sowing (regenerating pastures) is less important than failure in the year of sowing. This is for two reasons:

1. Only a proportion of seed in regenerating pastures germinates each year (approximately 50%, depending on the hardseededness of the variety and other conditions), leaving some seed for future years;
2. In productive pastures the seedbank will be more than 100 kg/ha, so that if the pasture does not set seed in one year, sufficient seed remains in the soil for pastures to re-establish.

The risk of establishment failure in the year of sowing for annual medic is low at Walpeup and Werrimull. If 4 kg medic was sown on 25 April, between 1969 to 2003, the pasture is predicted to fail to set 20 kg seed in 17 per cent of years. Both lower sowing rates and earlier sowing, particularly in the drier northern Mallee, increase the risk of exposure to false breaks and loss of sown seed. The variety Paraggio was used in these examples, but earlier maturing varieties may be more successful.

Managing annual pastures to encourage adequate seed production reduces the need to sow pastures, reducing the risk of economic loss if sown pastures fail to establish. The risk of loss would be reduced if it were possible to predict drought years and not sow pastures in those years. Pastures such as annual medic which regenerate from seed reserves without the need for re-sowing reduce the costs of production and the risks due to climate variability.



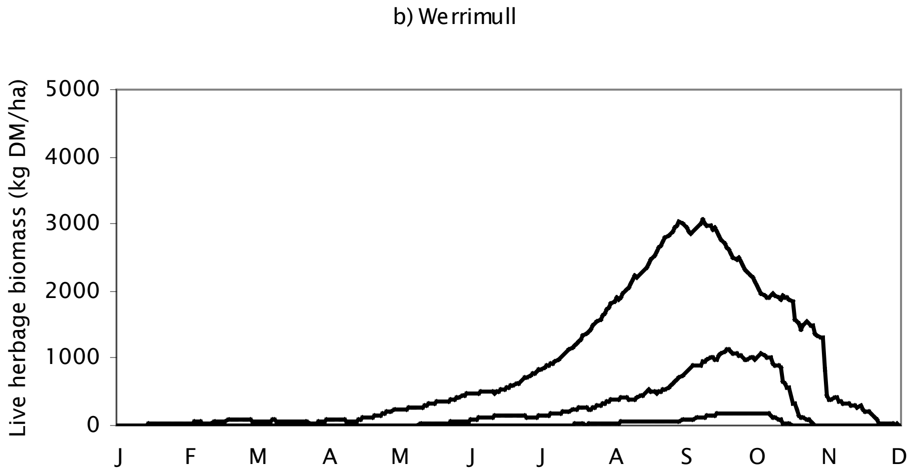


Figure 3. Estimated live herbage biomass (kg DM/ha) of an ungrazed dense annual medic pasture at a) Walpeup and b) Werrimull in poor, average and good years (10, 50 and 90th percentiles).

4. Pasture type

Key points
Dense pastures produce much more feed than sparse pastures in autumn/early winter when feed is most limiting.

Legume-based pastures improve sheep production.

Annual grasses may improve early pasture production but are poorer quality than legumes as they mature.

Annual grasses may have seeds that reduce wool and meat values and create health problems for sheep.

Annual grasses need to be removed before cereal crops are grown.

Lucerne and forage crops may improve feed supply but there is little data to define their economic value in Mallee farming systems.

4.1. Pasture density
Management creates as much variation in pasture production as does climatic variability. To be productive, pastures need to be dense. Pasture density depends upon adequate seed numbers. The effect of seed numbers on medic biomass production is shown in Figure 4. Pastures with seed reserves of 100 kg or more in January produce twice the biomass of lower seed reserves up to the end of July. The value of extra herbage for sheep feed is much greater in autumn/winter, when feed is in short supply, than spring.

Fallowing prior to seed-set, pasture topping using non-selective herbicides, over-grazing, and the use of sulfonylurea herbicides in previous crops all contribute to reduced annual medic seed-set and pasture density.

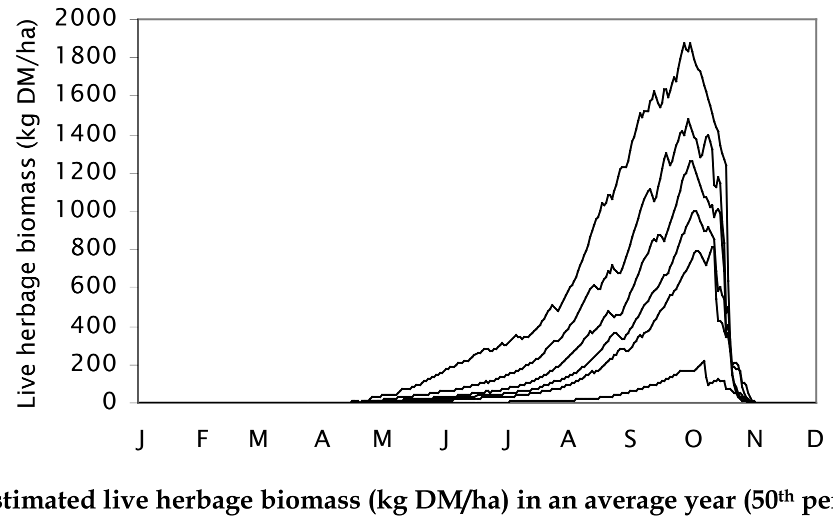


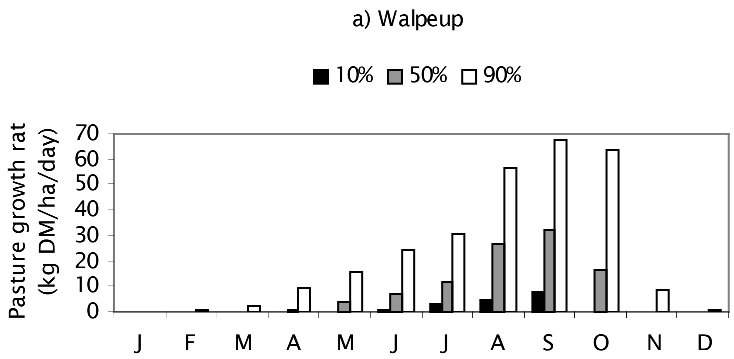
Figure 4. Estimated live herbage biomass (kg DM/ha) in an average year (50th percentile) at Walpeup for a regenerating medic pasture with seedbanks of 2, 12, 20, 50, 100 and 300 kg in January.

4.2. Grass vs medic

Sheep are likely to grow faster on a legume than a grass pasture at the same quantity of biomass. Many annual grasses produce seeds that reduce wool, skin and carcase values, and can damage the eyes of sheep, all of which reduce economic returns unless grass seeds are managed.

Annual grass grows faster than annual legume in autumn/early winter. However, failure to remove grasses can lead to high weed numbers and disease in subsequent cereal crops. Managing legume pastures to achieve high plant densities will improve biomass production in autumn/winter.

Estimated pasture growth rates for Walpeup and Werrimull in poor, average and good years (10, 50 and 90th percentiles) are shown in Figure 5 for a good (dense) medic pasture. Pasture growth rates will vary with plant density, pasture species and composition, soil fertility, grazing pressure and disease.



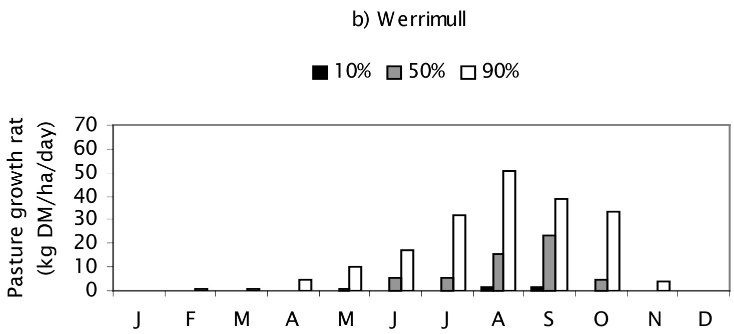


Figure 5. Estimated monthly pasture growth rates (kg DM/ha.day) for a dense medic in poor, average and good years (10, 50 and 90th percentiles) for a) Walpeup, and b) Werrimull (numbers = growth rate at the 50th percentile).

4.3. Nutritive value of annual pastures
Digestibility is a key measure of pasture quality. It is the percentage of a feed that is used by the sheep, the remainder passing through and not being used. As digestibility declines the energy content of the feed eaten and the quantity of feed sheep can eat are both reduced, resulting in slower growth. The nutritional quality of both annual legumes and grasses declines as they flower, mature and die (Fig. 6), but grasses decline at a much faster rate. This can result in higher lamb growth rates for lambs grazing legumes compared with grasses in late spring.

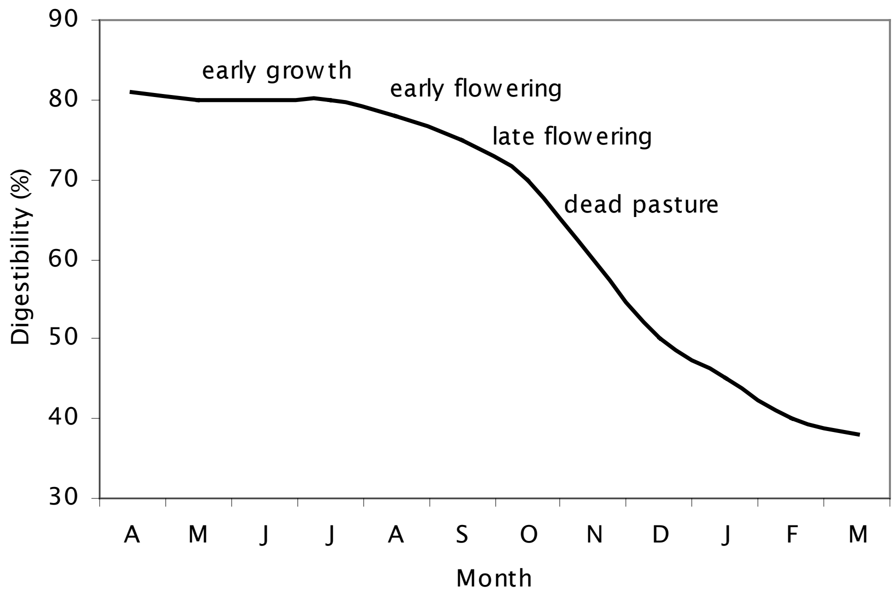


Figure 6. Digestibility (%) of annual pasture at different stages of maturity.

4.4. Lucerne and forage crops
Lucerne can be a valuable feed source in summer/autumn when other live feed is usually not available. It is particularly useful for finishing prime lambs or for growing Merino lambs over summer, since these sheep require higher quality feed than adults. Lucerne needs to be leafy to achieve high lamb growth rates – older stalks of lucerne have a low digestibility. In addition, lucerne can be slow to establish and grazing is limited in the year of sowing.

Vetch and other forage crops can be a valuable source of feed. However, establishment costs need to be considered. Grazing of sown forages is delayed for several weeks after sowing while plants establish, restricting the grazing area at the peak time of feed shortage. In average years, the faster early growth of forage crops may improve feed supply in winter compared with annual medic pastures. In low-rainfall years, with late sowing, vetch may provide little feed value until spring. However, the high quantity produced in spring provides opportunity for production of hay, opportunity trading and finishing of sheep, or harvest of grain.

Insufficient data is available to compare the economic value of lucerne and forage crops with annual medic-based pastures in Mallee farming systems.

5. Crop stubbles and summer weeds

Key points

Sheep will generally lose weight on crop stubbles if little grain or live weed is present.

Large quantities of live weed are available in wet summers. Skeleton weed is a valuable feed source for sheep.

Poisonous weeds cause high levels of sheep mortality in the Mallee and reduce grazing options.

5.1. Crop stubbles

The main value of crop stubbles is in grain and any live weeds that germinate. The dead component alone has a very low nutritive value that is usually insufficient for sheep to maintain weight, even though large quantities may be available. Barley and oat straw have slightly higher nutritive value than wheat straw, but are also usually inadequate to maintain liveweight. However, in low rainfall years, crop stubbles, particularly from crops that have hayed off, have a higher nutritive value and may maintain adult sheep liveweight. Overgrazing of stubbles, particularly non-cereal stubbles, can lead to soil erosion. Sheep can be fed in containment areas to prevent soil erosion.

The nutritive value of wheat stubble was measured at Walpeup from December 1999 to May 2000 and June to October 2004 (Fig. 7). A minimum DMD of about 55 to 60 per cent and a CP of about nine per cent is necessary for adult sheep to maintain liveweight. Lambs require a minimum of approximately 12 per cent CP. Clearly, sheep would lose weight over summer if there was no grain or live weeds in the paddock, even if they only ate the leaf of wheat stubble. The quantity of grain remaining in stubbles after harvest is variable, and how long it lasts depends on stocking rate and whether rain causes germination. Nutritive value declines over time as the more palatable parts are eaten and the stubble decomposes.

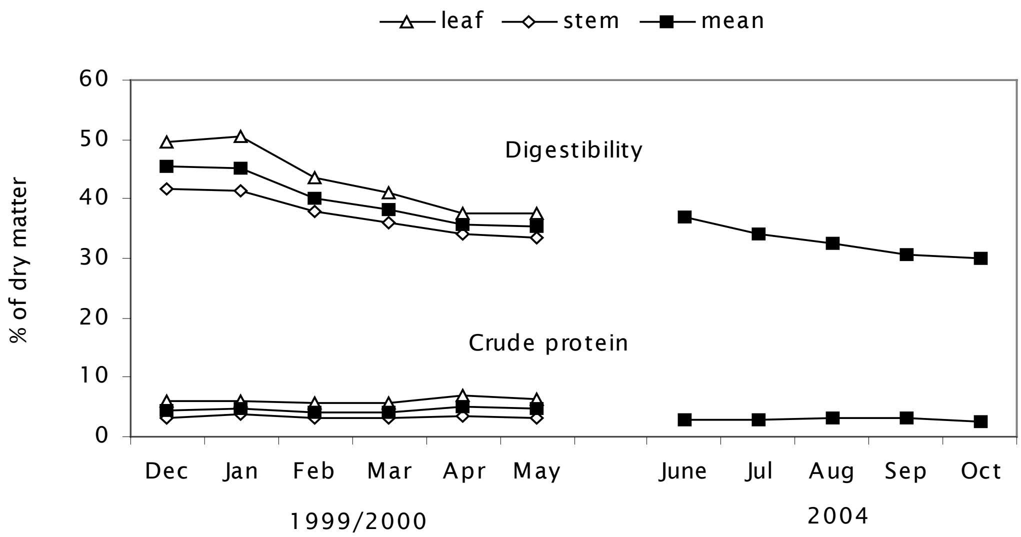


Figure 7. Dry matter digestibility (%) and crude protein (% DM) of wheat stubble for leaf, stem and the mean in 1999/2000 and the mean in 2004.

5.2. Summer weeds

Skeleton weed is the main non-toxic summer weed in the Mallee, and is often present in sufficient quantities to allow ewes to maintain weight over summer. The quantity of other live plant for sheep feed over summer/autumn is more dependent on rainfall. This is highly variable, and is also dependent upon cropping practices. In more than 30 per cent of years at both Walpeup and Werrimull, it is predicted that sufficient rain is expected to fall to produce more than 50 kg live medic in February, assuming a high seedbank. If medic is germinating it is also likely that cereal grain in crop stubbles will germinate and produce feed. Measurements suggest that in years of average summer rainfall, cereal stubbles and weed growth are sufficient for ewes to maintain weight to the end of February in autumn-lambing flocks, and longer in later-lambing flocks.

In most years, live feed between February and June will be limiting sheep production, but wet summers such as 2000 can produce the levels of live pasture shown in Table 1. Pasture levels in paddock 1 in 2000 were adequate for autumn-lambing ewes not to require supplementary feeding. In paddock 2, most of the live plant was caltrop and heliotrope and grazing these is a health risk.

Table 1. The mean quantity (kg DM/ha) of total live biomass (non-toxic live in brackets) in two paddocks at Walpeup in 2000

Date	Paddock 1	Paddock 2
20 December	-	0 (0)
27 January	219 (207)	307 (11)
29 February	448 (218)	456 (0)
27 March	1654 (1348)	1177 (15)
02 May	1498 (1498)	390 (143)
29 May	2725 (1721)	683 (514)

5.3. Poisonous summer weeds

While summer weeds can provide quality feed for sheep, some plants create management problems. Caltrop and heliotrope are widespread in the Mallee and both cause large numbers of sheep deaths (Harris and Nowara 1995). Heliotrope increases the likelihood of sheep being adversely affected by other stressful conditions.

Caltrop is most toxic when in active growth, resulting in photosensitisation and possibly death. If seed set is not prevented, the spiny burrs from infestations can cause lameness and infection, particularly in young lambs because their hoofs are soft. This will result in reduced growth rates of lambs. Although the reduction in growth rates has not been measured, lambs recovering from photosensitisation or lameness were 7 kg lighter (38 compared with 45 kg) than the rest of the flock in March 2005. Paddocks with high burr numbers may restrict the number of paddocks available for grazing.

Other problem weeds:

- Health problems (if eaten in sufficient quantity);
  - portulaca, onion weed,
  - onion grass, stinkwort,
  - oxalis, phomopsis-affected lupin stubble.

- Wool contamination/skin damage or eye damage;
  - barley grass, silver grass,
  - some brome grasses, burrs on little woolly burr medic (trefoil).

6. Matching feed supply and demand

Key points
Matching feed supply to demand optimises feed utilisation and reduces the need for other feed sources.

Consider pasture growth rates, climatic variation in pasture supply, time of lambing, and stocking rates.

6.1. Pasture growth rates and sheep intake

Figure 8 shows the relationship between annual pasture growth rates in poor, average and good years (10, 50 and 90th percentiles) and pasture intake (kg DM/ha) for ewes lambing in April and July. Intake is calculated assuming pasture is 80 per cent digestible, ewes maintain maternal weight during pregnancy, and lambs grow at 200 g/day from birth to sale at six months of age at 41 kg liveweight. These ewes will lose about 5.5 kg during early lactation, and regain it during late lactation and after weaning. No milk is produced after 120 days lactation, and ewes are assumed to maintain liveweight.

During periods of feed deficit, ewes can be allowed either to lose weight, or be supplementary fed. However, excessive weight loss, particularly during late pregnancy, can result in high rates of ewe and lamb mortality. Feed deficits during lactation result in slower lamb growth, and ewes may fail to regain weight loss, reducing the potential lambing percentage in the following year. Wool production will also be reduced.

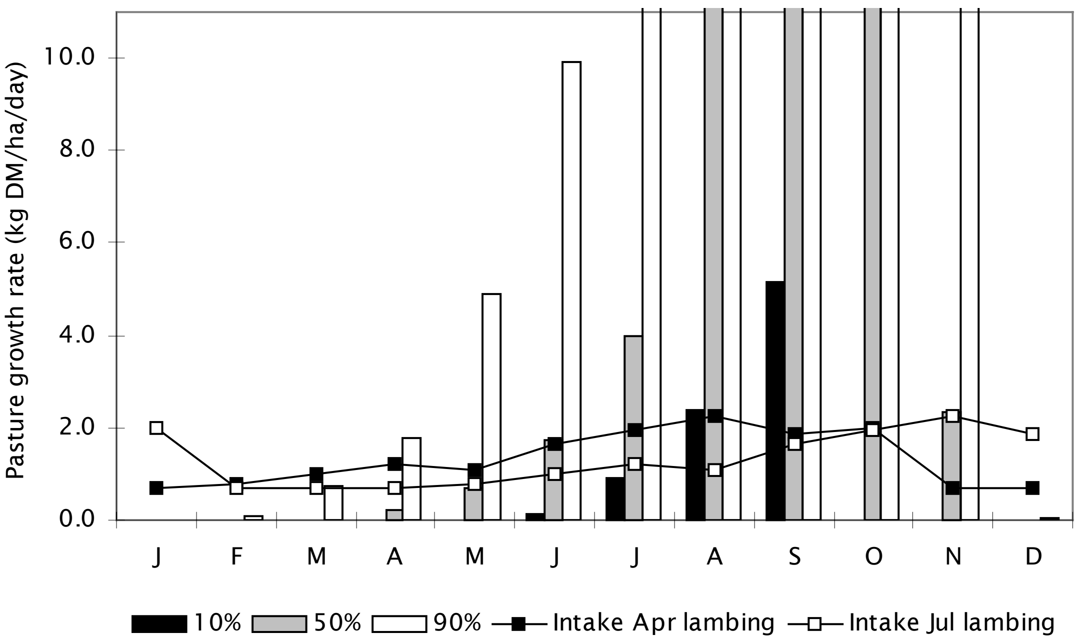
Figure 8*a* for Walpeup shows that for an average year for an average grassy pasture, at 1 ewe/ha feed demand exceeds pasture growth rates from December to May in April lambing flocks, but only to April in July lambing flocks. Feed supply of live pasture growth meets or exceeds feed demand for six to seven months of the year. A more productive pasture (Fig. 5) with higher growth rates in autumn would allow a higher stocking rate, or less supplementary feeding in autumn.

At Werrimull (Fig. 8*b*), an average year's pasture growth only meets demand by 1 ewe/ha in three to four months, between July and October for both lambing times. This suggests that 1 ewe/ha would be the maximum annual stocking rate possible for this type of enterprise grazing this type of pasture. A more productive pasture (Fig. 5) could meet demand for five to six months of the year, with much less supplementary feeding needed for autumn-lambing ewes. However, there is a higher risk of feed supply at Werrimull due to very low pasture production in poor years.

Pasture growth rates vary widely between different paddocks. Less productive paddocks than that used in these examples will require a lower potential stocking rate.

These examples show the importance of feed sources other than live pasture in summer/autumn. In the Mallee, crop stubbles and summer weeds are the main source of paddock feed over this period but they may not be adequate for lambs or late pregnant/lactating ewes.

a) Walpeup



b) Werrimull

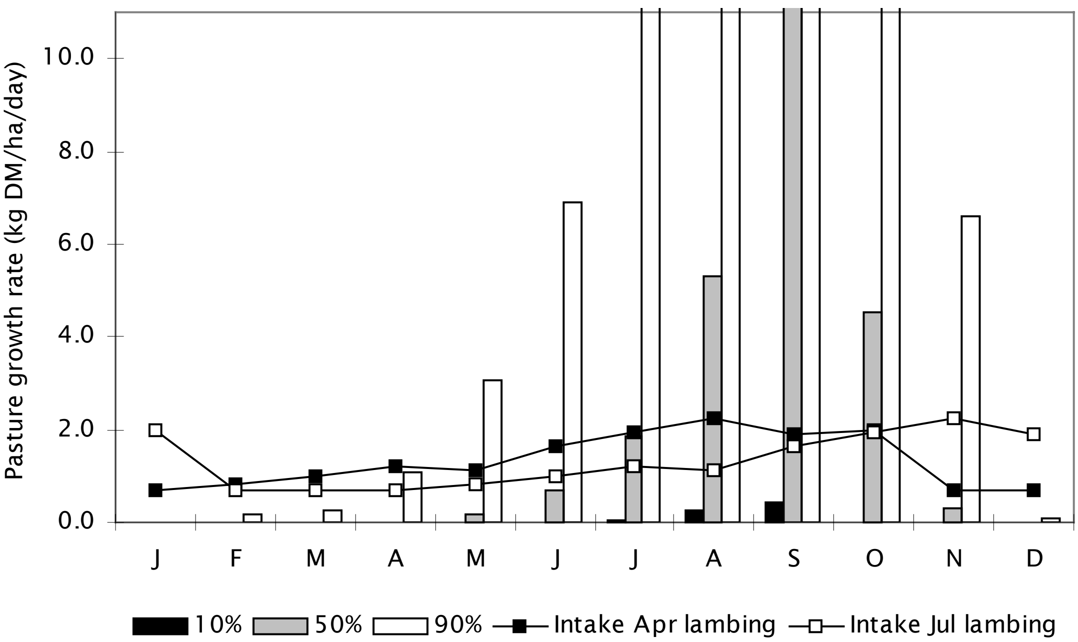


Figure 8. Estimated monthly growth rates (kg DM/ha.day) for a grassy medic pasture in poor, average and good years (10, 50 and 90th percentiles) at a) Walpeup and b) Werrimull and intake (kg DM/ha.day) of 80% digestibility pasture required by one April or July lambing ewe to maintain maternal weight in pregnancy and grow a single lamb at 200 g/day to 6 months of age (41 kg).

7. Seasonal variation in ewe and lamb weight

Key points
The weights of first cross lambs measured or estimated in good, average and poor years are shown.

High levels of supplementation may be required in poor years to achieve the lamb weights shown.

Lamb growth rates over summer were 100 g/day in an average year and more than 150 g/day in a wet summer, and largely depend on the quantity of live weed present. Lambs will need supplementing over summer if inadequate live weed or grain is present in crop stubbles.

Ewes are likely to maintain weight on crop stubbles between December and February in average years with some live weed available, but autumn-lambing ewes are likely to lose weight in late pregnancy without supplementary feeding.

Opportunity feeding of lambs and containment feeding of sheep may increase gross margins, depending on sheep and feed prices.

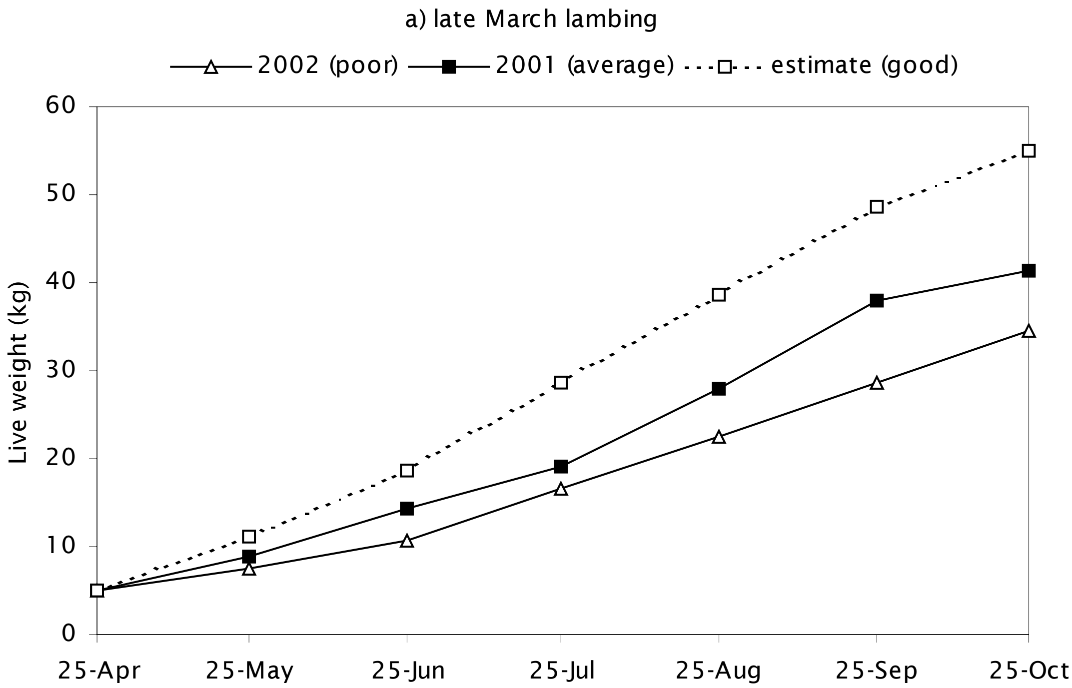
7.1. Estimated lamb weights
An understanding of likely lamb weights from a production system allows calculation of gross margins. Figure 9 shows the estimated liveweight of first cross lambs grazing dense annual pastures in poor (2002, 2004), average (2001) and good (2000) pasture years in the central Victorian Mallee. The estimates assume a stocking rate of about 2.0 to 2.5 ewes/uncropped ha, with supplementary feeding. These stocking rates will not be possible in lower rainfall regions without considerably more supplementary feeding, which may not be profitable, or on less productive pastures. Most estimates are based on data from different experiments, adjusted to the same lambing time, with weights at the end of October estimated. The weights are therefore a rough guide only. Actual weights will depend on the quality of pastures, genetics, management and stocking rates. If lambs grow at 250 g/day from birth, for a March lambing they will be about 55 kg in late October, or 38 kg from a late June lambing.

Figure 9 shows that in an average year, an autumn lambing may produce a lamb liveweight of about 41 kg in late October, while a June-born lamb may be about 34 kg (estimated, no data available).

For a poor year, the October weight of 35 kg for an autumn-born first cross lamb is based on the extreme drought of 2002, when lambs were fed grain from 6 August until sale in October. If grain had not been fed, weights in October would have been much lower. For a late June lambing in a poor year, weights are based on 2004 data, where drought forced the sale of some ewes in August, reducing the stocking rate from 3.0 to 0.7 ewes/ha. This allowed a larger quantity of live pasture to grow in spring than is likely at 2 ewes/ha in a poor year. 2004 was unusual in that live pasture was available into January, which allowed much higher lamb growth rates in October than could be expected in a poor year.

No data was available for March born lambs in a good year, so estimates are shown. In 2000, June born lambs grew well in winter but growth rates declined in September.

On the same type of feed, pure Merino lambs will not grow as fast as first or second cross lambs and will be lighter at the same age.



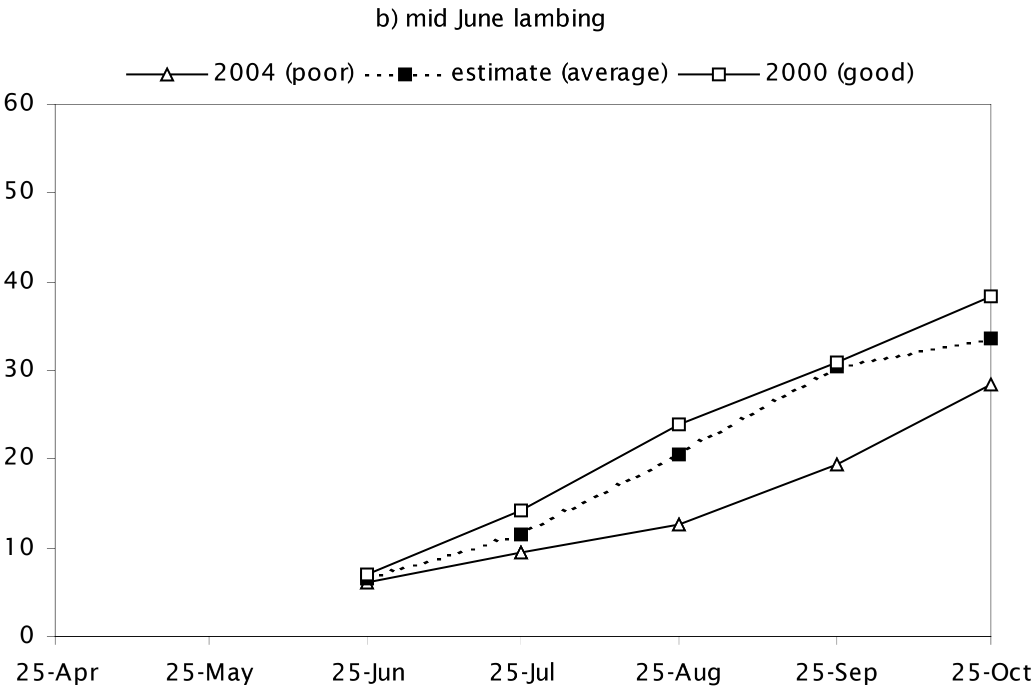


Figure 9. Estimated average liveweights (kg) of Merino x terminal sire lambs in poor, average and good years in the central Victorian Mallee for a) late March and b) mid June lambing times. Dotted line estimated, other lines calculated from real data corrected to the same lambing date at approximately 2 ewes/uncropped ha on better than average pastures.

The supplementary feeding required to achieve the weights in Figure 9 is estimated in Table 2, based on a stocking rate of approximately 2 ewes/ha. Actual feeding levels and lamb weights achieved will vary depending on stocking rate and pasture growth. Autumn-lambing ewes require more feeding because less pasture is available at lambing time when adequate nutrition is critical.

At lower stocking rates, supplement may only be required in poor years. For example, in 2002, at 1 ewe/ha and feeding 50 kg grain, March-born lambs could achieve 36 kg by late October. In average and good years, less feed is required to achieve a similar lamb weight if stocking at 1 compared with 2 ewes/ha, but fewer lambs will be produced per hectare.

Table 2. Estimated grain feeding (kg) at 2 ewes/ha in poor, average and good seasons in the central Victorian Mallee (not including grain to supplement lambs in summer)

		Season	
	Poor	**Averag e**	**Good**
Autumn lambing	131	40	15
June/July lambing	63	15	0

There is insufficient data to provide estimates of lamb weights and feeding in the drier northern Mallee, although on good pastures with some feeding, 1 ewe/ha may be able to be carried in an average year.

7.2. Lamb growth rates over summer

Financial gain from retaining crossbred lambs over summer, rather than selling them earlier, depends upon an increase in weight and/or an increase in lamb value/kg. Additional feed and shearing costs also need to be accounted for. Crop stubbles and summer weed growth provide opportunities for sheep or lamb finishing systems as an alternative to lamb breeding enterprises, at least in some seasons. Merino lambs kept as replacements need to at least be gaining weight slowly over summer to avoid health problems.

Lamb growth rates over summer are dependent upon grain or live weed in stubble, or supplementary feeding, unless perennial pastures are available. The quantity of grain remaining in cereal stubbles after harvest is generally low, and lambs are not as adept at finding it as adult sheep. Pulse stubbles often contain high quantities of grain (200 to 400 kg/ha) but care needs to be taken to remove sheep before the soil surface becomes powdery and prone to wind erosion.

The growth rate of lambs was measured over summer in 2001 and 2004 at Walpeup. In average summers with little live weed (between November 2001 and April 2002, and January and March 2005) First cross lambs grazing cereal stubble/pasture gained about 100 g/day. In a wet summer (2004/2005), lambs grew at 150 g/day, although growth rates were up to 240 g/day for paddocks with a higher quantity of live weed. Table 3 shows that in a wet summer with a lot of live feed (up to 300 kg DM/ha), lambs grazing lupin or pea stubbles did not grow faster than lambs on pasture or cereal stubble, however, they were carried at a higher stocking rate. In most years, pulse stubbles, while grain remains, will produce much higher lamb growth rates than dead pasture or cereal stubbles. Lupin stubbles may only be safe to graze for a short time, or not at all, in wet summers due to the risk of lupinosis.

In poor years or if weeds are controlled in cereal stubbles over summer, crossbred lambs may only maintain weight, and are likely to lose weight once any remaining grain has been eaten. Unacceptable death rates of lambs may occur on dead pasture/stubble if adequate nutrition is not provided. Lambs should be monitored and provided with supplementary feed with adequate protein (minimum 12%) and energy if paddock feed is inadequate.

Table 3. Liveweights (kg) of July-born Merino x White Suffolk lambs grazing different feeds in summer 2004/05

	Lambs/ha	22 Nov.	8 Dec.	6 Jan.
Medic pasture	2	32	33	40
Lupin/pea stubbles	5.4	33	35	39
Cereal stubble	2	32	33	39

7.3. Ewe weight change over summer

The energy and protein requirements of unmated or early pregnant ewes are lower than that of growing lambs (minimum 9% protein for ewes, 12% for lambs), and ewes will maintain weight feed of lower nutritive value during summer. However, for autumn-lambing flocks, the feed requirements of ewes increase markedly during late pregnancy. Excessive weight loss during late pregnancy may lead to pregnancy toxaemia and death. Ewes in poor condition at lambing have poorer mothering ability and in turn lower rates of lamb survival. They also produce less milk, meaning lambs will not grow as fast as lambs from well-fed ewes in the first few weeks after birth. They may also produce wool of lower staple strength than better-fed ewes.

Ewe weight change over summer is dependent upon grain or live weed in stubble, or supplementary feeding. On-farm measurements in the Mallee show that ewes can gain weight rapidly in wet summers, and are likely to maintain weight in average years until the end of February with no supplementary feeding if some live weed is available (Fig. 10). In this example, skeleton weed was the main live weed in average years. Unmated ewes or ewes in early to mid pregnancy may maintain weight until the seasonal break in average years. However, if it is assumed that liveweights increase by 5 to 10 kg with foetal weight in the last six weeks of pregnancy, Figure 10 shows the maternal weight of ewes (excluding the weight of the foetus) declined in late pregnancy for autumn-lambing ewes, with substantial weight loss during lactation in average and poor years.

Variation between paddocks may be as large as variation between years. Over February/March 2005, the weight gain of ewes in different paddocks at Walpeup ranged from 56 to 235 g/day, due to variation in the quantity of live weed. Actual weight changes will vary between farms and ewes should be monitored to prevent excessive weight loss, particularly in autumn-lambing flocks.

While desirable for sheep, the impact of weed growth over summer on subsequent crop production should also be considered. The quantity of stubble and heavy grazing of these can lead to soil erosion. It is preferable to remove sheep under these conditions. Options include feeding in containment areas, agistment or sale.

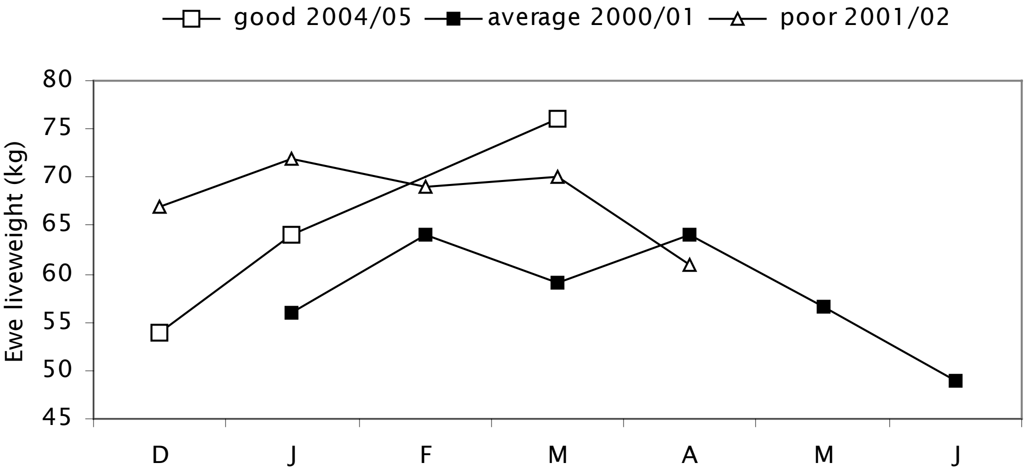


Figure 10. Liveweight (kg) of ewes in the central Victorian Mallee over summer/autumn in good (2004/2005), average (2000/2001) and poor (2001/2002) seasons. Ewes lambed in April 2001, May 2002 and July 2005. Ewes were supplemented from May 2001, and April 2002, with no supplementary feeding in 2005.

7.4. Opportunity feeding of lambs and containment areas

When paddock feed runs out, it may still be profitable to feed both Merino and crossbred lambs grain to increase weights before sale. However, the profitability of doing this depends on the difference between the value of lamb before and after feeding, and the cost of feed (Table 4). If premiums are available for heavier weights, positive returns are more likely. Contracts can reduce the risk of declining lamb values during the feeding period. The average feed conversion ratio for lot feeding is 7:1 (7 kg feed results in 1 kg of liveweight gain), although it will be less in Merino compared with crossbred lambs. Where paddock feed provides some nutrition, less grain feed will be required to achieve the same liveweight gain and it is more likely to be profitable to feed lambs.

Table 4. Calculating financial returns from feeding lambs to increase liveweight by 10 kg, assuming no paddock feed is available

Estimate current value of lamb	Initial lamb liveweight (kg)	30	35	40
	Dressing %	46	46	46
	Carcase weight (kg)	13.8	16.1	18.4
	Value (c/kg carcase wt)	300	300	300
	Value per carcase ($)	41.40	48.30	55.20
Estimate future value of lamb (10 kg liveweight heavier)	Future lamb liveweight (kg)	40	45	50
	Dressing %	46	46	46
	Carcase weight (kg)	18.4	20.7	23
	Possible carcase value ($)			
	@200 c/kg	36.80	41.40	46.00
	@300 c/kg	55.20	62.10	69.00
	@400 c/kg	73.60	82.80	92.00
Increase in carcase weight (kg)		4.6	4.6	4.6
Cost of feeding to achieve weight gain	$ per lamb 70 kg @ $200/t; conversion ratio 7:1	14.00	14.00	14.00
Financial gain from feeding* (Future carcase value - feed costs - current carcase value)	$ per lamb			
	@ 200 c/kg carcase	-18.60	-20.90	-23.20
	@ 300 c/kg carcase	-0.20	-0.20	-0.20
	@ 400 c/kg carcase	18.20	20.50	22.80

*Cost of feeding figures do not include allowances for lamb mortality, cost of shearing, labour or capital items required in order to feed. Also, financial gain does not consider opportunity costs of investing income from early sale of lambs. Skin values are not included.

Sheep can be maintained during drought or seasonal deficiencies in containment areas. During seasonal feed shortages, it may be more efficient to use containment areas rather than paddock feeding, with the added benefit that paddocks are not eroded and pastures are not damaged. Containment areas reduce feed requirements by preventing sheep wasting energy walking to search for feed. However, the profitability of using containment areas over the longer term in drought depends on feed and sheep prices.

Table 5 shows that in the drought of 2002 when sheep were fed in a containment area for part of the year, feeding gave positive returns unless feed was expensive and the value of lamb low. These returns assume no ewes were sold and no replacement ewes were purchased. The losses due to feeding sheep may be less than the loss if ewes were sold pre-lambing and replacements bought in post-drought at high prices, but will vary depending on lamb values and the difference between sale and purchase price.

Table 5. Gross margins ($/uncropped ha) during a drought at different lamb values and feed prices for a Merino x terminal sire enterprise

	Gross margin $/uncropped ha		
	Cost of feed $/ewe		
	15 (@ $100/t)	30 (@ $200/t)	45 (@ $300/t)
Net value lamb @ 100c/kg $11.50	11	-4	-20
@ 200c/kg $24.00	24	9	-6
@ 300c/kg $35.50	37	22	7

Assumes no replacement ewes are purchased. Data from DPI Walpeup 2002: 2 ewes/uncropped ha. Ewes lambed on 6 May (94% lambs marked). Ewes were fed 0.5 kg/day cereal hay 6 May to 10 Jul; 0.4 kg/day grain 2 April to 10 Jul; 0.4 kg/day 6 Aug to 20 December. Lambs were weaned early (6 August) at 21 kg liveweight and fed 0.5 kg/day grain until sale in September. During feeding, lambs grew at 180 g/day and were 31 kg (13.3 kg carcase weight assumed) at the end of September. In total 150 kg feed/ewe was required. The net value of wool was assumed to be $15/ewe.

8. Fitting sheep into a cropping system

Key points
Fallowing reduces feed production directly and by reducing plant density in regenerating pastures. This cost has to be weighed against benefits to the cropping enterprise.

Pastures and grazing can provide benefits to subsequent crops – increased nitrogen, weed and disease breaks.

8.1. Fallowing and feed production
Fallowing is widely used in the Mallee and reduces the feed supply to sheep, through an immediate effect, and also by preventing seed set and therefore reducing potential pasture production.

The impact of pasture density, grass cleaning, or chemical fallowing on lamb weights was measured in 2004 (Table 6). Three paddocks were initially grazed at the same stocking rate of 3 ewes/ha, with ewes lambing in July.

In 2004, lambs grazing on a grassy medic, ineffectively grass-cleaned in late August, were a similar weight to lambs produced on a dense medic pasture. However, ewes and lambs on the grassy medic needed much less grain feeding. If the density of medic had been low, and grass-cleaning effective and applied earlier, pasture production would have been reduced and therefore resulting in lower lamb weights. The low-density grassy pasture was unable to produce enough feed to support the ewes and lambs after chemical fallowing in August. This management only produced a similar lamb weight to the dense medic pastures because the sheep were moved to a paddock of oats/barley grass. However, the lamb growth rates were possibly reduced by the maturing grass and the barley grass seeds irritating the lambs.

Table 6. Liveweight (kg) of July-born first cross lambs grazing different pastures in 2004 and the quantity of grain fed to ewes and lambs

	17 Aug.	14 Sep.	12 Oct.	Kg Grain Fed
Dense medic	10	16	25	54
Dense grass-cleaned medic	11	18	27	19
Low density annuals, chemical fallow August[A]	11	18	23	57

[A]Between 17 August and 14 September, 17% of area was rye. The sheep were removed to oats on 14 September.

The direct impact of long fallowing on feed supply for sheep varies with the rotation, type (mechanical or chemical) and timing of fallowing.

The stocking rates possible and lamb growth rates will depend on the degree of weed control. Complete weed control with mechanical fallowing will prevent sheep being grazed. However, low numbers of sheep may be useful to help control weeds on fallow paddocks Lamb growth rates may be reduced to less than 100 g/day after chemical fallowing, resulting in October weights 10 kg less than for lambs grazing live pastures.

The indirect impact of fallowing on feed supply through lower density pastures may be substantial, reducing the potential stocking rate. The annual medic seedbank may be reduced by up to 50 per cent per year of fallow or crop, depending on the hardseededness of the variety. The effect on grasses is less clear.

8.2. Effects on crop production

Pasture or fallow management and grazing can affect crop production in the following year through effects on soil water, crop diseases, weed densities and nitrogen supply. The economic returns of whole rotations should be considered when determining the profitability of different farming systems – not just crop yields. Analysis also needs to consider seasonal variation.

The grazing of pastures and stocking rate can effect wheat yields and protein content of grain in the subsequent crop:

- Grazing can increase nitrogen supply to crops, with the potential to increase yields and grain protein content. However, the effect of grazing on crop yields depends on the seasonal conditions under which the crop grows. Increased nitrogen supply to crops due to grazing may result in greater herbage production, creating a greater risk of water stress during grain filling, which can result in lower grain yields (Baldock *et al*. 1998);
- Grazing at high stocking rates, compared with low stocking rates, can increase wheat yields by 0.6 t/ha in an average rainfall year, due to better weed control (Latta & Carter 1998). Responses in crop yields are likely to depend on seasonal conditions. Increasing the density of annual medic pastures reduces the density of both winter and summer-growing weeds (Williams & Vallance 1982). This can reduce the cost of weed control. Lucerne pastures reduce the density of summer weeds more than annual pastures due to competition.

Pastures allow the use of non-chemical weed control methods such as grazing, slashing or cultivation. Herbicide resistance is an increasing problem for cropping systems.

9. Economic analyses

Key points
Stocking rate is a key driver of gross margin returns from sheep enterprises. Extra production in average and good years can outweigh extra feeding costs in poor seasons, but depends on sheep and feed values.

Pasture/wheat rotations may produce similar gross margins to fallow/wheat rotations, providing the pasture/sheep enterprise is highly productive.

9.1. Assumptions for gross margins

The example gross margins shown should be used as a guide only. The production assumptions used are estimates, and relative gross margins may change if production differs.

Gross margins have been calculated based on the 2000-2004 production data in the central Victorian Mallee or estimates where data was not available, using a range of values for lamb (Table 7). These are a guide only and performance on individual farms will vary with pasture production and management. Optimal stocking rate will be lower in regions of lower rainfall.

Assumptions used in gross margins (an example is shown in Appendix 1):

- The pastures are assumed to be productive and not long-fallowed;
- 90% lambing;
- All lambs sold in October (March lambing) or February (June lambing) (100g/day lamb growth over summer assumed for June lambing, no grain feeding over summer);
- Merino ewe wool $7/kg clean, 60% yield;
- Supplementary feed $200/t;
- Ewe values vary with lamb value;
  lamb 200c/kg carcase weight - replacement ewes cost $40, cast for age ewes $20,
  lamb 300c/kg carcase weight - replacement ewes cost $60, cast for age ewes $30,
  lamb 400c/kg carcase weight - replacement ewes cost $100, cast for age ewes $50.

Table 7. Estimated first cross lamb weights, supplementary feed and wool produced in good, average and poor seasons at 2 stocking rates and lambing times in the central Victorian Mallee

		March Lambing		**June Lambing**
Season		**1 ewe/ha**	**2 ewes/ha**	**2 ewes/ha**
Good	Lamb weight (kg)	55	55	50.3
Average		41	41	45.5
Poor		35	35	40.5
Good	Grain (kg)	0	15	0
Average		17	40	15
Poor		55	131	63
Good	Ewes wool (kg greasy)	6.5	6.5	6.5
Average		6	6	6
Poor		5	5	5

9.2. Stocking rate comparison

The gross margins suggest stocking at 2 ewes/uncropped ha at Walpeup for late March lambing ewes will produce much higher returns than stocking at 1 ewe/ha, despite high levels of supplementary feeding (Fig. 11). The advantage of the higher stocking rate increases as lamb values increase. However, in poor years the higher cost of feeding results in a lower return if lamb prices are low (200 c/kg), and only a slightly higher return if lamb prices are high (400 c/kg). If feed prices increased or the value of cull sheep declined, the high stocking rate could result in negative gross margins in poor years.

The optimum stocking rate will vary between regions, but will be more closely dependent on the level of pasture production on individual farms. Higher than optimum stocking rates can lead to high feeding costs, lower ewe weights, lower lambing rates, and lower lamb weights, so that gross margins per ha could decline. Low stocking rates lead to higher per head production and lower feed costs, but per ha returns remain low.

Strategies to increase lamb marking percentages or lamb weights, both of which are key factors in gross returns, may not result in higher gross margins/ha if they are costly to achieve (eg high feed costs). The challenge is to find the optimum management for each farm and feed base.

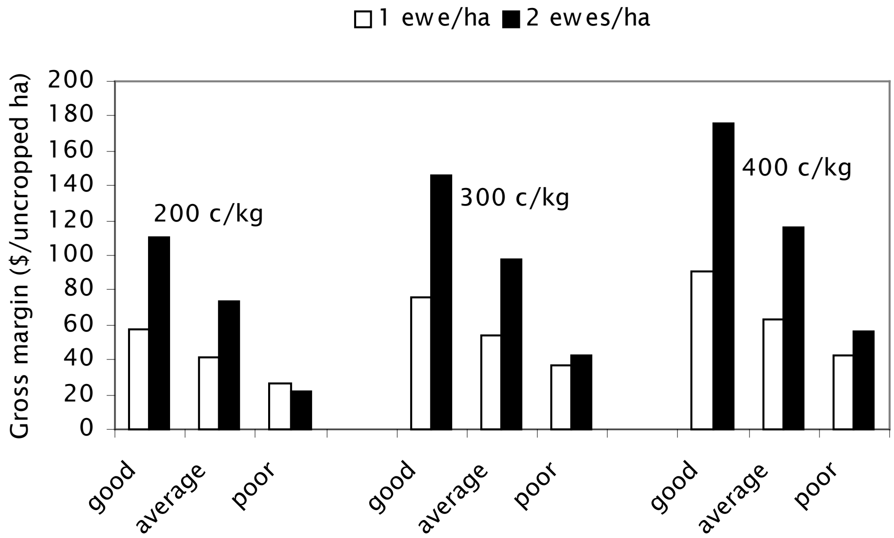


Figure 11. Estimated gross margins ($/uncropped ha) for a Merino x terminal sire enterprise in the central Victorian Mallee stocked at 1 or 2 ewes/uncropped ha in different seasons and different lamb values (c/kg carcase weight).

9.3. Lambing time comparison

Figure 12 shows that there may be little difference in gross margin returns between March and June lambing if the same lamb marking percentage is assumed. In poor years, returns were higher for the June lambing due to lower feed costs and higher lamb weight. Returns were still higher for the June lambing if feed costs were similar to the March lambing. However, if June-born lambs had to be supplementary fed over summer, the returns may differ.

In good years, the March lambing produced higher returns. However, this was due to heavier lamb weights, and if June born lambs grew faster than assumed over summer or were kept longer, and were sold at a heavier weight, the returns may differ. In addition, the June lambing may result in a higher lambing percentage, increasing returns. Any impact of variation in price between months when sheep are sold should also be considered when calculating returns.

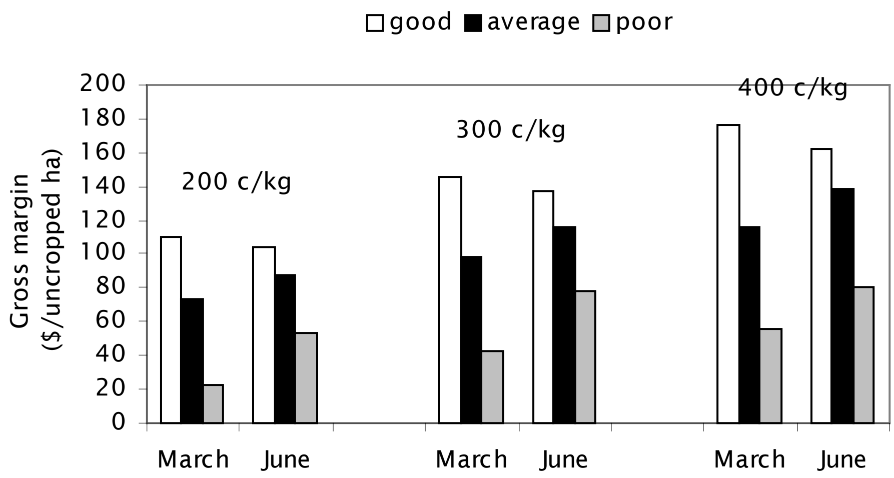


Figure 12. Estimated gross margins ($/uncropped ha) for a Merino x terminal sire enterprise in the central Victorian Mallee stocked at 2 ewes/uncropped ha lambing in March or June, in different seasons and different lamb values (c/kg carcase weight) (90% lambs marked/ewe joined).

9.4. Comparison of rotations

Gross margin analyses do not include overhead costs (machinery, sheds, fencing, and business costs not directly attributed to an enterprise) and so do not indicate farm profit. The gross margin returns from cropping can be much higher than for sheep in average and good years, but losses are also high in poor seasons. The effects on cash flow in individual years may be important.

Wheat yields from experiments at Walpeup were used to compare two rotations (Table 8*a* & *b*). Wheat values are assumed to be similar for the two rotations although differences in protein and quality may occur. Annual pasture production was not reported and the experiment was not grazed, so it was assumed 2 ewes/uncropped ha were carried on the pasture/wheat rotation. Fallows were commenced in August and it is assumed no sheep were carried in a fallow/wheat rotation, although there is opportunity for summer/autumn grazing, and low stocking rates could be carried, particularly if one paddock on the farm was left as pasture in spring.

Wheat freight and charges are assumed to be $55/t. Wheat production costs (including pasture or fallow) are assumed to be $100/ha for fallow rotations (Hall 2001), and $93/ha for the pasture/wheat rotation. Pastures are regenerating, with the cost of establishment spread over many years and selective herbicide used to control grasses. The gross margins for the autumn-lambing sheep enterprise were taken from Figure 8.

Table 8a. Wheat yields (t/ha) for 2 rotations at Walpeup

Season	Year	Growing Season Rainfall (mm)	Fallow/Wheat (t/ha)	Pasture/Wheat (t/ha)
Average	1985	181	1.9	1.6
Good	1986	281	3.3	2.9
Average	1987	187	1.8	1.5
Average	1988	221	2.2	1.7
Average	1989	177	2.7	2.3
Poor	2004	135	0.7	0.1
		Average	**2.1**	**1.7**

Data based on Incerti *et al* (1993); Robertson and Latta (2004). Wheat yields in 1985 are adjusted for the difference in soil water to reflect the use of cereal cyst nematode resistant varieties.

Table 8b. Estimated gross margins ($/whole-farm ha) for 2 rotations using different stocking rates at different wheat ($/t on-farm) and lamb values, for an average over 6 seasons, a good year and a drought year

Average over 6 years

	Fallow/Wheat (2.1 t/ha) Ewes/fallow ha				Pasture/Wheat (1.7 t/ha) Ewes/pasture ha					
	0	0.5	**0.5**	0.5	1	**1**	1	2	**2**	2
Wheat $/t gross		Lamb value c/kg carcase weight								
		200	300	400	200	300	400	200	300	400
150	**50**	60	**64**	66	55	**62**	67	70	**83**	93
175	**76**	86	**90**	92	76	**83**	88	91	**104**	114
200	**102**	112	**116**	118	98	**105**	109	113	**126**	135

Good year

	Fallow/Wheat (3.3 t/ha) Ewes/fallow ha				Pasture/Wheat (2.9 t/ha) Ewes/pasture ha					
	0	0.5	**0.5**	0.5	1	**1**	1	2	**2**	2
Wheat $/t gross		Lamb value c/kg carcase weight								
		200	300	400	200	300	400	200	300	400
150	**107**	121	**126**	130	117	**126**	133	143	**161**	176
175	**148**	163	**167**	171	153	**162**	170	179	**197**	212
200	**189**	204	**208**	212	189	**198**	206	215	**233**	248

Drought year

	Fallow/Wheat (0.7 t/ha) Ewes/fallow ha				Pasture/Wheat (0.1 t/ha) Ewes/pasture ha					
	0	0.5	**0.5**	0.5	1	**1**	1	2	**2**	2
Wheat $/t gross		Lamb value c/kg carcase weight								
		200	300	400	200	300	400	200	300	400
150	**-17**	-10	**-7**	-5	-32	**-27**	-24	-34	**-24**	-17
175	**-8**	-2	**2**	4	-31	**-26**	-23	-33	**-23**	-16
200	**1**	7	**10**	12	-30	**-24**	-21	-32	**-21**	-15

Table 8*a* suggests pasture/wheat rotations can give similar or better average returns to fallow/wheat at current sheep prices. The differences in returns depend on the relative prices for wheat and prime lamb, and utilisation of the pasture. If the stocking rate for pasture/fallow was only one ewe per uncropped hectare, the difference between the rotations was much smaller. Even if fallow produces large increases in grain yield in low rainfall years, over the longer term the reduction in crop yields in pasture/wheat rotations can be balanced by returns from pasture. **However, the relative returns from sheep and crop production are critical in determining the relative gross margins of the two rotations.**

The gross margins for good and drought years show how the performance of rotations differs in extreme years. In good years, there was little difference in wheat yields between the two rotations, and returns from sheep at high stocking rates were large. The gross margin of a wheat crop was much higher than for livestock, but if half the land area is in fallow and producing low returns, the whole rotation gross margin was much higher for the pasture/wheat rotation if high stocking rates are used. Returns could be increased if it was possible to predict good seasons at sowing time, and increase the area of crop sown.

In drought years, the pasture/wheat rotation produced lower gross margins than the fallow wheat due to a lower wheat yield and because of higher feeding costs with increasing stocking rates. However, in the fallow/wheat rotation, including low numbers of sheep resulted in better returns than if no sheep were produced.

Apart from financial benefits, the use of pasture reduces the risk of soil erosion and ground-water recharge.

Alternatives:

- If a low stocking rate of 0.5 ewes/ha could be supported in the fallow/wheat rotation, this rotation could produce similar average returns to the pasture/wheat rotation carrying 2 ewes/ha if lamb values were low, but still produces lower returns if lamb prices were 300c/kg or better;
- Even if sheep could not be carried year round in a fallow/wheat rotation, agistment or sheep trading systems can increase returns from uncropped land. Returns can be calculated based on likely sheep growth rates or experience. However, trading systems include a risk of a decline in sheep values between when they are bought and when sold. Contracts may reduce this risk;
- The current gross margins from Merino self-replacing sheep flocks are likely to be lower than for the Merino x terminal sire flock examples used. When meat prices are high, and wool prices low, gross margins in self-replacing Merino flocks may be increased by mating the oldest ewes to terminal sires, increasing the proportion of ewes in the flock to increase stock sold, or growing Merino wether lambs to a suitable sale weight and selling them. Merino lambs are capable of growing at 300 g/day if pastures are adequate;
- The gross margins for any sheep enterprise can be calculated for comparison using the example in Appendix 1 as a guide. The major factors that vary between enterprises are cost and number of replacement sheep, lamb-marking percentage (sheep and lambs sold), number and value of sale sheep (weight and price), and wool production and value. Other factors to consider are market risks (variation in price for meat and wool, closure of markets), ability of the feed base to support production, labour requirements and compatibility with cropping systems.

10. Optimising production from the feed base on mixed farms

There is a large potential to increase returns on mixed farms in the Mallee through greater utilisation of the feed supply. Factors to consider are:

- Choice of livestock enterprise;
- Optimise stocking rate – stocking rate is the key driver of returns in all sheep enterprises;
- Consider seasonal opportunities for carryover lambs; sheep finishing on stubbles – calculate whether these options increase returns, and whether the financial risk is acceptable;
- Good seasons create opportunities to sell at heavier weights, sheep or lamb trading, or to graze sheep on less area while increasing cropping;
- Optimise pastures to suit crop rotations.

Further research required

- Comparison of the feeding levels and lamb weights at different stocking rates in different farming systems in the Mallee region to validate the estimates used here.
- The production and economic benefit of alternative pasture and fodder crops as part of a livestock/cropping system.
- To define the effect of different fallow/rotations on pasture and potential sheep production as well as subsequent crop production.

References

Baldock JA, Moore AD, Bellotti WD and Yunusa I (1998) Influence of grazing on nitrogen and water dynamics in cereal-pasture rotation. Proceedings of the 9th Australian Agronomy Conference, Wagga Wagga. pp. 859-860. (Australian Society of Agronomy: Wagga Wagga)

Hall N (2001) Mallee Gross Margins 2001-2002. (Department of Natural Resources and Environment, Victoria).

Harris DJ, Nowara G (1995) The characteristics and causes of sheep losses in the Victorian Mallee. *Australian Veterinary Journal* **72,** 331-340.

Incerti M, Sale PWG, O'Leary GJ (1993) Cropping practices in the Victorian Mallee 2. Effect of long fallows on the water economy and the yield of wheat. *Australian Journal of Experimental Agriculture* **33**, 885-894.

Latta RA and Carter ED (1998) Increasing production of an annual medic-wheat rotation by grazing and grass removal with herbicides in the Victorian Mallee. *Australian Journal of Experimental Agriculture 38*, 211-217.

Robertson S and Latta R (2004) Final report RMP project 4.18 Farming systems to reduce recharge (Primary Industries Research Victoria, Walpeup)

Williams CMJ and Vallance NA (1982) New medic pasture systems to increase production in pasture/cereal rotations in the Victorian Mallee. Proceedings of the 2nd Australian Agronomy Conference, Wagga Wagga. p. 317. (Australian Society of Agronomy: Wagga Wagga).

Appendix 1. Example gross margin for 1000 ewe flock, average rainfall year

White Suffolk over Merino ewe
Replacements purchased each year to maintain 1000 breeding ewes
March lambing 90% lambs marked/ewe joined
Lambs sold October 19 kg carcase weight @ $4/kg, skin value $10
Wool 700 c/kg clean — Ewe mortality 6%/year
Lamb mortality 4%/year — Rams joined to ewes: 2%

		Unit/Dose	$/Unit	No. Sheep	$ Value/hd	Total $
Income						
Wool	ewes	3.6	7	942	23.18	21839.33
	rams	2	5.24	20	9.64	192.83
	lambs	0	0	0	0.00	0.00
Crutchings	ewes	0.14	2	1000	0.28	280.00
	rams	0.14	0	0	0.00	0.00
	lambs	0	0	0	0.00	0.00
Sheep						
	lambs			882	86	75852.00
	cfa ewe			214	50.00	10700.00
	cfa ram			4	50.00	200.00
			total	1100		
TOTAL INCOME						109064.16
Costs						
Buy stock	rams			6	400.00	2400.00
	ewes			270	100.00	27000.00
Shearing	ewes			970	4.00	3880.00
	rams			20	8.00	160.00
Crutch	ewes			1000	0.60	600.00
	lamb			882	0.60	529.20
	rams			20	1.20	24.00
Vaccine	ewes			1000	0.16	160.00
	rams			20	0.16	3.20
	lambs	x 2		900	0.32	288.00
Lice and fly	ewes			1000	0.30	300.00
	rams			20	0.30	6.00
	lambs			0	0.30	0.00
Drench	ewes			1002	0.12	120.24
	rams			20	0.12	2.40
	lambs			900	0.12	108.00
Ram brucellosis	rams			20	7.00	140.00
Freight	selling			1100	1.00	1100.00
Supplement feed	ewes			1000	8.00	8000.00
	lambs			0	0.00	0.00
Wool selling cost 22c/kg clean						785.66
Wool tax 2%						446.24
Stock selling cost 6%						4771.36
TOTAL COSTS						50824.31
GROSS MARGIN						58239.85
Gross margin/ewe						**58.12**
Gross margin/ha @ 2 ewes/uncropped ha						**116.24**