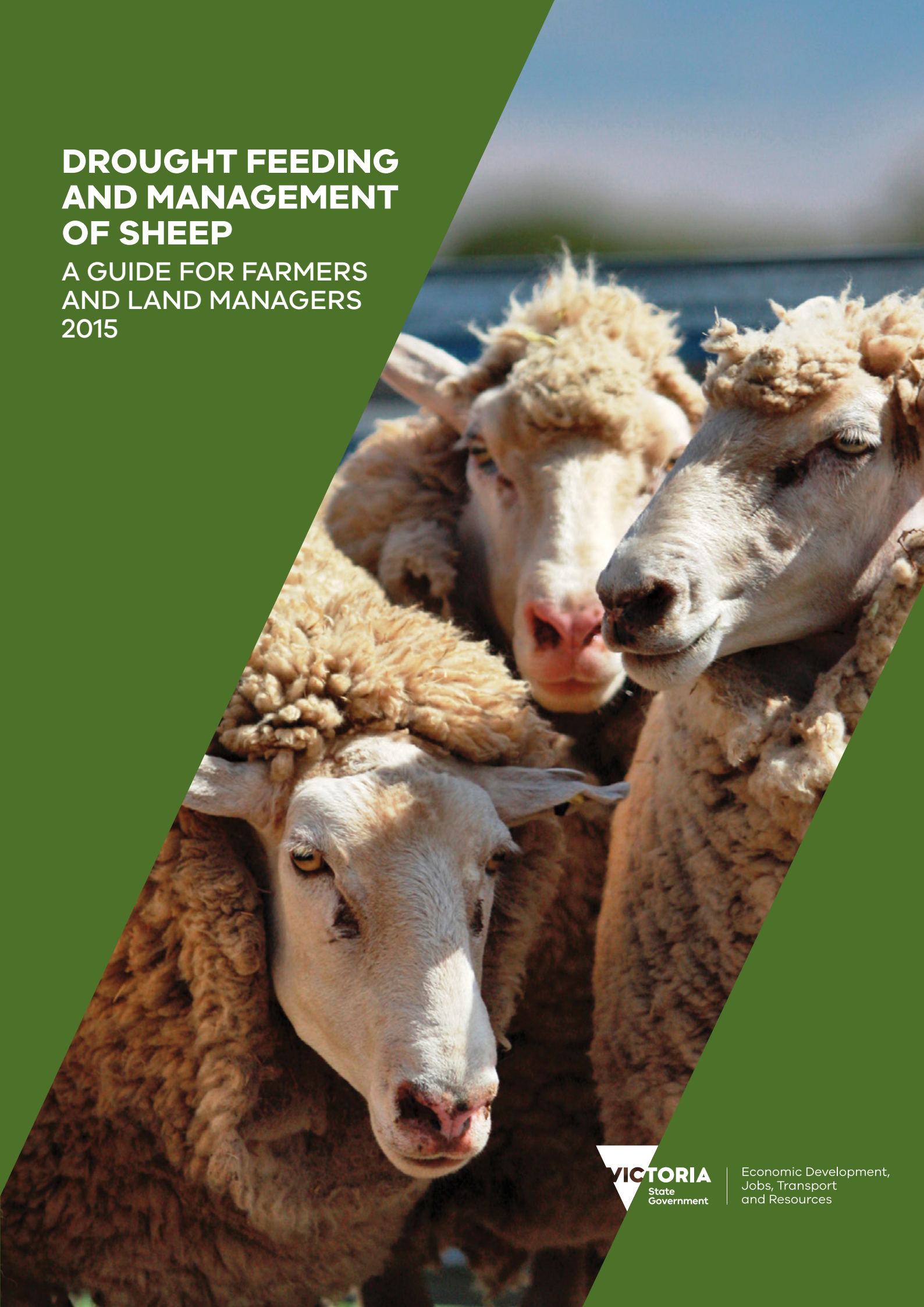
DROUGHT FEEDING AND MANAGEMENT OF SHEEP

A GUIDE FOR FARMERS AND LAND MANAGERS 2015



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Edited by Jane Court

CONTENTS

Acknowledgments 1
Glossary of abbreviations 1
Introduction 2
Key Messages 2
Chapter 1 3
Preparing a Drought Action Plan 3
Introduction 3
Important questions to ask 3
Environmental impact of your plan 4
Tips from past droughts 4
Effect on you and your family 4
Management options 4
Other management decisions 6
Chapter 2 7
Setting targets 7
Assessing fat reserves of sheep 7
Targets for sheep 9
Chapter 3 12
Feeding sheep during a drought 12
Total energy and protein requirements 12
Feed supplied from pasture and crop residues 14
Choosing a supplementary feed 15
Other nutritional requirements 16
How much to feed 19
Total feeding costs 20
Other considerations 22
Water requirements 22
Chapter 4 26
Managing sheep during a drought 26
When to start 26
Introducing sheep to hand-feeding 27
Feeding frequency 27
Managing and monitoring 28
Breaking routine or changing feed 28
Deciding when to stop feeding 28
Chapter 5 29
Feeding in stock containment areas 29
Site 30
Structure 30
Water 30
Feed 30
Management 31
Releasing sheep 31
Growers' Experiences 31
Animal health 32
General 32
Case Studies – Stock containment areas 33

Chapter 6 **37**
Sheep health **37**
Most common diseases 37
Less common diseases 38
Animal welfare 40
Chapter 7 **41**
The feed value of unusual feedstuffs **41**
High moisture content feeds 42
Blending and levels of feeding 42
Types of feeds 42
Chapter 8. **48**
Other online resources: **48**
Water 48
Livestock 48
Appendix 1: **50**
Use of Firearm and Captive-bolt Stunner (Pistol): Recommended Position and Direction for the euthanasia of sheep **50**
1. Using a firearm 50
2. Using a captive bolt stunner 50

List of Tables

Table 1 – Condition scores and what to feel **8**
Table 2 – Target weights for weaners **9**
Table 3 – Estimated costs of feeding for more lambs **10**
Table 4 – Total drought rations for sheep **13**
Table 5 – Examples of the range in nutritive values of common available stubble plant material **14**
Table 6 – Nutritive values and ranges of common drought feeds **16**
Table 7 – Cents per megajoule of energy calculated from $/tonne and MJ/kg DM **18**
Table 8 – Total weekly energy requirements for sheep **19**
Table 9 – Stock Water requirements Litres per animal per day **23**
Table 10 – Salinity tolerance levels for stock water **24**
Table 11 – Suitable weights for starting to feed sheep to maintain at CS 2 **26**
Table 12 – A program for bringing sheep on to grain **27**
Table 13 – Feed consumption in the first month of a drought* **27**
Table 14 – Canola hay and silage FeedTest® results 2006 **45**
Table 15 – Energy and protein compositions of unusual feedstuffs **47**

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Glossary of abbreviations

kg	kilograms
g	grams
mm	millimetres
cm	centimetres
l	litres
m^2	square metres
MJ	megajoules
T	tonnes
ME	metabolisable energy (energy units)
ppm	parts per million
DM	dry matter
CP	crude protein
N/kTex	Newtons per kilotex (a measure of staple strength)
EC	electrical conductivity

Introduction

Droughts and dry seasons are very much part of farming in Australia. They come at irregular intervals and bring hardships to farming enterprises, farmers and their families and rural communities. Farmers put in place a range of measures to prepare themselves for such events.

This booklet is a practical guide on sheep feeding and management during a drought to help producers break down into manageable steps the daunting planning phase. Feeding guidelines in this booklet have been developed from both scientific research and farmer experience and are focused on maintenance feeding. Feeding for production guidelines are outlined well in other resources such as :

Ewe management – Lifetime wool website http://lifetimewool.com.au/index.aspx

Feedlotting lambs at : http://agriculture.vic.gov.au/agriculture/livestock/sheep/victorias-sheep-meat-and-wool-industry/feeding-and-nutrition/feedlotting-lambs.

As no two droughts are the same, this booklet cannot cover all situations. Rather, it aims to provide general recommendations which can then be modified to fit the requirements of the individual. Application of the best information and advice can assist in developing a plan to suit your situation in managing through drought. Plans should include conservation issues, animal feed requirements, feeding in confined areas and making an assessment of water reserves and water quality.

Droughts can be demoralising events, but planning and management based on sound information can help you through the experience. We hope this booklet will contribute to you and your family successfully managing through drought.

If you require more information on the many dimensions of drought, contact the Department of Economic Development, Jobs, Transport and Resources on 136 186.

Key Messages

- Consider your options for keeping, selling and feeding stock early plus other management options such as early weaning, joining and shearing.
- Do short and long term budgets for feed, water and finance.
- Consider containing stock to protect soil and pastures.
- Introduce grain slowly to reduce the occurrence of acidosis and either shandy rations or re-introduce sheep to new batches or grain sources.
- Sheep on high cereal grain diets require Calcium (as limestone) and sometimes Sodium (as salt).
- Monitor stock condition regularly and adjust rations accordingly
- When purchasing feeds, compare feed costs on a cents/MJ basis to ensure value for money (see chapter 4 for more information).
- Ration good quality roughage sources (e.g. good hay) for times when need to increase rations quickly, as in cold wet weather.

CHAPTER 1

Preparing a Drought Action Plan

Introduction

Droughts are part of life for sheep farmers in Victoria, so producers generally make provision for them by storing fodder and improving water supplies during good seasons.

However, each drought brings its own set of difficulties. How well you survive the drought will depend on the initial plan of action and the modifications to the strategy as the drought progresses.

Planning and decision making must be done as soon as you recognise the possibility that the poor season may progress to a drought. If you leave the decisions until the drought worsens, many of the management options available early may be closed to you. Prices for sale stock usually drop dramatically, agistment dries up, fodder prices generally soar and off-farm employment becomes difficult to find.

The first step is to list the farm's financial and physical resources so that the effects of various strategies, both short and long term, can be calculated. Water is probably the first thing to consider, because if this resource is inadequate it will be difficult to retain large numbers of stock.

The next step in choosing a drought action plan is to estimate when you think the drought will break. This will affect your calculations on how long you will be feeding sheep, how much it will cost and whether you will decide to sell stock or not. It is best to over-estimate the time you expect to hand-feed your sheep to be on the safe side.

You will need to address the list of questions below on your action plan when deciding what to do.

Important questions to ask

- What is my current financial situation?
- Do I need to see a financial counsellor?
- Have I the time and equipment to feed sheep?
- How long will I have to feed for?
- Am I aiming at maintenance or production targets?
- What are the feeding needs of the various classes of sheep?
- What fodder will I use and what will they cost at various stages of the drought?
- Have I adequate water supplies to survive the drought?
- How widespread is the drought?
- Is suitable agistment available?
- Is droving an option? Regulations on droving differ between shires and in some shires droving is not an option
- What prices are sheep now?
- What prices will sheep be after the drought?
- What effect will reduced stock numbers have on my overall feeding costs?
- What effect will my strategy have on my pastures and soils?
- What effect will my action plan have on my long-term viability?
- Should I see my bank manager now?

Allowing stock to starve is not an option and is an offence under Victorian law.

The plan does not need to be implemented all at once and should be flexible to allow for changes in circumstances. For example you may only sell a certain class of stock or buy some fodder if conditions do not improve by a certain date.

You will find that having a plan of action will greatly reduce the amount of stress on you and family members. Though the plan may need continual modification as the drought progresses, each family member will be working towards specific aims, especially if you have discussed the plan with them beforehand.

Environmental impact of your plan

You need to consider the long-term effect your plan will have on your pastures and soils.

If your pastures are mostly annual species or your soil type is unstable, then you may need to lower the number of stock you intend to keep so that you minimise the long-term effects your plan has on the environment. You should seriously consider confining at least some of your flock to a small part of the farm. This option has been successfully undertaken by farmers in previous droughts with the stock, pastures and soils emerging from the drought with minimal impact (see Chapter 5 for further details).

If you were not on your farm during a previous drought, talk to neighbours or relatives about what happened to your district during that period. They may be able to suggest strategies that reduce the impact of the drought without significantly increasing your financial burden.

Tips from past droughts

Farmers who successfully survived the 1982 and 1994 droughts were asked what they did to ensure they got through. In summary, they:

- made plans and took actions early
- did simple budgets for various feeding and selling options
- knew their hay supplies and were prepared to ration roughage
- prepared cash flow budgets for 2-3 years
- reviewed decisions regularly
- acted quickly and decisively
- looked for opportunities
- remained positive
- planned a holiday
- were prepared to put sheep into stock containment areas to preserve their pastures and soil.

In 2002, more farmers fed sheep in containment areas or droughtlots. The experiences from this are included in Chapter 5.

Effect on you and your family

Undoubtedly, you are only too aware of the stress the drought will have on you and your family, even leaving aside the financial impact. It is essential to discuss your drought strategy with your family and then with others that may be effected. It is also important to keep up social contacts, such as church and sporting groups, to give you and your family a break from farming activities.

Management options

Toughing it out

It is your legal responsibility to ensure that sheep do not starve to death or become distressed during a drought. Therefore, doing nothing is not an option open to you in the long term. Even in the short term, it is of questionable value. You may be tempted to do nothing in the hope that the poor season will not turn into a drought. In the meantime, paddock feed diminishes, the condition and value of stock slip and feed prices soar. These changes close off many of the other options available to you earlier on in the drought.

The message is to plan early and set deadlines to activate specific actions. Doing nothing is not an option unless the drought is not severe or you are highly understocked.

Agistment

Sending sheep away on agistment is sometimes more economical than feeding and the time saved from feeding might be more usefully employed. It also releases more feed for the stock remaining on the property. Don't forget to inquire in your own district, especially early in the drought, as you may be able to find ungrazed paddocks for rent. However, if the drought becomes more widespread, agistment becomes harder to find and the cost rises rapidly. It may then be cheaper to feed stock at home. It may also be costly and impractical to supervise sheep (especially lambing ewes) at a distance.

The cost of transport and the possibility of disease and losses must be taken into account. The possibility of selling the stock after the drought in the area of agistment may also be considered, thus eliminating the return transport costs.

Droving

Another method of finding off-farm feed resources is by droving stock along roadsides. This is allowable in only some shires. There are legal restrictions and local environmental considerations which apply to this practise and which vary between shires and may change. The risk of disease spread also needs to be considered. Check with the shires involved before starting this option.

Selling

Early planning and action improves the options for selling sheep. In particular, selling decisions need to be made before stock have lost too much condition to be saleable and market prices have started to drop.

When deciding what stock to sell and when, the following factors should be considered:

- present value of stock (including the wool value)
- the quality of stock
- capacity to carry stock through
- taxation effects
- likely demand for the stock at the end of the drought
- likely length of the drought
- possibility of improving the quality of the sheep.

In general, a sound policy is to sell some stock and feed the rest. Cast for age and cull sheep will normally be the first to go.

Further sales should be planned, keeping two general aims in mind. One is to maintain as many breeders as possible to assist in building up stock numbers quickly after the drought breaks. The second is to keep the most productive sheep. Wethers would generally be sold before ewes and older sheep sold before the 2 to 4 year-old groups (1 - 3 years for wethers).

Better grown ewe weaners should be given preference for available feed over other weaners. Given a suitable ration, weaners may be carried through a drought, but they are more susceptible to nutritional stress and disease than mature sheep.

Finally, taxation can have an important bearing on selling policy during a drought. Its effects, especially if a large part of the flock is to be sold, need to be worked out before the stock are sold, particularly where low 'cost price' valuations are used for taxation purposes.

Requirements for stock leaving the farm

All sheep and goats must be tagged with an NLIS Sheep tag before leaving their property of birth, and before leaving any other property.

All movements must be accompanied by a properly completed National Vendor Declaration (www.mla.com.au/lqs or ring 1800 683 111). The only exemption regarding tagging is for dairy goats, but a NVD must accompany them when moved to another property.

If sheep or goats on agistment have lost their NLIS tag prior to their return they must be tagged with an NLIS Sheep Post-Breeder tag printed with the property identification codes (PICs) of the agistment properties.

In some cases agistment properties can be linked to the PIC of the home property, which would eliminate the need to use an NVD or attach an NLIS Post-Breeder tag. For more information contact the NLIS Helpline on 1800 678 779.

Fit to travel

Stock must be in a fit condition if they are to be transported, whether for slaughter or to another farm. An animal is not fit if it:

- Is not strong enough to undertake the journey
- Cannot walk normally, bearing weight on all legs
- Is severely emaciated or visibly dehydrated
- Is suffering from severe visible distress or injury
- Is blind in both eyes
- Is in late pregnancy

For the full publication "is it fit to load" go to: http://www.mla.com.au/News-and-resources/Publication-details?pubid=5873

Purchasing sheep after the drought

To minimise the risk of introducing disease, sheep must be accompanied with a completed animal health statement. This can be sourced at http://www.farmbiosecurity.com.au/industry/sheep/

Humane Destruction

If some classes of stock are unsaleable, and no other option is feasible, then these animals should be humanely destroyed. In past droughts, shires have made facilities available to dispose of carcases after destruction.

Information on appropriate methods of destruction can be obtained from animal health staff from your local DEDJTR office also See Appendix 1.

Feeding

Feeding is an expensive and time-consuming option.

Sheep will normally be fed rations just sufficient to maintain their weight in a condition of at least Condition Score 2 until the drought ends. Keeping breeding ewes at a higher condition (e.g. Condition Score 3) will greatly improve their lambing performance. It will take more feed to maintain ewes at a heavier weight, but if you aim to do this then it is more efficient to feed to maintain them at this level before they drop, rather than feed to increase their weight.

In some cases, short-term finishing rations may be justified for stock suitable for sale as prime lambs or shipping wethers. However, budgets need to be carefully calculated as the profit margins are generally small.

Previous experience shows that the quality of dry pastures, stubbles and failed crops is often much better than first anticipated. This reduces the feeding levels needed to maintain liveweight and thus, the estimated cost of retaining stock. Weighing and assessing the condition of stock ensures that feed demands are being met and also that stock are not overfed. The cost of sheep scales can often be recouped by avoiding over-feeding or preventing under- feeding during a drought.

Information on nutritional requirements of various classes of sheep, feeding rates and stock management is given in the following chapters. If you are aiming to feed your ewes at a higher production level for better reproduction performance, visit the lifetime ewe website which outlines detailed nutritional requirements of ewes at a range of performance conditions.

http://lifetimewool.com.au/index.aspx

Other management decisions

Shearing, pregnancy and lactation all increase the nutritional requirements of the sheep flock. Changes to mating, weaning and shearing times can sometimes be used to reduce feed demands during the drought.

The cost of drought-feeding a breeding ewe for 6 months (including late pregnancy and lactation) is about 50 per cent more than for a dry ewe, so savings can be made by delaying joining or by not joining. However, the long-term effect of this action needs to be carefully considered.

Delaying the time of joining for an early autumn lambing flock has the potential to greatly reduce supplementary feeding costs. Joining may be put back a few weeks or changed to a late winter or spring lambing.

Potential feed savings for producers who already lamb in late winter or spring are unlikely to be as great.

A more drastic measure is to not join some or all of the ewes. The most obvious age groups not to join would be the maidens and the old ewes, especially if liveweights are low (see Chapter 2).

Although a change in the time of joining or reducing the number of ewes joined may save money or supplementary feed in the short term, this benefit must be weighed against long-term costs. Factors such as complicating management, disrupting the flock structure and altering future income levels need to be considered.

Early weaning, if not already practised, can reduce feed costs and simplify management of both the ewes and the lambs. The ewes can then be managed as dry stock and the lambs given priority.

The crucial factors for success of early weaning are that:

- the lambs are at least 6 weeks old and
- preferably close to 12 weeks
- they have reached at least 9 kg liveweight
- they receive high-quality rations.

Changing the time of shearing may help to reduce feed costs, especially if shearing is currently during a cold time of the year. For most people this means bringing shearing forward to a warmer and drier time of the year which reduces feed demand and losses.

This option is not always practical and the benefits must be balanced against disruption in management and discount in wool prices due to the shorter wool.

CHAPTER 2

Setting targets

Before choosing a feed and deciding on quantities, it is important to set targets for feeding each class of stock. The targets for the feeding program may be, for example, to maintain ewes in a suitable condition for joining, or to hold replacement weaners at their present weight and body condition for the next 3 months. Different targets will impose a different feeding regime, and cost, on the producer. In addition, the targets set may affect the most economical choice of feed.

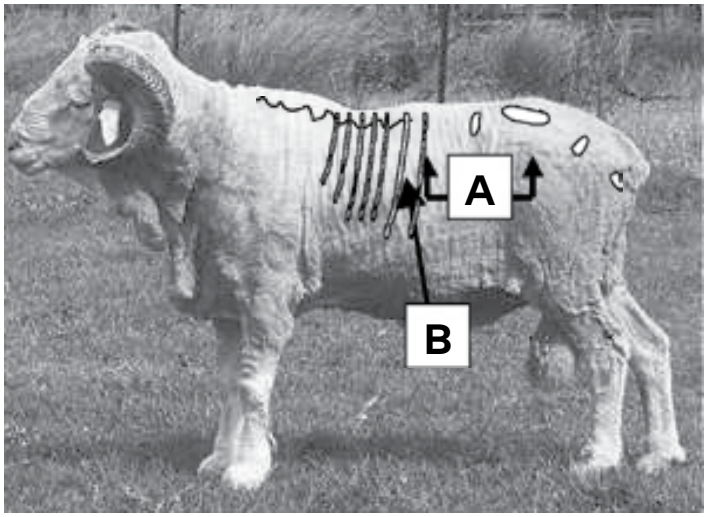
Assessing fat reserves of sheep

Assessing the amount of fat that an animal has on reserve is a very useful tool for monitoring the stock and assessing the needs of animals to either gain weight or even to lose weight.

It is very quick, cheap and easy to do, while remembering that monitoring liveweight is a must for young animals (lambs) that have little fat reserve and need to gain weight.

Fat cover in sheep is measured either at the short ribs (condition score) or the long ribs (fat score).

Figure 1. Picture of the sites on the sheep for assessing fat reserves

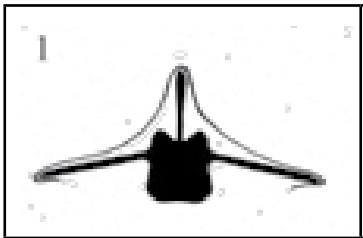
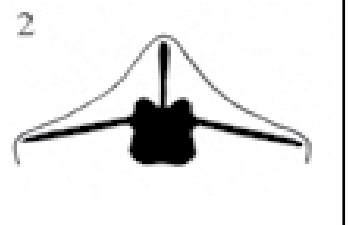
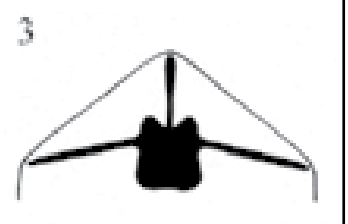
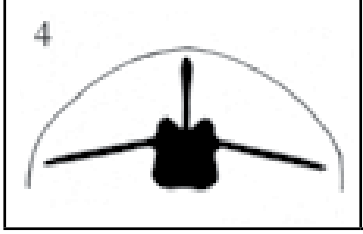


A) Site for assessing condition scores.

B) Site for assessing fat scores – 10 cm down the second last long rib is the GR site and the site for measuring fat depth in slaughter lambs.

Condition scoring is more sensitive for monitoring condition for management such as for reproduction targets. Guidelines on what to feel is outlined in Table 1.

Table 1 – Condition scores and what to feel

	Backbone Prominent and sharp Short Ribs Ends are sharp and easy to press between, over and around Eye Muscle Thin, the surface tending to feel hollow
	Backbone Prominent but smooth Short Ribs Smooth well-rounded ends – can feel between, over and around each smoothly Eye Muscle Reasonable surface with the surface tending to feel flat
	Backbone Can be felt but smooth and rounded Short Ribs Ends are smooth and well covered – firm, pressure necessary to feel under and between short ribs Eye Muscle Full and rounded
	Backbone Detectable with pressure on the thumb Short Ribs Individual short ribs can only be felt with pressure Eye Muscle Full with a covering layer of fat

Target Condition Scores

A rule of thumb used for drought and maintenance feeding is that stock be at least Condition Score 2 in tough times of the year and need feeding when half the mob are at a Low Score 2 or less (lean or backward store).

Ideal targets for joining and late pregnancy through to lambing is Condition Score 3. Running ewes below this level may compromise reproduction but this needs to be balanced with the cost of getting them through a drought.

Fat scoring

Fat scoring assesses the fat cover over the long ribs. It is also a useful measure for monitoring the status of the animal but has been more widely used in the prime lamb industry for market reasons. It is a measure of the depth of fat over the GR site – 10 cm down from the backbone on the second last long rib (Site B on Figure above), which is the site measured for fat depth after slaughter.

Fat scores range from 1 to 5 and each score is equivalent to an addition 5 mm of fat. So a sheep with a Fat Score 5 will have over 21mm of fat at this site compared to an animal of Fat Score 1, which may have 0-5 mm fat.

Liveweight

Measuring liveweight, for most of us, is more sensitive for monitoring changes in animals. A drop in a fat or condition score is equivalent to a loss of about 7 to 9 kg. Therefore if you don't have the skill to distinguish animals less than a condition score apart, weight loss may be too great before you pick it up. A set of scales can pay for itself if used to assess feed requirements through animal weight change.

Liveweight can be misleading for assessing ewes in late pregnancy as they will be putting on considerable weight associated with the lamb and may be losing some of their own fat reserves to do this.

Weaners need to be monitored by weight as fat reserves are usually low in young animals and they have a requirement to grow. The table below shows some critical weights to aim for to increase survival.

Targets for sheep

Lambs

Early weaning can reduce feed costs and simplify management of both ewes and lambs. One of the main advantages is to wean before ewes lose too much condition so they can be maintained at a weight for getting back into lamb at joining. The important factors for the lambs are an absolute minimum age of 6 weeks, a minimum liveweight of 9 kg, and the use of high quality rations and good management. For merino breeders that wean at 12 - 14 weeks anyway, there are not a lot of opportunities to wean much earlier.

Weaners

In a "normal" season, the growth target for weaners would be to achieve 50 per cent of their mature (4-year-old) weight by the autumn break. Some later compensation for poor growth during drought months could be included as part of the target drought-feeding strategy. However, severe under-nutrition of ewe weaners in their first year can reduce lifetime reproduction by up to 20 per cent. Table 2 shows target weights for young sheep from birth to first joining.

Table 2 – Target weights for weaners

Mature weights	Target weights (kg)				
	Birth	Pasture drying off	Autumn break	Late winter	Joining
45 kg	4	20	22.5	27	34-36
50 kg	4.5	22.5	25	30	37-40
55 kg	5	25	27.5	33	41-44
60 kg	5	27	30	36	45-48
70 kg	5.5	31.5	33.5	42	52 -56
% Mature weight	8-9%	45%	50%	60%	75-80%

Finishing prime lambs

If the season is such that lambs are not finished before feed limits production, then finishing lambs on full grain diets must be costed carefully. There are a number of good sources of information and feed budgets available through DEDJTR offices and Meat and Livestock Australia (MLA).

Ewes and reproduction

The cost of full drought feeding for a breeding ewe for 6 months during late pregnancy and lactation is at least 50 per cent more than for a dry ewe. Considerable cost savings can be made by not joining, or by delaying joining, but this needs to be considered with the longer term effect on income.

When making decisions about joining ewes in a drought, two points to keep in mind are:

- Ewe liveweight - chances of successful reproduction decline rapidly as liveweight falls below 35 kg for Merinos and 40 kg for larger framed sheep. If ewes are below the critical liveweight, it may be best not to join them.
- Roughage to be available to supplement a drought-fed grain ration during later stages of pregnancy and in early lactation.

Severe under-nutrition of the pregnant and lactating ewe can permanently decrease the lifetime wool production of her lamb and also reduces the chances of getting back into lamb at the subsequent joining.

If a decision is made not to join ewes in spring or summer because of drought, a later joining may still be possible following rains which may occur in early autumn.

Lambing percentages after droughts are often low, particularly in maiden ewes. Maintaining ewes at Condition Score 2 is likely to impact on lambing percentages. If the average condition of a mob of ewes is Condition Score 2, then it is likely that 50 per cent of the mob are less than score 2. You may wish to consider maintaining ewes in better condition to improve percentages and recovery after the drought.

This needs to be balanced against the cost to maintain them at a higher weight. As a guide, responses in the number of lambs born per each additional kilogram in ewe weight at joining per 100 ewes joined, varies from about 1.5 - 2.5 per cent. Autumn lambing crossbred ewes and small merinos are likely to be at the lower end and spring lambing crossbred ewes and highly responsive ewes may give the higher responses.

For every extra kilogram heavier that a ewe is maintained, about 70 grams extra of barley or wheat is needed per week. Table 3 illustrates how you might estimate the cost of maintaining ewes at a higher condition to improve lambing percentage. Table 3 shows the ration of barley needed to maintain ewes at a weight of 40 or 47 kg (on a full ration) with the expected increase in lambing percentage and estimated cost per additional lamb born.

Table 3 – Estimated costs of feeding for more lambs

Target weight of ewes	Target condition score of ewes	Ration of barley needed to maintain target weight	Extra number of lambs born per 100 ewes joined	Ration cost for 6 months per 100 ewes with a feed cost of $300 per tonne	Ration cost per additional lamb born (Ration cost per lambed weaned at 80% of lambs born)
kg	CS	kg/head/week		$	
40	2.0	3.5		$2520	
47	3.0	4.0	10[#1]	$2880	$33.60 ($42.00)
			14[#2]	$2880	$25.20 ($31.50)
			18[#3]	$2880	$20.16 ($25.20)

[#1] 10 lambs per extra 100 ewes born is equivalent to 1.5 extra lambs per ewes joined per kg liveweight (responses might be expected in some merino flocks and autumn lambing crossbred flocks)

[#2] 14 lambs per extra 100 ewes born is equivalent to 2 extra lambs per ewes joined per kg liveweight (responses expected in some merino flocks and winter lambing crossbred flocks)

[#3] 18 lambs per extra 100 ewes born is equivalent to 2.5 extra lambs per ewes joined per kg liveweight (spring lambing crossbred ewe flocks and highly responsive merino flocks).

In this example, at a cost of grain at $300 per tonne and feeding is for 6 months, the extra cost per lamb born is between $20 and $33. The cost will be higher per lamb for survival to weaning and beyond weaning. At a weaning survival rate of 80 per cent the cost per lamb in this example is between $25 and $42. This survival rate will vary widely and is an example only.

You need to do your own sums and expectations on responses, but this will give you a guide to balancing feed costs and reproduction.

The outcome will vary depending on:

- The cost of grain
- If roughage is required
- The response in conception, as this has been found to be quite variable for different sheep types
- Length of maintenance feeding (6 months used in this example)
- Lamb survival. The example has used 80 per cent survival to weaning but this will vary widely.

There may be additional benefits of having heavier ewes such as fewer deaths and more wool to help offset these costs. The cost will also be higher if money is borrowed.

While nutrition and condition of ewes have the most impact on conception and lambing percentages, there may be other contributing factors. Rams should not be ignored and need to be on the same level and type of rations as the ewes well before joining.

Maiden ewes

Maiden ewes need to be about 75 per cent of their mature weight at joining. If maiden ewes are well below this you may consider not joining.

CHAPTER 3

Feeding sheep during a drought

The aim of feeding sheep in a drought is to maintain weight in dry sheep and to meet the requirements of late pregnant and lactating ewes. Lambs and weaners need to grow sufficiently so that they do not suffer permanent checks (Chapter 2). Other classes of stock may require a finishing ration when deemed to be a profitable option.

Selecting the types and amounts of feeds to give sheep during a drought involves six steps:

- Calculating total energy and protein requirements of each class of sheep
- Assessing how much can be met from pasture and or crop residues
- Calculating which available and suitable fodder are cheapest (Which feed)
- Calculating the amount and cost of the selected feed
- Assessing water requirements
- Monitoring the individual mobs and adjusting ration up or down.

Total energy and protein requirements

Feed energy is a major requirement and normally the first limitation during a drought. The energy derived from digested feed to maintain body functions and to produce wool, foetal growth, milk or more body weight is termed metabolisable energy (ME). It is therefore the energy that can be used by the animal and is also measured as digestibility. The units used to measure the energy content of a diet are megajoules (MJ) of metabolisable energy (MJME). It is standard practice to describe energy value of feeds and energy requirements in units of ME (hereafter called energy units).

In Victoria, protein is generally not the limiting factor in drought rations that supply adequate energy to meet the needs of the stock. However, for those sheep with special requirements, care is needed to make sure that their protein needs are met.

The total energy requirements for different classes of sheep are given in Table 4, along with minimum crude protein as a percentage of the dry matter of the diet fed.

Adjustments for liveweight

Table 4 gives full rations for 40 kg and 60 kg sheep. Rations for sheep of different weights need to be adjusted accordingly. Increase the ration if necessary by 10 per cent (which is equal to 0.4 kg of wheat or 0.6 kg of medium quality hay per head per week) for each 5 kg of extra liveweight.

> For example, a ration of 3.5 kg of wheat per head per week should keep a medium-framed sheep in store condition at about 40 kg liveweight. A further increase of 0.4 kg would be needed to keep a sheep at about 45 kg.

Similarly, rams are larger framed than ewes or wethers of the same breed. They will need a ration 10 per cent greater to maintain their condition in the non-breeding season.

Depending on their condition, they may need an extra 10 per cent to 20 per cent added to their ration for 4 - 6 weeks to ensure that they reach a strong "forward store" condition at joining.

Table 4 – Total drought rations for sheep

Weekly energy requirements for maintenance and minimum dietary protein concentrations for different classes of sheep, assuming no paddock feed is available. Check adjustments to rations for allowances needed for larger breeds, and setting your own rations for more detail.

	Class of stock	Energy requirement MJ/week	Minimum crude protein % DM		Feed	Ration kg per head per week	Remarks
1.	Adult dry sheep, ewes in early stages of pregnancy in store condition				Wheat	3.5	
				or	Oats	4	
				or	Hay (good)	5	
	• 40 kg liveweight – medium framed	42	6	or	Hay (poor)	7	
	• large framed, or crossbred ewe at 60 kg liveweight				Wheat	4.75	
				or	Oats	5.7	
				or	Hay (good)	7	
		57	6	or	Hay (poor)	10	
2.	Pregnant ewes, last 4-6 weeks before lambing				Wheat	5	
				or	Oats	5.6	
	• medium framed			plus	Hay (good to av.)	1	Some hay (or dry paddock feed) is desirable but, if in short supply save until after lambing and increase grain ration by 0.5 kg as a substitute.
		62	8	or	Hay (good) alone	7	
	• Large framed, or crossbred – 60 kg liveweight				Wheat	5.5	
				or	Oats	6	
				plus	Hay (good to av.)	1.5	
		84	8	or	Hay (good) alone	10	
3.	Ewes with lamb at foot*				Wheat	7	
				or	Oats	9	
	• medium framed			plus	Hay (good)	1.5	Rates apply to mobs with normal lambing patterns from start of lambing. If lambing is concentrated, increase Rations by 1 kg grain plus 1 kg hay for first 3-4 weeks following the lambing peak, for full milk production.
				or	Hay (average)	2	
		84	10	or	Hay (good) alone	10	
	• Large framed				Wheat	8.5	
				or	Oats	10	
				plus	Hay (good)	2	Wheat alone is satisfactory feed for lactating ewes.
				or	Hay (average)	2.8	
		120	10	or	Hay (good) alone	14	
4.	Lambs						
	• Early-weaned lambs up to 15 kg liveweight gaining 1 to 2 kg per hd/wk	35	12	plus	Mixed cereal grain (3 parts) and lupins (1 part) Hay (good) at 10%	Feed to appetite (3.5)	Combine the mixed grain feed with hay and feed the combined ration.
	• Weaned lambs greater than 15 kg liveweight			or	Wheat	2	Give access to the best grazing at all times. If no useful grazing is available, give extra 1.5 kg good hay (or 2 kg average hay).
				or	Oats	2.3	
				plus	Hay (good) plus grazing (about 1/3 ration)	3	If hay is very scarce, reduce to 0.3 kg and increase grain by 0.8 kg (per week).
		35	10	or	Hay (good) alone	4.5	

* Energy requirements for lactating ewes assume that ewes maintain body condition. If lambs are kept on the ewes longer than 6 - 8 weeks, requirements will increase as the lamb requirements increase.

Feed supplied from pasture and crop residues

It is relatively easy to estimate a full supplementary ration for a particular class and weight of sheep but it is more difficult to estimate what proportion of this ration to feed if stock have access to pasture or stubble. If you have done a ProGraze or Lifetime Ewe Management course and are confident in estimating the amount and quality of feed in the paddock, there are some good tools that can help calculate the ration. For example, the Lifetimewool website:

http://lifetimewool.com.au/Tools/dryfeedbud.aspx

Otherwise, a simple option is to start with at least one third to a half of a full ration and monitor the sheep for weight gain or loss. The ration can then be altered appropriately. Of course, this starting proportion can depend on what fodder is being fed, the condition of the sheep, the aims of feeding and how much paddock feed is available. Note that unless you are monitoring live weight regularly, by the time you pick up weight loss, it may be too late and/or expensive to lift weight back up, so it is better to feed a higher rate and drop back if appropriate.

Experience from previous droughts indicates that more paddock feed is available than would first appear. Sheep can scavenge quite a bit of feed from sparse, dry pasture and buried clover or medic burr. The presence of paddock feed early in a drought makes it easier to get the sheep accustomed to the drought rations before they have to be fed close to full rations.

The other consideration is ground cover and the need to protect the soil, the nutrients and the vegetation. As bare ground increases (see Chapter 5) areas of bare ground start to join, creating opportunities for washing and dust blowing. The critical level of cover will vary depending on the soil type and the slope.

Crop stubbles

In many part of southern Australia, crop stubbles are an important part of the feed supply for the sheep flock over summer. The nutritive value of stubbles varies considerably and is primarily related to the amount of residual grain left after harvest. Stubbles will vary within the paddock considerably as they include grain, weeds, leaf, chaff and stem. Sheep will eat the most digestible feed first and leave the least digestible (the stem) until last. Weight loss will occur accordingly.

Table 5 provides the range of nutritive values of commonly available stubble plant material (excluding grain) and grain alone.

Table 5 – Examples of the range in nutritive values of common available stubble plant material (Source FeedTest straw tests 2014/15 season)

Material	Crude protein %	Metabolisable energy (MJ/kg DM)
Barley/wheat straw	0.4-6.4	4.4-9
Oat straw	0.9-11.3	4.3-9
Legume straw	1.9-11.9	3.6-10
Barley / Wheat grain	6-23	11-15
Oat grain	6-12	9-13
Lupin grain	26-40	12-14

As the table shows, straw is below energy and protein levels that will maintain stock.

Accurate feed budgeting is difficult in cereal stubbles but is relatively simple in crops with large grain size such as lupins, peas and beans. This is done by measuring the amount of grain in the stubble by randomly throwing a quadrat of known size and collecting and weighing the seed to determine kilogram of grain per hectare.

If you assume that sheep will eat 0.5-1.0 kg grain a day (they can eat 2.5 - 3.5 per cent of body weight) then you can estimate how long before sheep will start to lose weight. Stubble grazing trials in North-West Victoria in 2001 produced growth rates in lambs of between 180 and 220 grams per day on pea and bean stubbles. Lentil stubbles were more variable with growth rates ranging from 140 to over 200 grams per day. Cereal stubbles over a week period resulted in an average growth of 90 grams per day.

However when grain is no longer available, weight changes have been reported from minus 176 grams per head per day to gains of 65 grams per head per day (when summer rains produced growth of green feed).

In a separate cereal grazing trial in the Horsham district, wethers on weed free wheat stubble lost 4 kg over a 12-week period. In the same trial, the addition of molasses and urea blocks resulted in a live weight loss of 1.5 kg whereas the addition of 100 grams of lupins per head per day gave a 0.5 kg gain over the same period.

Lupin and legume stubbles provide a higher value grain and stubble. Lupin stubbles can be toxic to sheep when infected with a fungus, which causes lupinosis.

Protein and roughage

It is usually safe to say that where stock are receiving sufficient energy from pasture then for dry stock at least, protein will not be limiting. Where some green is available, energy may be limiting but the green pick will still provide protein requirements to stock.

Where stock are fed in paddocks where there is some dry feed, roughage or fibre is unlikely to be limiting.

Choosing a supplementary feed

Feed resources held on the farm are often the most obvious choice for a drought ration, but may not necessarily match the feeding targets. If the farm feed resources are in demand commercially, it may even pay to sell them and buy in something else at a cheaper price, provided that the feeding targets can still be met with the purchased supplement.

Feed values rise as drought progresses, so do not be too anxious to sell off surplus feed, only to discover that it is needed later on.

Energy is one of the most important requirements for animals in a drought. Common energy supplements for sheep also usually provide enough protein, vitamins and minerals. Unless your stock have a special need for protein, vitamins or minerals, choose the drought feed that provides energy at the lowest cost.

Energy values of feeds differ (see Table 6), as does the relative cost of the energy they contain.

Feed values (energy and protein) can be highly variable. Variations are due to district, variety, season and growing conditions. Table 6 shows the energy and protein ranges commonly found in feeds in Victoria. However, having the feed tested by a registered laboratory such as FeedTest® (Werribee) or Livestock Logic (Hamilton) is the best way of being confident about the quality of purchased or home grown feed.

The feed values in Table 6 are on a Dry Matter basis as provided by a feed test. This needs to be taken into account when estimating the amount of energy being fed. For example, if wheat has an energy value of 13 MJ per kg of dry matter, for every kilogram of wheat fed to sheep, they will get 12MJ (13MJ x 90÷100), if wheat has 90 per cent dry matter. (See the section on calculating the cheapest source of energy to do your own calculations).

Table 6 – Nutritive values and ranges of common drought feeds

Feed type	Energy (megajoules/kg DM)		Protein (% Crude protein)	
	Average	Common range	Average	Common range
Wheat, Triticale	13	12-15	12	8-23
Barley	13	11-13	11	6-17
Maize	13	12-14	9	8-13
Lupins	13	12-14	30	26-40
Peas	13	10-13	23	18-29
Faba Beans	12	10-13	25	18-28
Oats	11	9-13	9	6-12
Sheep pellets (brands vary)	10	6-13	12	4-21
Lucerne hay	8.5	7-9	20	16-25
Clover hay (early)	8.5	7-9.5	18	15-20
Pasture hay (mid- season)	7	6-7	11	8-16
Oaten hay	7	6-8	8	5-10
Grass hay	6	5-7	8	5-10
Cereal straw	5	4-8	4	2-5

Other nutritional requirements

Protein

As already mentioned, protein is usually adequate for mature dry sheep in commonly available drought fodders. Occasionally, though, protein concentrations in poor grass hays and oaten grain are below 7 per cent.

If this occurs, appetite may drop in the long term as the diet is unsuitable for rumen micro-organisms. They will break down the feed in the rumen at a slower rate so the animal cannot eat enough to supply energy requirements.

Weaner sheep and lactating ewes have higher requirements for protein and may need supplementation of cereal grain or hay diets with a protein rich diet.

It is clearly important to know the protein content of some feeds before they are used as a diet. This is particularly the case for grass hays and oats. The only way to obtain this information is to have samples tested in a laboratory.

Minerals and vitamins

Only two major minerals, calcium and sodium, are likely to be needed as additional supplements during a drought.

Calcium is deficient when diets consist mainly of cereal grain. To prevent calcium deficiency, add 2 per cent of finely ground agricultural limestone (calcium carbonate) to cereal grain (that is, for every tonne of grain add 20 kg of limestone). Do not use builders lime, burnt lime or slaked lime. Spread lime onto grain when filling the feed out bin. Lime is largely not lost when feeding out as the fine particles stick to the grain. Do not add lime to stored grain when filling the silo as lime may corrode the lining of the silo.

Sodium is deficient in most grains. Common salt can be provided at 0.5 per cent if needed, but often water supplies have sufficient salt to alleviate the need to supplement.

Alternatively, both salt and calcium can be provided in a salt lick. The percentage of each mineral can vary, but calcium levels above 30 per cent start to limit uptake. You can mix your own licks cheaply or take the more expensive option of buying commercial blocks. One difficulty with licks is that some sheep in the mob do not partake and the intake of the others can be highly variable. There have been reports of calcium deficiency in young animals that have been lot fed with calcium supplied via licks.

Only two vitamins, A and E, are likely to be deficient as a direct result of drought feeding, and are rare in adult sheep.

Vitamin A is obtained from green pasture, hay with a good green colour and yellow maize. Even a short green pick will supply adequate quantities of the vitamin. Vitamin A is stored in the liver. Young sheep usually experience deficiencies when they have been without green pasture, green hay or yellow maize for 6 months.

Symptoms include night blindness, eye discharges and illthrift. Treat with a Vitamin A drench if sheep have been without a source of the vitamin for 3 - 4 months and 9 - 10 months respectively. A single drench protects the sheep for about 6 months. An inter-relationship exists between Vitamin E and selenium. Grains and hays are fair to good sources of Vitamin E, although considerable variation does occur.

Vitamin E deficiency induces symptoms similar to selenium deficiency (that is, still born lambs and older lambs that suffer from a stiff, stilted gait, lameness and illthrift). The deficiency is usually treated with a water-soluble drench.

If you suspect these or other vitamin deficiencies, seek veterinary advice for confirmation and dose rate instructions.

Fat

Some feed sources have a higher concentration of fat than others. Although fat represents a concentrated form of energy, levels greater than 5 per cent fat in a sheep diet will decrease intake. (For example, the fat levels in maize can vary from 4 - 8 per cent). This is important when considering some alternative feed sources and how much needs to be incorporated into a ration.

Costing fodders on energy value

Fodders such as grain and hay are always sold on a price per tonne (or some other unit of weight or size) of feed. Feeds contain moisture, and therefore need to be converted to a dry matter basis before they can be compared.

The most important basis for comparison of feedstuffs is their energy content. Table 6 lists the energy and protein values of a range of common feeds. All values are expressed on a dry matter (DM) basis.

This section aims to help producers calculate which feed is the best value for money. To make comparisons you must first look at the energy and dry matter content of the feed.

How to calculate the cost of feed on an energy basis

Example: Which feed is the best value on an energy basis?

	Cost/ tonne	**Dry matter** %	**Energy** MJ/Kg/ DM %
FEED A	$195	85%	10MJ
FEED B	$230	90%	13MJ

FEED A: Calculate the cost/MJ of metabolisable energy

Step 1

Calculate the price of the feed on a dry matter basis @ 85% dry matter

In a tonne of this feed there is 850kg dry matter and the rest is water. To calculate the cost of a kilogram of dry matter, divide the cost/tonne of feed by the number of kilograms of dry matter.

$195/tonne ÷ 850kg = $0.23/kg dry matter This is the same as 23 cents/kg dry matter.

Step 2

Calculate the cost per MJ of Energy

In each kilogram of dry matter there are 10 MJ of energy.

23c/kg DM ÷ 10MJ

= 2.3c/MJ of metabolisable energy

Feed A costs 2.3c/MJ of energy

FEED B: Calculate the cost/MJ of metabolisable energy

Step 1

Calculate the price of the feed on a dry matter basis @ 90% dry matter

In a tonne of this feed there is 900kg dry matter and the rest is water. To calculate the cost of a kilogram of dry matter, divide the cost/tonne of feed by the number of kilograms of dry matter.

$230/tonne ÷ 900kg = $0.26/kg dry matter This is the same as 26 cents/kg dry matter.

Step 2

Calculate the cost per MJ of energy

In each kilogram of dry matter there are 13 MJ of energy.

26c/kg DM ÷ 13MJ

= 2.0c/MJ of metabolisable energy

Feed B costs 2c/MJ of energy

Therefore, Feed B is better value per unit of energy, costing 2c/MJ, compared to 2.3c/MJ for Feed A.

Table 7 calculates some of the relative prices of feed energy, over a range of prices. It can be used to compare the purchase of feeds with different energy levels.

Example:

If you can buy wheat for $225 per tonne, (with 12MJ/kgDM) you are paying a unit energy cost of 2.1 cents per MJ. This would be the same value as oats at $190 per tonne, or good lucerne hay at $180 per tonne. If oats or lucerne hay were selling for less than these prices, they would be better value on an energy basis.

Table 7 – Cents per megajoule of energy calculated from $/tonne and MJ/kg DM

		$ / tonne															
Fodder	**MJ/ Kg DM**	**125**	**150**	**175**	**200**	**225**	**250**	**275**	**300**	**325**	**350**	**375**	**400**	**425**	**450**	**475**	**500**
Grain / pellets	14.0	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0
	12.0	1.2	1.4	1.6	1.9	2.1	2.3	2.5	2.8	3.0	3.2	3.5	3.7	3.9	4.2	4.4	4.6
(Assuming	10.0	1.4	1.7	1.9	2.2	2.5	2.8	3.1	3.3	3.6	3.9	4.2	4.4	4.7	5.0	5.3	5.6
90% DM)	8.0	1.7	2.1	2.4	2.8	3.1	3.5	3.8	4.2	4.5	4.9	5.2	5.6	5.9	6.3	6.6	6.9
Hay	10.0	1.5	1.8	2.1	2.4	2.6	2.9	3.2	3.5	3.8	4.1	4.4	4.7	5.0	5.3	5.6	5.9
(Assuming	8.0	1.8	2.2	2.6	2.9	3.3	3.7	4.0	4.4	4.8	5.1	5.5	5.9	6.3	6.6	7.0	7.4
85% DM)	6.0	2.5	2.9	3.4	3.9	4.4	4.9	5.4	5.9	6.4	6.9	7.4	7.8	8.3	8.8	9.3	9.8
Silage	14.0	2.2	2.7	3.1	3.6	4.0	4.5	4.9	5.4	5.8	6.3	6.7	7.1	7.6	8.0	8.5	8.9
(Assuming	12.0	2.6	3.1	3.7	4.2	4.7	5.2	5.7	6.3	6.8	7.3	7.8	8.3	8.9	9.4	9.9	10.4
40% DM)	10.0	3.1	3.8	4.4	5.0	5.6	6.3	6.9	7.5	8.1	8.8	9.4	10.0	10.6	11.3	11.9	12.5
	8.0	3.9	4.7	5.5	6.3	7.0	7.8	8.6	9.4	10.2	10.9	11.7	12.5	13.3	14.1	14.8	15.6
Straw	6.0	2.3	2.8	3.2	3.7	4.2	4.6	5.1	5.6	6.0	6.5	6.9	7.4	7.9	8.3	8.8	9.3
(Assuming	4.0	3.5	4.2	4.9	5.6	6.3	6.9	7.6	8.3	9.0	9.7	10.4	11.1	11.8	12.5	13.2	13.9
90% DM)	2.0	6.9	8.3	9.7	11.1	12.5	13.9	15.3	16.7	18.1	19.4	20.8	22.2	23.6	25.0	26.4	27.8

How much to feed

Drought rations and feed requirements are outlined in Table 4. If you know the energy value of the feed you have, you can calculate your own ration requirements using Table 8 below. Note that these estimates are to maintain adult sheep (ewes and wethers) at CS 2 and that ewes have single lambs.

Table 8 – Total weekly energy requirements for sheep

Sheep weight (without foetus)	Total weekly energy requirements in megajoules (MJ)			
	Class of sheep			
	Dry mature	Pregnant (last 4 weeks)	Ewe and lamb*	Weaned lambs**
15	-	-	-	35
20	-	-	-	37
25	30	-	-	40
30	34	49	90	45
35	38	55	93	42
40	42	62	97	-
45	46	68	100	-
50	50	74	104	-
60	57	84	120	-
70	64	90	130	-

*Requirements are for the ewe to maintain body condition. If the lambs are not weaned early, these requirements for the ewe and lamb will increase as the lambs get bigger.

** assumes reasonable growth rates.

To calculate the total feed needed, simply divide the number of energy units (ME) in your chosen feed into the energy units required for each class of stock.

Example 1

45 kg wether requires 46 MJME per week

Feeding wheat 12 MJME per kg

Full ration = 3.8 kg wheat per week

Example 2

50 kg ewe with lamb at foot 104 MJME per week (1 week old)

Feeding maize at 13 MJME per kg

Full ration = 8 kg maize per week (protein may be limiting)

Feed Intake

How much an animal can physically eat in one day is affected by the digestibility and the fibre content of the diet. This means that high fibre diets that have low energy values (like some hays and straws) will not supply enough energy for the animal because they cannot digest enough feed in a day to meet their needs. A measure of fibre that is available with a Feed Test of hay and straw is Neutral Detergent Fibre (NDF). If this measure is known then a simple sum can provide an estimate of how much the animal can eat. The maximum percentage of a sheep's live weight that can be eaten is:

120/NDF%

For example, if a hay has a NDF% of 70%

120/70 = 1.7%.

Therefore the maximum a sheep can eat of this feed is 1.7%. A 20 kg animal can eat a maximum of 0.3kg per day and a 50kg animal can eat 0.85kg per day. If the energy value of the feed is low (which is likely if the NDF% is high) then it is likely that the animal will not be able to eat enough to meet it's needs.

Adjustments to rations

In cold conditions, the energy requirements of the sheep increase and the rations will need to be increased by 20 per cent or even more under severe conditions. If cold conditions occur when sheep have just been shorn, provide whatever shelter is available and boost rations at least twofold.

Hay is the safest for such a sudden increase in the ration, but it can be gradually replaced by grain if the increase has to be sustained. If grain alone is to be fed, then the frequency of feeding rather than the amount offered at each feed should be increased.

On muddy ground, increase rations by about 0.5 kg per head if grain is trailed to make up for wastage caused by trampling.

Total feeding costs

The information found in Tables 4, 7 and 8 in this chapter can be used to calculate the amount and the cost of the total ration for different classes of sheep. This figure then needs to be adjusted for the proportion of the total ration being feed e.g. one third during the early part of the drought up to one half for most of the remainder.

Example: Cost of fully drought-feeding dry adult sheep.

If a 40 kg wether or dry ewe requires 42 MJ of energy per week for maintenance, the cost is calculated by using the energy cost from Table 7 multiplied by the weekly energy requirement.

For example:

For wheat at $210 per tonne:

42 MJ per week at 1.8 cents per MJ = 76 cents per week

For oaten hay at $90 per tonne:

42 MJ per week at 1.3 cents per MJ = 55 cents per week

Once you have calculated the relative costs, you need to check that the least-cost ration will be suitable in all other respects for the classes of sheep you wish to feed.

The checklist for this is:

- is there adequate protein in the diet?
- can sheep eat enough to satisfy their needs?
- will the supplement, plus paddock feed, provide adequate roughage?

Whatever the aim, the important point to remember in drought feeding is to continually monitor the condition of the mob. The present condition of the mob, the amount of paddock feed left in the paddock and weather conditions all have important effects on the amount of hand feeding needed. Only by monitoring the condition of the sheep in the mob and modifying feeding in response to changes, can you be sure that you are feeding neither too much nor too little.

Feed budgets

A simple feed budget will help to estimate likely grain requirements, predicted total cost as well as monthly cash flow requirements. This will also help you decide whether to keep and feed stock or sell and buy back. Two examples are given below. The cost of grain, your prediction of when the drought will break and the amount of a ration fed will change as a drought progresses. Budgets must be regularly updated.

Example 1

Assumptions: The drought will break in mid-April.

1,000 weaned lambs (25 kg) fed in the paddock at a **half ration**. Supplementation starts in December but does not reach the required ration until January.

A full ration of pellets at 12 MJME per kg is 3.3 kg per head per week. Pellet price = $ 350 per tonne

	Nov	Dec	Jan	Feb	Mar	Apr	May
kg/head/week	0	1	1.6	1.6	1.6	1.6	1.3
Monthly kg required for the mob	0	4,000	6,400	6,400	6,400	6,400	5,200
Cumulative grain requirement	0	4,000	10,400	16,800	23,200	29,600	34,800
Cost per Head/ month	0	$1.40	$2.24	$2.24	$2.24	$2.24	$1.82
Cumulative cost per head	0	$1.40	$3.64	$5.88	$8.12	$10.36	$12.18
Cumulative cost per mob	0	$1,400	$3,640	$5,880	$8,120	$10,360	$12,180

Therefore, in this example, you will require 34.8 tonnes of pellets for this mob at a total cost of $12,180 or $12.18 per head.

Example 2

Assumptions: The drought will break in June.

1,000 wethers (40 kg) fed wheat in the paddock at a half ration and then put in a stock containment area in January. A full ration of wheat at 12 MJME per kg is 3.5 kg per head per week. Wheat price = $310 per tonne

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
kg/head/ week	1.5	1.5	3.5	3.5	3.5	3.5	3.5	3.5	2
Monthly kg required for the mob	6,000	6,000	14,000	14,000	14,000	14,000	14,000	14,000	8,000
Cumulative grain requirement	6,000	12,000	26,000	40,000	54,000	68,000	82,000	96,000	104,000
Cost per head	$1.86	$1.86	$4.34	$4.34	$4.34	$4.34	$4.34	$4.34	$2.48
Cumulative cost per head	$1.86	$3.72	$8.06	$12.40	$16.74	$21.08	$25.42	$29.76	$32.24
Cumulative cost per mob	$1,860	$3,720	$8,060	$12,400	$16,740	$21,080	$25,420	$29,760	$32,240

In this example, you will require 104 tonnes of wheat at a total cost of $32,240 or $32.24 per head.

Other considerations

The cost of feeding sheep is not just the feed purchase price. Labour costs, freight costs, extra storage and handling costs, and the likely amount of wastage have all to be taken into account when calculating the relative costs of feed on your farm.

The introduction of weeds can be a problem with buying in feed, and samples should be inspected carefully for weed seeds. However, it is not always possible to detect a potential problem, or even to refuse a feed on these grounds.

One way to minimise a potential weed problem is to restrict feeding out of any suspect fodder to a limited number of paddocks. There are several issues regarding feeding and management of sheep during drought which significantly increases the risk of importing new weeds onto farms. A brochure, 'Weed Warning - Drought, Fire & Flood', on this topic can be accessed at http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/weeds/weed-warning-drought-fire-flood

Water requirements

One of the main limitations of feeding animals through a drought is the availability of good quality water. Water is essential for animal survival and performance. Poor water quality is a common cause of under preforming animals.

Will I have enough water?

Knowing your property and how water supplies perform in times of drought is essential information for the planning phase.

Calculating the total water available and the total water required by stock over the drought period will tell you how many stock and of what class you can carry through.

To do a water budget for your property, list all the dams by paddock and calculate the water available in each one. Add these quantities together to find out the total water available on your farm.

Compare this figure with the total water required by stock to determine how many animals you can carry through.

Animal requirements

The amount of water an animal requires will depend on a number of factors including:

- the class of animal (a lactating ewe will require significantly more water than a weaner)
- the temperature and season
- the feed on offer (grains are a dry feed, while pasture contains some moisture)
- the quality of the water (water with higher salt levels will increase consumption).

Periods of high temperatures (> 38 degrees Celsius) will increase an animal's water requirements beyond the levels in Table 9.

Table 9 Stock Water requirements Litres per animal per day

Stock type	Consumption L / day
Sheep	
Weaners	Up to 4
Adult dry sheep	Up to 6
Ewes with lambs	Up to 10
Cattle	
Weaner (250-300kg)	Up to 55
Dry stock	Up to 80
Lactating first calf heifers (350-400kg)	Up to 90
Lactating cows (500kg)	Up to 100
Horses	Up to 50

How to calculate how much water you have

STEP 1

Calculate the surface area of the dam

Multiply the length and width of the dam

Example: 40m x 20m = 800 m²

STEP 2

Calculate volume

Use the following formula to calculate the volume of the dam in cubic metres.

Volume (m³) = 0.4 x Surface area x Depth

0.4 is a conversion factor that takes into account the slope of the sides of the water storage.

Example:
Volume = 0.4 x 800m x 5m

= 1600m³

STEP 3

Allow for evaporation and seepage

Evaporation will vary with dam shape and depth, the time of year and dam location. In Victorian conditions, up to 25% can evaporate between October and April.

Seepage into the water table may also need to be taken into account. Variation between dams can be significant. Regular monitoring or prior knowledge of a dam's capacity to hold water is necessary to accurately estimate how long your dam water will last. More depth may need to be taken off to account for this seepage.

Example: = 1600m³ less 25% after allowance for evaporation and seepage

= 1200m³

Calculate amount in litres

Multiply volume in m³ by 1000 to get litres

Example: 1200m³ x 1000 = 1 200 000L

STEP 4

How much will stock drink?

Use Table 9 to calculate the daily requirements of all animals that rely on the dam for their water.

Calculate the daily intake of the animals

Example: 2000 dry sheep consuming 6 litres a day will consume 12 000 litres per day.

Divide the total dam capacity by the daily water usage

Example: 1 200 000 litres /12,000 litres = 100 days of water available.

Water quality

The major water quality problem during drought is high levels of salt, although algae and animal manure can foul water following heavy summer rains or strong winds.

Young sheep have difficulty thriving on water supplies with higher than 5,000 ppm salt while adult stock can handle up to 10,000 ppm, especially once they get used to it. Levels above 10,000 ppm salt need to be treated with caution. As well as the total salt level, if the water contains more than 400 ppm magnesium salts, then the water is risky to use, especially for young sheep.

Salt content

Evaporation concentrates the level of salt in a dam. During a drought year, low water levels can result in doubling of salt concentrations over the summer.

Table 10 lists salt levels in drinking water that can be tolerated by various classes of stock. In general, the salt content of water should not exceed 10,000 ppm and the magnesium level should not exceed 600 ppm.

Pollution

During the 1982-1983 drought, many dams in northern Victoria were severely polluted by manure and dried vegetation blowing from bare paddocks. The water turned black and gave off a putrid smell. Stock stopped drinking.

Retention of ground cover on paddocks adjacent to dams will avoid this problem developing. The installation of sediment traps can also assist in preventing this issue when rain falls. Sediment traps can be made from shade cloth or straw bales to capture vegetation and manure from running into dams.

Algal blooms

Algal blooms are common over summer months when water temperatures rise as dams get shallow and the levels of phosphorus and nitrogen in the water build up.

Most algal blooms are not toxic. Some blue- green algae however, produce toxins which can have serious health implications for humans, animals and birds drinking or coming in contact with the water. It can kill animals within a few hours of ingestion.

Blue-green algae forms a scum which looks like green acrylic paint and leaves sky blue marks on rocks or plants around the edge of the dam.

If you suspect that you have a blue-green algal bloom:

- isolate all stock from the dam or water supply
- collect a sample for testing by a water laboratory (use gloves, don't allow the water to come in contact with skin)
- contact a veterinarian if animals show symptoms of poisoning (loss of appetite, breathing difficulties, muscle twitches, weakness, scours, photosensitisation – any white areas of skin become swollen and reddish)

Contact the Department of Economic Development Jobs, Transport and Resources for further advice on controlling the algal bloom.

Table 10 – Salinity tolerance levels for stock water

Type of Livestock		EC (µS/cm)	mg/L* (ppm)
Poultry	production decline begins maximum	3,100 6,250	2,000 4,000
Pigs	production decline begins maximum	3,100 6,250	2,000 4,000
Horses	health / growth affected maximum	6,250 10,900	4,000 7,000
Dairy Cattle	Production decline begins maximum	4,700 9,300	3,000 6,000
Beef Cattle	Production decline begins maximum	6,250 15,600	4,000 10,000
Lactating Ewes, Weaners	Production decline begins maximum	6,000 10,000	3,800 6,400
Sheep, dry feed	Production decline begins maximum	9,300 21,800	6,000 14,000

Minimising evaporation

To conserve water and maintain good water quality, one large deep dam is better than numerous shallow dams.

Hence, depending on dam location etc., it may be advantageous to pump the contents of a number of smaller dams into a single dam to minimise evaporative loss and save water.

Reticulating from dams rather than allowing animals direct access

Reticulating from dams avoids pugging and bogging problems and allows a more efficient use of the water. Reticulation systems however, must be simple, reliable and have sufficient capacity to meet peak demands. Schemes should include troughs.

Site troughs, tanks and pipes to suit future needs, where at all possible.

Protecting dams from wind-born contamination.

Keep adequate ground cover on the paddock to prevent material blowing into the dam in the first place.

If ground cover is already low, fencing can be used to trap blowing material before it reaches the water. A sediment fence on the windward side is a worthwhile investment.

Once material is in the dam, aeration of the water is necessary to improve its condition and make it more acceptable to stock. This is best done by pumping to a tank and reticulating to a trough. If aerated water is returned to the dam then the organisms growing on the organic material will quickly remove all the air again.

Actions to address a water shortage

Carting water

Carting water is an extremely labour intensive operation. For valuable stock it is presumably a valid option but otherwise it is best regarded as a last resort.

Check the quality of the water supply available for carting. Many streams and bores are quite salty.

Seepage and evaporation means it is not feasible to put carted water into an earthen dam – use tanks and reticulate to troughs.

Sinking bores

Investigate likely water yields and likely quality before drilling emergency bores.

Digging new dams

Do not bother when soil moisture is low. Only build earth dams when soil is moist enough for maximum compaction.

When seasonal conditions improve

Build up a contingency plan for the next dry period. Drought proof your property and its enterprises. Do not get caught by the next dry period.

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CHAPTER 4

Managing sheep during a drought

The start and finish of feeding, level of supplementation and introduction strategy are all important components of drought management. Feeding too early or too long can waste feed, while starting too late or stopping too soon can result in stock illness or deaths. Often the largest stock losses occur after the drought has broken, especially if the weather turns cold.

Unlike fire or flood, when sheep may have to suddenly rely on hand feeding alone, the onset of a drought is usually gradual. Drought conditions rarely deteriorate to the stage where no grazing is available and sheep have to rely solely on hand feeding.

Experience from previous droughts indicates that more paddock feed is available than would first appear. Sheep can scavenge quite a bit of feed from sparse, dry pasture and buried clover or medic burr. The presence of paddock feed early in a drought makes it easier to get the sheep accustomed to the drought rations before they have to be fed close to full rations.

On the other hand, the presence of paddock feed can have its down side. The gradual onset of drought can mean that producers do not notice that stock have lost so much condition that they are disadvantaged right through the drought.

From a wool quality aspect, relatively hunger fine wool can have very good tensile strength, provided that sudden feed changes are avoided. This requires vigilance in feeding and disease avoidance.

When to start

Feeding should start well before sheep become weak. It may take some time before they become accustomed to hand feeding and begin eating their ration. If sheep have lost too much condition before feeding has begun, or before they readily accept grain, it may be hard to lift their liveweight back to desirable levels. This is particularly applicable to lambs or weaners that were not fed supplements when grazing with their mothers.

A criterion often used is a weight 3 kg above the critical weight for survival or your target weight. If you start feeding at that stage, the sheep can lose weight during the introductory period without drastically altering their chances of survival or the cost to bring them back up to the desired weight.

Table 11 provides some guidance on weights to start feeding sheep to maintain them at Condition Score 2.

Table 11 – Suitable weights for starting to feed sheep to maintain at CS 2

	Average kg	Bottom ¼ of mob kg
Medium-framed sheep (50kg)	40	37
Large framed/crossbred	50-55	48

If sheep are being introduced to a straight grain diet with no roughage or standing dry feed to help maintain weight while the grain ration is built up, the weights in Table 11 need to be adjusted upwards another 3 kg.

Adult sheep above these starting weights can be allowed to lose some weight and condition at the start of a drought. This weight loss needs to be controlled. A drop in weight of 5 kg over a number of weeks and a drop back to store condition will save a lot of feed.

The period of controlled weight loss can coincide with the feeding of introductory rations. The flock can safely lose from 1 - 1.5 kg on average a week for this period. Losses of 2 - 2.5 kg (or more than 3 - 4 per cent of bodyweight), or more per week should be avoided.

Introducing sheep to hand-feeding

Sheep have to be brought onto grain gradually because a sudden change in diet can cause grain sickness or founder. If possible, educate sheep on to feed while there is still reasonable paddock feed.

Train sheep that have not been fed before by including previously fed sheep in the mob to encourage the inexperienced sheep to feed. Untrained sheep are best educated in small paddocks.

Start the ration at the rate of up to 50 grams per head per day, for adult sheep, (25 grams for weaners) and increased slowly to the full suggested ration over about three or four weeks (see Table 12).

Once the equivalent weekly rate is reached, the introduction program can stop. So, if you have decided to feed 2 kg of feed per week you can stop the program after day 17 when the stock have been established on the less regular feeding regime. If you have decided to feed only 1 kg per week, you could start feeding 300 grams every second day from day 7.

The table is only a guide to educating animals to take grain. In the early stages it is unwise to progress to higher levels of feeding until nearly all of the sheep have taken to the ration or shy feeders have been drafted off.

Table 12 – A program for bringing sheep on to grain

Feeding days		Amount of grain per feed	
		gram per head	kg per 100 sheep
1, 2	feed daily	50	5
3, 4	feed daily	100	10
5, 6	feed daily	150	15
7, 8	feed daily	200	20
9, 10	feed daily	250	25
11,12,13, 14	feed daily	300	30
15, 17	feed on alternate days	600	60
19, 21	feed on alternate days	850	85
23, 26, etc	feed every third day	1,300*	130*

* Gradually adjust to suit final ration

If many cases of grain sickness or founder (lameness) occur, particularly at the 2-3 week stage, the program needs to be modified by not increasing the ration for a few days or reverting to daily feeding.

The educational ration may be fed out in thin trails so that it can be eaten along with paddock roughage on the ground. If no paddock roughage is available, hay must be fed at as little as 10 per cent of the ration.

The above comments apply to wheat, barley, maize, sorghum and pellets, or rations with a high starch and low fibre content. Oats and lupins have a higher fibre content than the other grains and the full rations recommended may therefore be built up more quickly over a period of from 14 - 21 days, with little risk of causing digestive upsets.

A guide to the initial amount of feed you will use in the first few weeks for a flock of 1,000 sheep is provided in Table 13.

Feeding frequency

Frequency of feeding is determined by the state of the sheep, type of feed, availability and capacity of troughs, and risk of feed losses through rain, birds and other animals.

Dry sheep, and ewes up to the last 6 weeks of pregnancy can be fed 3 days apart or twice weekly. However, ewes in late pregnancy or during lactation and young weaners require daily feeding. This can be achieved with a self-feeder or by feeding hay and grain on alternate days.

Table 13 – Feed consumption in the first month of a drought*

Week	Tonnes per 1,000 sheep
1	0.8
2	1.9
3	2.9
4	3.0
(Full feeding)**	(3 to 5)

* based on table 12

** will depend on type of sheep and feed

Managing and monitoring

The management of sheep during this period and throughout the drought depends on knowing how the animals are faring.

Recommendations in this book are only guidelines, because the amount of pasture, size of sheep, value of grain and amount of energy required for walking around will vary from farm to farm. The only real way to know how they are going is to weigh them. Tag or brand 25 - 30 sheep from each mob and weigh them regularly throughout the drought. Individual tagging will give you a more accurate estimate of weight gain and loss. However, if it is easier to randomly draft sheep each time, you will need to weigh more – 10 per cent of the mob or a maximum of 80 would give you a good estimate. Knowing weight changes can save you the cost of unnecessary feeding as well as prevent deaths of sheep that slip too far before being fed or are not getting enough to eat.

A variable proportion of sheep and lambs will not adapt to drought feeding. The proportion of shy feeders depends on age, previous feeding history, ration, mob size (the proportion rises steeply once the mob size is above 400), but up to 10 per cent is not uncommon. Remove shy feeders from the mob and feed them separately. Some will eventually eat the ration. Those that don't, can be fed good quality hay, or sold.

Breaking routine or changing feed

If a break in the normal 2 - 3 day feeding routine occurs through the delay of supplies, do not resume feeding the full ration when supplies become available. Begin feeding again daily, on about half-rations, and build up to the full ration over a few days before returning to every third day.

It is especially important to avoid sudden changes in the ration. Sheep which have become accustomed to one type of grain cannot immediately adjust to another. Deaths and a high incidence of tender wool can result from a sudden switch of feed. Even the same grain type obtained from a different source has caused losses. It is desirable to estimate early in the program how long supplies will last. This will allow time for planning of a gradual changeover from one feed to another.

In the 1982-83 drought, digestive problems often occurred when a new batch of sheep pellets was fed, even when the sheep had been well accustomed to the previous batch. Manufacturers sometimes change the major grain ingredients, or change the processing procedure, from one batch to the next.

If it is necessary to use a different grain, arrange the supplies early and mix the old grain with the new, gradually increasing the concentration over at least four feeds.

Additions to the ration of 1 per cent sodium bentonite or 1 per cent salt may reduce the risk of grain poisoning during the change.

Deciding when to stop feeding

Using the rule of thumb based on condition scores, stop feeding when less than a quarter of the stock remain at a Condition Score of 2 or less, after the drought breaks. Do not do this suddenly.

In previous droughts, many properties have experienced their heaviest losses during the period immediately following drought- breaking rain.

Prolonged wet conditions turn sheep off their feed. Problems exist under these conditions if grain is fed on the ground. As soon as the first green pick emerges, sheep will chase it and expend more energy.

In most circumstances, sheep are kept confined to restricted feeding areas until adequate pasture is available. At that point, allow increasing grazing time each day until full grazing is provided after 6 - 7 days. Allowing immediate full grazing will lead to digestive disorders.

CHAPTER 5

Feeding in stock containment areas

Stock containment areas are yarded areas where stock are lot fed for survival or maintenance on a full ration. Stock containment areas enable stock to be removed from susceptible paddocks. Placing sheep in stock containment areas reduces erosion and gives pastures a chance of surviving the drought.

Lot feeding for production, such as for finishing prime lambs, is a separate issue and is not covered in this chapter. If seeking this option seek specialist advice from your local stock adviser.

During a drought there is a high risk of losing valuable soil as pasture cover reduces. If pasture cover is reduced below about 70% wind will start to blow away soil particles, causing erosion and loss of valuable nutrients and topsoil. Bare areas will also be more prone to washing when the rain does come.

Once stock have been removed, ground cover is likely to decrease further as a result of wind erosion, particularly in pastures dominated by annual species. It is important therefore to remove stock while around 70% ground cover still remains.

Improved pastures are also very vulnerable to overgrazing. Pastures that you have invested money and time in establishing can be lost if continuously overgrazed and should be among the first paddocks to consider destocking.

A paddock that has been grazed below 70% ground cover. A light wind removes considerable topsoil. Do not let this happen to your paddocks!

80% ground cover

70% ground cover. Remove stock before this point. At 70%, the bare patches are quite large and are starting to join up, creating opportunities for soil movement

50% ground cover

Feeding in stock containment areas should be considered:

- to protect vegetative cover on pastures or failed crops and to allow pastures to recover after the break
- where weeds in purchased feed are a concern
- to protect areas vulnerable to erosion
- when stock are losing weight on full drought rations in paddocks
- to facilitate stock feeding, watering, monitoring and handling.

Site

Location of the site is important and it should be set up as a permanent structure, like sheep yards, for future emergencies (drought, fire or flood) or possible lot feeding opportunities.

The site should have :

- a moderate slope and a well drained, stable soil such as a clay or clay loam
- ready access to the house
- no important remnant vegetation
- shade, shelter and good drainage
- access to good quality water and clean facilities
- minimal problems with noise and smell which will cause concern to you or your neighbours.

Consider water quality in terms of runoff. The stock containment area should be set back from watercourses and water storages by 500 metres, if no other management methods are used. A nutrient filter should be established on the down slope side of the site to prevent runoff into water storages and watercourses.

Structure

The **minimum** area required for different classes of sheep under the Model Code of Practice for the Welfare of Animals are:

Lambs (up to 41 kg) – 1m^2 per head
Adult sheep – 1.3 m^2
Ewes and lambs – 1.8 m^2

Areas between 2.5 and 5m^2 per sheep have been used successfully. Stocking heavier may have the advantage of increasing soil compaction in the containment area to reduce dust but this also very dependant on soil type. A good management size mob is about 500 sheep. If you are considering containing more than one group, you will need good subdivisional fencing as well as boundary fencing. You may consider a separate yard for grain feeding troughs as this will allow you to mix feeds and additives before stock start to eat. You will also need to consider access of vehicles, ease of filling feed troughs, water and ease of cleaning.

Monitoring stock is extremely important and you may also consider ways of weighing or monitoring a group fortnightly.

If there are trees in the area you propose to use, protect these with guards as they will be ringbarked.

Water

A good, reliable water supply is extremely important in stock containment areas. Generally stock will be fed diets very low in water content and therefore must be supplied with water at all times.

Maximum desirable salt levels for stock water are given below.

Dry sheep	10,000 ppm	(16,700 EC)
Lactating ewes	5,000 ppm	(8,3 00 EC)
Young sheep	5,000 ppm	(8,3 00 EC)

Bore water should also be tested for other toxic minerals such as magnesium. When budgeting on a water allowance you can plan for average daily consumption of 4 L per head per day, however this can change dramatically with the weather. On very hot days, intake will be greatly increased so you need to be able to supply the maximum rate of up to 9 L per head per day. Trough space is less important than flow rate. Water trough allowance does not need to be more than required in a paddock, sheep will adjust and take turns to drink at the trough. A good rule of thumb is that the flow rate should pump enough water for the mob in 2 or 3 hours.

Troughs need to be checked daily and cleaned regularly.

Feed

Allow 15 - 20 metres of double-sided trough for 100 sheep. Use the bigger area for large or full woolled sheep.

Feed troughs can be bought or made cheaply from materials like roof capping, folded roofing iron and suspended cloth.

Full rations for different classes of stock are given in Chapter 3. If you wish to keep stock in better than store condition you could increase rations 20 - 30 per cent. As stock will not have access to any pasture, inclusion of roughage is important. Ideally 30 per cent hay should be included but as hay is very expensive during droughts the proportion can be reduced to 10 per cent. Hay in the diet is likely to cause less problems with grain poisoning and is the safest to increase quickly in cold conditions and with shorn sheep.

As outlined in Chapter 3, the deficiencies likely to occur with high grain diets as in a drought or lot feeding are sodium, calcium, fibre and Vitamins A, E and B1. Adding a 50:50 mixture of limestone and salt at two per cent to the grain will fulfil sodium and calcium requirements. Roughage will be adequate with some hay or straw in the diet, especially with grains of low fibre content. Oats has about 12 per cent fibre, compared to barley at 5 per cent and wheat at only 2 per cent.

Management

Adult sheep are the easiest to manage in a feedlot. Feedlotting ewes and lambs should be avoided if possible. Adult sheep, weaners and hoggets should be yarded separately. Sheep must be vaccinated against enterotoxaemia (pulpy kidney) if the ration is high in grain. They should be drenched into the area, worm tested regularly, and ideally drenched before being released.

It is better to start sheep on grain in the paddock before introducing them to a feedlot situation (two weeks). If you can't do this, make sure that most of the diet in the first two weeks is hay and then increase the grain ration gradually. Start at 50 g per head per day grain and make up the rest with hay building up to the desired ration over two weeks. Feed your best hay first and feed hay before grain. Start off feeding daily for the first two weeks and then cut down to two to three times a week. You can then feed hay one day and grain the next.

It may take a while to get the ration right and, as the cost of feed is especially high during a drought, consider weighing 20 - 50 sheep regularly. Over and under feeding is costly. Aim to keep older stock at a minimum of Condition Score 2.

There will always be a number of sheep that do not take to a lot feeding situation and should be identified regularly and removed to pasture, smaller yards or sold.

In cold, wet and windy weather, increase the feed by 30 per cent, preferably by feeding more hay. With recently shorn sheep, increase the feed by 50 per cent. If extra hay is not available, give one extra feed during the week. Replace any feed wasted, as a result of rain damage, with new feed.

Releasing sheep

When the break does come, the change in feed can be quite sudden and may cause digestive problems. Therefore, when you are considering releasing the sheep from the containment area, do it when sheep have a full stomach and continue to feed hay for a few days. Ewes that are lambing may need the full ration for a few weeks. There have been reported cases of hypocalcaemia in late pregnant ewes, despite being fed sufficient limestone. Removing ewes in late pregnancy from access to feed, such as by mustering or crutching has been the most common cause. It may also occur due to a reduced ability to maintain calcium balance with limestone supplemented diets and/or poor absorption of calcium from green pastures post the drought breaking.

Strategies to prevent this may include ensuring that ewes are not stressed or off feed for long periods. Restricting limestone in the diet for 2-3 weeks pre-lambing may assist in the ewes' ability to mobilise and absorb calcium. Feeding of roughage on short lush pastures may increase calcium absorption. Older ewes are more susceptible.

Growers' Experiences

A considerable number of farmers have used stock containment areas or drought lots during droughts. The most recent study of their experiences was produced by Australian Wool Innovation (AWI) after 2002. Some of the key messages from this were:

- 85 per cent of the reasons for deaths in a containment area was due to acidosis and shy feeders (or poor doers).
- Reducing death rates from acidosis includes training animals onto grain carefully, including roughage and taking care with diet changes (including releasing onto pastures)
- Shy feeders must be removed from containment areas regularly and this needs to be more frequent as mob size increases
- Mortality can be reduced and production improved by having stock densities at about 2,000 sheep per hectare and mob sizes at 1,000 or less.
- Including roughage reduced death rates and also the number of poor doers. This response was better with straw than with hay.
- There were no advantages of feeding in troughs rather than on the ground with mob sizes less than 2,000 head. In fact, at low mob sizes there were fewer deaths with ground feeding, possibly due to reduced smothering and better feed access.

Animal health

Experiences with stock containment areas in South Australia in 1988 showed that pregnancy toxaemia was the next most common problem after acidosis. This can be reduced by recognising the higher demands of ewes in late pregnancy. A full late pregnancy ration should be reached by 6 weeks prelambing. Feed at least 20 per cent of the ration as hay.

Accidents, pulpy kidney, suffocation and flystrike were other causes of death. The problem where sheep are confined to small areas is that if there is any disease it can spread very quickly. Therefore, diseases like flystrike and pink eye need to be identified quickly. Problems have been experienced with changes in batches of processed feeds and even with new sources of grain. Therefore, some caution should be taken when changing to a new load of feed, such as mixing the new and old over a number of feeds.

Stock need to be monitored daily and sick animals removed. Avoiding stress such as boggy ground, overcrowding, dust and irregular feeding will help reduce diseases such as Salmonellosis and Pneumonia. Regular cleaning of feed and water troughs will also prevent diseases.

General

Farmers who lot fed in previous droughts believed it to be a worthwhile exercise, and it is now part of future drought management strategies. However, managing a stock containment area involves a transition from a broad acre manager to an intensive manager where you are in control. All feed and water is supplied by you and sick sheep can't go off by themselves and sit in the shade. It therefore does require constant vigilance and good management. It also means you can have better control over weight loss and gain and come out of a drought with valuable land assets and stock numbers intact.

Further information is available at www.agriculture.vic.gov.au/drought

Case Studies – Stock containment areas

1. NEIL, SUE, DAVID AND JACQUI ALLEN

The Allens farm wool and crops near Mitiamo in North-Central Victoria. In 1995 they put 1,500 merino ewes in stock containment areas from January to mid-April. They found the ewes adapted well in the containment areas and repeated this in 2002. The site was chosen because it has a gentle slope, trees for shade and water access close by.

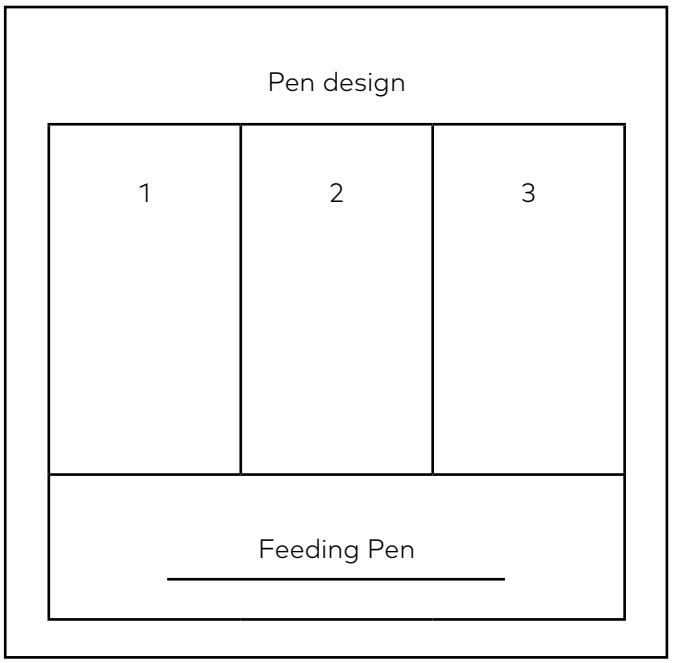
Stock management

The sheep are stocked at 1 sheep per 5 metres (or lower density depending on mob size). They are in mobs of approximately 300 - 500 (so three pens) but also have a separate pen for feeding which covers the length of the pens, as shown in the diagram (top right). This allows the troughs to be cleaned out easily and also to feed out without having to get in and around the sheep. This design has also reduced the trough space required as the mobs alternate every day into the troughs for grain. Troughing is steel railway sleepers upside down.

Ewes are joined in the containment areas in January. In 1995, ewes lambed in May–June in the paddock with 80 per cent lambing.

In 2002, maiden ewes were released onto stubbles for joining and adult ewes joined at fatscore three in the containment areas at 0.5 to 1 per cent rams.

Pen Design



In 1995, the Allens fed oats and hay and had no problems with acidosis. In 2002, sheep were fed pellets and hay but they experienced problems when the pellets were fed after a day of no feed. The program was changed so that pellets were fed after hay.

Feeding program:

Day 1 – hay in pens (2 kg per head per week)

Day 2 – pellets in feed pen (2.8 kg per head per week)

Day 3 – nothing

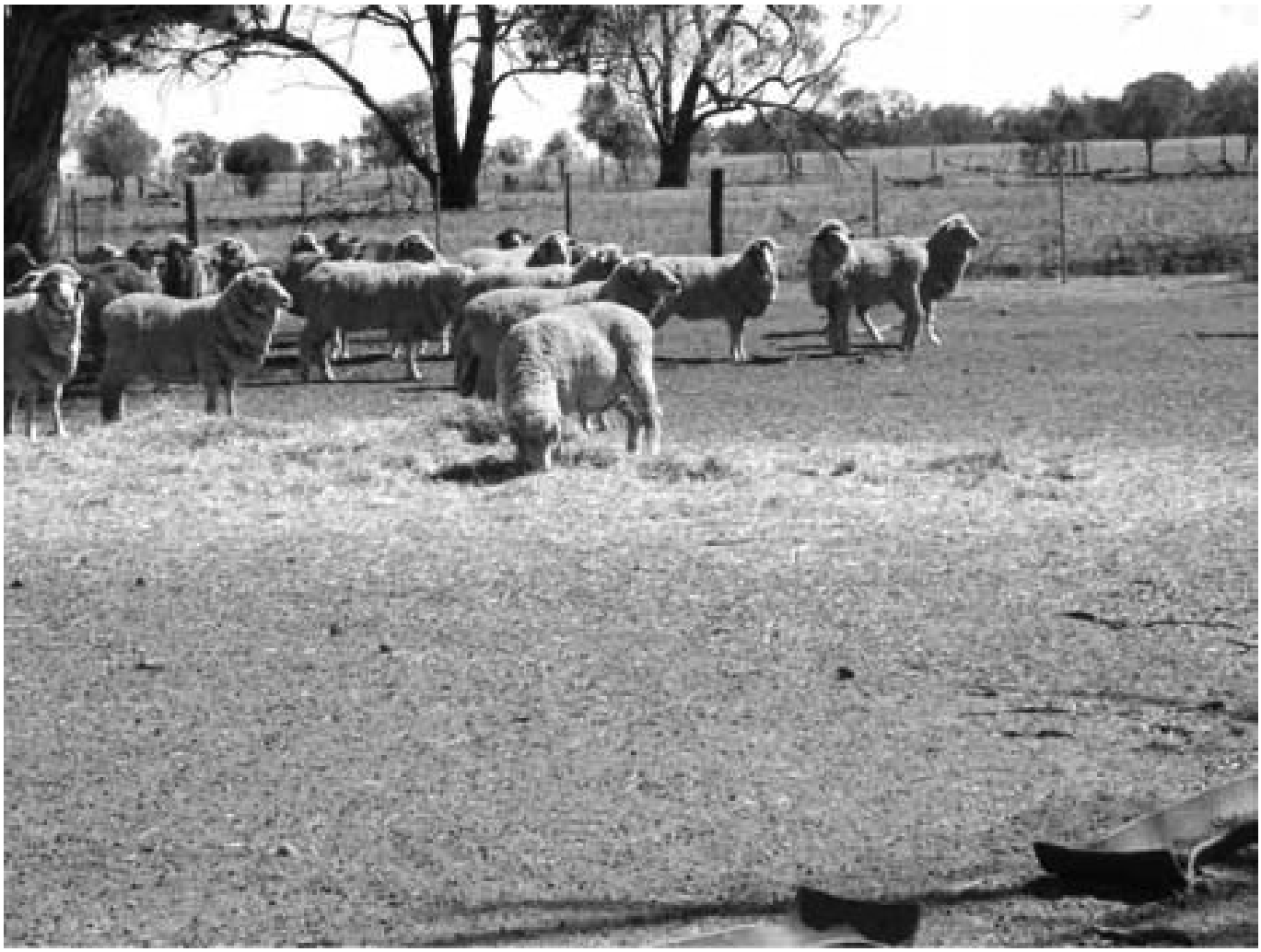
The grain is fed in the separate feeding pen and the sheep are given access for 24 hours and then go back into the stock containment areas. At this feeding rate, the ewes lifted in condition for joining (these are ewes at about 60 kg in Fat Score 2.5 - 3). The hay was very good quality – 9.6 MJME per kg.

Water

Each pen has one 12 foot water trough (about 600 litres). Water is supplied by pressure with gravity as a back up and provides water flow of about 50 litres per minute. Troughs are cleaned out weekly.

Wool quality

The Allens shear in March. In 1995, the wool quality of the ewes in the stock containment areas was fairly similar to a normal year. Yield was 62 per cent (compared to 67 per cent normally) and staple strength was 37 N per kTex.



2. CHARLIE CROCKER

Charlie and Marie Crocker ran a wool producing enterprise near Violet Town. In 1994, Charlie decided to put adult sheep into stock containment areas to retain the high investment in improved and fertile pastures. Pens were set up to hold mobs of 1000 sheep stocked at roughly 1 sheep per 2.5 m^2. Pen design was a simple, 6-line ringlock with one plain wire and no stay assemblies.

Location was along an unused roadside that provided afternoon shade and had easy access to water. Soil type is a sandy loam.

Stock management

Sheep were vaccinated and drenched into the sites in January 1995. Tail enders were taken off. For example, in the wether mob about 100 were taken out over two drafts and remaining sheep maintained condition well on the ration provided.

The ewes were joined in the feedlot at 2 per cent. Lambing percentage was 50 per cent – given they were maiden ewes in a drought, this was not too bad.

Feeding

Feeding in the containment areas was pretty easy. Once the sheep were used to the routine, the tractor could be driven in to fill the troughs without sheep running round the vehicle. The troughs were placed near the fence which also helped. After a while they didn't need to shut the gate while feeding.

The sheep were fed three times a week, Monday, Wednesday and Friday and the Crockers had the weekend off. They were fed 3 kg wheat per head per week plus hay on Friday. When the break came and it got wet and cold, the area was very wet so they increased the hay feeding. Limestone and salt were added, using a bucket, directly into the feeder.

They started feeding on sawdust, but due to some concern about salmonellosis, used troughs which could be cleaned out. They got some decking iron from a yard in Melbourne, which meant the tractor could easily straddle the troughs for ease of feeding. The hay rolls were fed out on the sawdust.

Wool quality

The wethers were shorn in late January and the ewes were May shorn. The wool was tender – either because of acidosis getting the sheep onto grain quickly or when they were let out onto green feed. They tried feeding hay to reduce the changing feed but it is hard to stop the wool breaking with these feed changes.

Dust wasn't a problem. The sheep were stocked at this density to increase compaction in the pens.

Water

Each mob of 1,000 sheep had one four foot diameter concrete trough with one inch polypipe (trough capacity of 500 litres). The troughs were on the garden pressure pump. The flow rate was about 35 litres per minute - and this kept up to the sheep. The system was also hooked up to a gravity system as a back up if there was a power failure.

Tips

Pens and troughs can be made quite cheaply, using laneways is a possibility. The system worked well and will be repeated. High stocking density was a key to the dust problem and removing shy feeders into another pen helped retain good health of the mob. Getting sheep onto grain slowly in the paddock will help reduce acidosis problems getting them into the pens.

Troughs can be made cheaply using materials on hand

Where containment areas are close to dams, or water ways, silt traps are required to protect dam or stream water quality

CHAPTER 6

Sheep health

Past experience indicates that if sheep remain in good store condition during the drought then they will experience very little disease – in fact, less than in a normal season. However, if the stock are stressed, then diseases are much more likely to occur.

Regardless of the care you take, there are a number of conditions that may occur in drought-feeding situations, especially when sheep are congregated onto small areas for feeding. You do need to keep an eye on the health of your sheep. In addition, the type of disease likely to occur will change as the drought progresses. You should contact your animal health adviser about recommendations for prevention and control if you have any concerns.

Most common diseases

Pregnancy Toxaemia (twin lamb disease) and Hypocalcaemia

Pregnancy toxaemia is a metabolic disorder of ewes that may occur in the last six weeks of pregnancy. It is caused by a lack of energy in a period when there is a high demand causing a rapid breakdown of body tissue. Therefore mature pregnant ewes with inadequate nutrition are susceptible and those in poor condition, or over-fat or with twin or multiple lambs are most at risk. Pregnancy toxaemia can be induced by stress or other conditions causing low intake (eg. worms, foot abscess and yarding).

The disease usually appears over several weeks with a few ewes showing signs of standing alone or lagging behind, unsteady walk and apparent blindness. Clinical signs may progress over a number of days. Ewes that are down become very dull and finally may go into a coma. Occasionally the foetus dies and the ewe recovers, though often with difficulty during lambing. Clinical signs of Pregnancy Toxaemia are the 'tip of the iceberg' and are a sign that the mob is underfed. Severe under-nutrition in late pregnancy and lactation will have other production impacts on poor lamb growth, survival and long-term production.

Treatment with registered products containing propylene glycol may be successful in the early stages, especially if ewes are still able to stand. Ewes that are down or in a coma usually die despite treatment. Good quality supplementary feed should be provided to, at least, those ewes most at risk. Prevention involves close observation, supplementary feed and careful management during the last weeks of pregnancy.

This disease should be differentiated from Hypocalcaemia, which is also seen in late pregnancy and early lactation but caused by metabolic calcium deficiency. The disease occurs over a short time frame and usually affects more ewes in the flock. Stock that have been held in yards overnight prior to transport or shearing may also develop hypocalcaemia. The only clinical sign may be sudden death during or after transport. Grain diets can predispose stock to this condition and prevention relies on the addition of 1 - 2 per cent ground limestone to the ration.

There have been reported cases of hypocalcaemia in late pregnant ewes, despite being fed sufficient limestone. Removing ewes in late pregnancy from access to feed, such as by mustering or crutching has been the most common cause. Hypocalcaemia may also occur due to a reduced ability to maintain calcium balance with limestone supplemented diets and/or poor absorption of calcium from green pastures post the drought breaking.

Strategies to prevent this may include ensuring that ewes are not stressed or off feed for long periods. Restricting limestone in the diet for 2-3 weeks pre-lambing may assist in the ewes' ability to mobilise and absorb calcium. Feeding of roughage on short lush pastures may increase calcium absorption. Older ewes are more susceptible. Animals with hypocalcaemia may respond to treatment with calcium solution.

Grain poisoning (Acidosis)

Grains are carbohydrate rich foods and if excessive quantities are eaten, there is a sudden change in the microbe population in the rumen. This leads to the formation of large amounts of lactic acid which causes grain poisoning. The same effect may occur with a change in grain types.

In practice the condition commonly occurs:

- when sheep are introduced to grain too quickly
- when there is a sudden increase in the amount of grain being fed
- when there is a change in the type of grain or concentrate being fed or even the same grain type but from a different source
- when feeding pellets and other highly digestible carbohydrates such as bakery bi-products.

Clinical signs vary from mild to acute depending on amount of grain and previous experience with grain. In milder cases sheep have a depressed appetite and are unstable on their feet. In severe cases symptoms include scouring, abdominal pain, acute lameness with heat and pain around the feet, apparent blindness and death.

Initial management involves removing the immediate source of grain, assessing the flock and sitting up any sheep that are down. Treatment is based on neutralising the excessive rumen lactic acid. Treat any affected sheep with 15 grams of sodium bicarbonate in 1 litre of water as an oral drench. Most sheep once down, however, will rarely recover despite treatment. Valuable stock should receive veterinary attention. The flock should be given roughage such as hay until recovered. Monitor faecal consistency and drafting off the affected cases may be practical in large mobs with small numbers affected.

To reduce the risk of this condition, follow guides for introducing sheep to grain (Chapter 4). When changing feeds, do so gradually and ideally mix the new feed into the old feed over at least four feeds and before the old feed cuts out. Adding 2 per cent sodium bentonite to grain rations will help reduce the risk of poisoning during grain introduction.

Pulpy kidney (Enterotoxaemia)

Pulpy kidney is an acute toxaemia caused by clostridial bacterial in the intestine. This disease is more common in sheep when there are changes in diet and upsets. Clinical signs are sudden death with rapid rotting of the carcase.

All stock should be given a 5:1 or 6:1 booster vaccination prior to feeding. If in doubt about the vaccination status of the sheep, give two vaccinations 4 - 6 weeks apart. On occasions, another booster may be required as the drought progresses if sheep are dying with the telltale symptoms.

Ovine Johne's Disease (OJD)

OJD is a fatal wasting disease of sheep. Many sheep infected with the bacteria may carry the bacteria in the gut and spread the disease without showing obvious clinical signs. During periods of stress and crowding shedding of the OJD bacteria may increase and more animals may become infected. Therefore it is important that sheep in containment areas are vaccinated against OJD.

Worm and liver fluke infestations

Normally worms are not a problem during hot dry conditions. However, sheep that are stressed for any reason may have reduced immunity and may show the effects of worm infestation. Clinical signs are illthrift, anaemia and scouring. However, if sheep are scouring it may not be worms. It is important to determine the cause of the scouring before reaching for a drench gun.

When worms are confirmed by either a faecal egg count or post mortem, drench the sheep with an effective drench. Worm burdens should be regularly monitored through the use of faecal egg counts.

Liver fluke is more common in dry times when sheep graze wet fluke-prone areas such as wet gullies and creek beds. Chronic fluke results in anaemia and illthrift. Severely affected sheep can develop bottle jaw and die suddenly. It can be confused with barbers pole worm. If in doubt consult a vet or submit faeces for a worm and fluke egg count. Affected sheep should be treated with a flukicide that effectively removes both mature and immature fluke.

Less common diseases

The following are a range of other diseases that can be encountered during a drought. The list is not exhaustive and you should contact your animal health adviser for an accurate diagnosis and remedial action.

Plant poisoning

Often plants not normally considered toxic may be eaten in excessive amounts and can cause mortalities. In drought situations, hungry sheep will eat plants that are not normally eaten. Seek veterinary advice if plant poisoning is suspected, as there is a wide range of plants which can cause problems during a drought.The introduction of hungry stock onto any new feed sources (e.g. failed crops or even young rapidly growing pasture following rain) may cause stock losses so it is important to introduce sheep gradually to new diets. If sheep are kept in containment areas over a drought, ensure they have ready access to hay and other supplements during the first few days of release into a paddock.

Urea poisoning

This problem can be caused by intake of excess amounts of urea from blocks or in mixed feed. Another possibility of urea poisoning is when sheep drink pools of water on the top of urea blocks after rain. Try to ensure that urea is mixed thoroughly with feed when used as a supplement. Keep urea blocks out of the rain in sheltered areas.

Salmonellosis

Faecal contamination of feed and water supplied with Salmonella organisms can cause an outbreak in stressed sheep. It is more likely to be a problem when the area becomes wet or muddy following heavy rain or from overflowing water troughs and large mobs are feeding from the same area. Symptoms are fever, scouring and sudden death. Treatment requires antibiotic treatment and advice should be sought from your vet. Try to reduce the risk by feeding on new trails or clean troughs, if possible.

Urinary Calculi (bladder stones)

The common predisposing cause is a limited water intake. This can occur as a result of faecal contamination of water, stagnant water or a high salt content in the water. Losses can also occur when sheep are fed on grain rations for over three months without a calcium supplement. It is usually only a problem in rams and wethers. Affected sheep may be dull and down or found after sudden death. There may be a grossly enlarged or even ruptured bladder caused by obstruction to urine outflow, or 'water belly' due to urine straining. Treatment is rarely successful. The disease is best avoided by providing the sheep with the highest quality water possible at all times and adding ground limestone when feeding grain.

Pneumonia

Pneumonia is caused by bacterial infections aggravated by dry dusty conditions. It is more common with lambs being fed on dry, dusty feeds in troughs, especially finely hammer milled hay. Symptoms are nasal discharge, coughing, illthrift and sudden death. To lower the risk of this disease, avoid feeding dry and dusty feeds. This may require some damping down of the feed in troughs.

Vitamin A deficiency

Vitamin A deficiency can occur in lambs born to grain fed ewes in drought. Grain and most hays are low in Vitamin A. Lambs must be completely off green feed for some months before clinical signs will occur. For further details, see the section on Minerals and Vitamins (Chapter 3).

Vitamin E deficiency

Vitamin E deficiency is often associated with feeding weaners on hay or grain over extended periods, especially young weaners. Affected animals appear bright and alert but they are reluctant to stand. In other cases there is sudden death. Examination of dead animals reveals pale muscles.

Vitamin E and selenium deficiency may have an interrelationship and present with identical signs. Again see the section on Minerals and Vitamins (Chapter 3) for further details.

Polioencephalomalacia (PEM)

PEM occurs due to a deficiency in thiamine (vitamin B1). It can occur in feedlot animals due to reduced intake or destruction of thiamine as a sequel to acidosis. Sulphur toxicity may also lead to PEM. Typical signs include blindness, aimless wandering and a 'star gazing' appearance.

Coccidiosis

Stress and overstocking of lambs and weaners under warm, moist conditions can precipitate this disease. The clinical effects are aggravated by concurrent worm infestations. Signs are scouring with watery faeces which may contain blood, lack of appetite, and dehydration, with anaemia and illthrift in some cases. Consider a faecal worm test to differentiate from worms and fluke and consult a veterinarian for treatment and management advice.

Chronic copper poisoning

Long-term excessive intake of copper in the diet, or as a result of a build-up of copper associated with liver damage caused by grazing on Paterson's curse or heliotrope. The disease is brought on by some form of stress (for example, nutritional or lactation stress).

Listeriosis (circling disease)

This is caused by bacterial infection which may harbour in silage or possibly associated with close intense grazing. The condition occurs sporadically and there are two main disease patterns that generally don't occur together:

- single animals may be found circling or wandering, uncoordinated, convulsing or dead
- a syndrome of abortion in ewes and death of newborn lambs.

Remove silage from sheep and replace with hay while seeking veterinary advice for a definite diagnosis.

Animal welfare

All farmers realise that animal welfare is an important issue at all times, but especially during a drought. Owners and their advisors should consider animal welfare as a major issue in their development of drought relief strategies.

Stock owners and managers have an obligation to, at all times, provide proper and sufficient food, water and shelter for stock under their care. Failure to do so contravenes the *Prevention of Cruelty to Animals Act* and may result in severe fines or even imprisonment.

Activities, such as shearing or transport, may exacerbate problems associated with sheep in average condition. An outbreak of any disease or condition which reduces intake, such as high worm burdens, footrot or pregnancy toxaemia will have a bigger impact than on sheep in good condition.

Sheep must not be allowed to starve to death. Where water and food requirements cannot be met they should be agisted, sent for slaughter or humanely destroyed on the property. See Appendix 1. Use of Firearm and Captive-bolt Stunner (Pistol) for euthanasia of sheep.

Producers should act early while stock are fit and strong, as delays usually reduce the number of choices available. Any decisions must be humane and reasonable.

Drought affected sheep are highly susceptible to stress and require careful handling if they:

- are unable to rise and walk they should be humanely destroyed on site
- go down after limited exercise they are not fit to travel and should be humanely destroyed on the property
- are still able to walk they should be agisted or sent directly to the nearest slaughtering plant. They should not be consigned through saleyards.

(From the *Code of Practice for the Welfare of Sheep*.)

Destroying stock on property is often a distressing task, so seek advice from DEDJTR officers and other farmers who may be undertaking the same task.

CHAPTER 7

The feed value of unusual feedstuffs

There is a wide range of unusual feedstuffs that can be safely and effectively fed to livestock.

Although such feedstuffs are commonly available in a fairly regular supply, inquiries about their value for feeding to livestock increase when feed for grazing livestock is short, such as during droughts.

Apart from these unusual feedstuffs generally being of poor nutritional value, they can also contain chemical residues that can cause contamination of meat and animal products when used as livestock feed.

All supplementary feeds may contain chemical residues. However, unusual feedstuffs not normally used for feeding livestock pose a much greater risk, because residue transfer assessments are unlikely. The same applies to imported feedstuffs, which may have high feed value to stock, but have an unknown history of chemical usage.

Agricultural chemicals used on fruit and vegetable crops are typically designed to be eliminated from the edible parts of the plant at harvesting, however some residues may still be present and in some cases concentrated, in the waste plant material after processing. It is when this waste plant material is fed to stock that problems can occur.

Residues can result from the capacity of stock to eat a greater quantity of the fruit/vegetable than humans.

Agricultural chemicals are not designed to be ingested by livestock. Unless animal residue studies have been conducted, little is known about the effect of these chemicals on stock and about the persistence of residues of these chemicals in animal tissue.

There is a very real possibility that the meat and animal products from stock fed unusual feedstuffs containing chemical contaminants will themselves become contaminated with these chemicals. This can impact severely on trade and market access as well as animal and human health.

For this reason, the best policy is to not feed unusual feedstuffs to stock without first establishing that the material is suitable. Producers should ask the supplier of unusual feedstuffs to certify that the material they are supplying is suitable for the purpose for which it will be used. A by-product vendor declaration should also be requested to verify this information. This will allow the producer to see the full chemical use history of the potential feed.

Ideally, unusual feedstuffs should be tested for chemical contamination by an accredited testing laboratory before being used as drought feed, although this in itself may not provide a satisfactory guarantee of suitability as analytical tests typically only screen for a narrow range of chemicals. It should also be noted that the chemical content of unusual feedstuffs may vary from batch to batch.

It should also be realised the composition of many feedstuffs varies widely because of differences in climate, soil conditions, maturity, variety, management and processing factors.

Therefore, the data presented in this chapter should be considered as a guide rather than a precise statement of nutrient composition.

Before finalising plans to feed any by-product or unusual feedstuff to livestock, it is advisable to have a sample analysed by a feed analysis service.

Most by-products and unusual feedstuffs should be used with caution and introduced into rations gradually, even when low prices favour their use. Factors to consider about unusual feedstuffs are: their nutritive value, palatability, possible toxicity or contamination with pesticides or heavy metals and the effects upon digestion and utilisation of the total ration. The use of by-product stockfeed needs to be declared when completing National Vendor Declaration forms.

SAFEMEAT, a partnership between the red meat and livestock industries and Commonwealth and State Governments has conducted risk assessments on the use of unusual feedstuffs.

Producers can obtain copies of these risk assessments from the SAFEMEAT website at http://safemeat.com.au/key-issues/chemical-residues.htm

High moisture content feeds

Stock can eat up to 3.5 per cent of their liveweight per day when the feed is in a dry form, such as hay or grain, but they cannot eat as much dry matter if the feed has a high moisture content.

Fresh, high-moisture feeds are often quite palatable to livestock but most such feeds will ferment and sour quickly unless they are dried or ensiled.

Blending and levels of feeding

Many unusual feedstuffs are a reasonable source of energy for the livestock - but quality can be variable. It is very important that any new feedstuff be gradually introduced to livestock over a period of about two weeks.

As a rule of thumb, most unusual feedstuffs can be effectively incorporated into the rations of livestock to a maximum of about 30 per cent of the total ration without any significant influence on the health of livestock.

Types of feeds

Stock feed is usually categorised as either concentrates (high in energy) or roughage (higher in fibre, but lower in energy). Concentrates can be high in either energy or protein content. Protein concentrates generally contain more than 20 per cent crude protein.

By-product energy concentrates

Almond hulls

Almond hull products vary considerably due to varietal differences and harvesting procedures. Soft almond hull, having about 10 per cent fibre, is a good feed and has about 85 per cent of the energy value of barley grain. However, some supplies of almond hulls are contaminated with sticks, dirt, hard shells and other foreign materials at harvest time. This greatly reduces their feeding value and acceptability by livestock.

Almond hulls can be used as a partial roughage replacement when roughage supplies are short and forage prices are high.

When mixed with other ingredients in commercial concentrate mixes, almond hulls usually are restricted to 20 per cent or less in order to maintain high nutrient levels and palatability of the concentrate mix. In complete feedlot rations, almond hulls are limited to about 30 per cent or less.

Apple pomace

Apple pomace is the by-product of apples used for cider or vinegar production. It can be fed fresh, ensiled or dried.

Two problems have hampered feeding of apple pomace in recent years. Pesticide contamination has been a problem in some areas, making the pomace unacceptable in dairy and (occasionally) sheep and beef rations. A second difficulty is that urea or other non- protein nitrogen compounds should not be fed with apple pomace due to the possibility of abortions or abnormalities of offspring. The reason for this is unknown.

Apple pomace is a highly palatable feed, medium in energy but very low in protein. When properly supplemented, it can replace up to about one-third of the concentrates in rations and 15-20 per cent in complete feedlot rations.

Bakery waste

Large amounts of unsold bread, doughnuts, cakes and other pastries are available in some areas and are excellent energy sources for ruminant rations. Bakery waste however, may potentially contain meat or other animal protein and so should be used with caution and in accordance with ruminant feed ban legislation.

They are usually high in fat and low in crude fibre. Protein levels (on a dry-matter basis) in the range of 10-12 per cent are typical. The low fibre content of the baked material and the baking process itself result in a feed which tends to stimulate ruminal propionate and reduce ruminal acetate production. This is desirable for feedlot livestock being fattened for market.

Up to about 10 per cent can be included in feedlot rations when supplies and economics are favourable. Supplies should be fed quickly.

Brewers' grains

Brewers' grains have 20 - 25 per cent crude protein (on a dry matter basis), making them a good protein source in addition to their energy value.

The brewing process makes this protein less soluble than that from many protein supplements. This could be valuable in rations, such as silage supplement with non-protein nitrogen, which contain large amounts of soluble protein.

Brewers' grains are fed both wet and dried. In the dry form they have about 80 per cent of the energy value of barley grain (the energy value varies depending on the brewery and additives used in the brewing process). They are not as palatable in the dried form as the original grain and usually are included as 25 per cent or less of a dairy concentrate mix, and 1 - 20 per cent in feedlot rations.

Citrus pulp

Citrus pulp is classified as a concentrate but is also valuable as a partial roughage replacement because of its high level of digestible fibre.

It commonly contains about 15 per cent crude fibre in the dry matter. Its energy value is about 94 per cent the value of barley grain. It has only about 7 per cent crude protein in the dry matter.

Citrus pulp is usually fed dehydrated. It must be introduced gradually into a ration to let stock get accustomed to its distinctive smell and taste. Levels up to 15-20 per cent are acceptable in feedlot rations.

Citrus pulps can also be fed fresh or as silage. Both are very acceptable to stock but pulp and peels from lemons are somewhat more acceptable than those from oranges and grapefruit. Transportation costs preclude the wet pulp from being fed very far from processing plants.

Citrus pulps are high in calcium and low in phosphorus, and aggravate the high calcium- to-phosphorus ratio in a ration when fed with legumes such as lucerne. Unless counter- balanced by other feeds low in calcium and high in phosphorus, citrus pulps can result in higher incidences of milk fever in cattle at, or soon after, parturition.

Fat

Fats and oils have an energy value about 2.25 times that of carbohydrates. Fats are also used to settle the dust and as a lubricant for feed processing. About 2 - 5 per cent fat is an acceptable level in commercial feedlot rations. Care must be taken to ensure the fats and oils are not contaminated with extraneous chemical during collection, storage and use. Tallow and used cooking oil may only be used when in accordance with Ruminant Feed Ban Regulations.

Grain screenings

Grain screenings result from the cleaning of small grains before they are milled for human consumption. The best grade of screenings consists primarily of broken and shrunken kernels of grain, wild oats and other palatable weed seeds. When ground, good screenings approach grain in feeding value and have been used as 25 per cent or more of concentrate mixed and 15 - 20 per cent in feed rations. However, light, chaffy screenings are much higher in fibre and resemble straw more than grain in feeding value. Such screenings should be restricted to 10 per cent.

Grape pomace or marc

Grape pomace or marc is the refuse in the production of grape juice and wine. It consists mainly of some combination of grape seeds, stems and skins. It has little feeding value, being very variable in both energy and protein and highly variable in dry matter. When included in a concentrate mix, it can be considered only as a filler to reduce the price of the mix. With new harvesting and winery techniques, grape pomace containing few or no stems can be produced. This waste feed has been fed successfully to a 15 - 20 per cent level in complete feedlot rations.

Grape marc has been found to be extremely palatable to sheep. Lambs in pen trials have consumed 350 grams per head per day when fed with straw. This diet was effective in reducing weight loss only.

Studies have found partitioning of oil soluble chemicals in grape seeds at violative levels, which would readily transfer to animal fat upon ingestion. There are also concerns regarding residual levels of copper, which can be toxic to stock, used in fungicides on grapes.

Onions

Onions have been fed successfully to sheep and cattle and they eat them readily. They can cause anaemia in sheep so it is recommended to introduce onions over a period of time and only up to 50 per cent of the total ration.

Molasses

All types of molasses are good energy sources but are low in protein. The energy value of cane molasses decreases rapidly when it is increased from 10 - 30 per cent of the total ration. In feedlot rations, up to 15 per cent is an acceptable level. Molasses and urea have been added to poor quality straw to improve both palatability and protein levels of straw when the main component of a diet.

Rice bran

Rice bran results from the processing of rice grain for human consumption. Besides the bran itself, it contains the germ from the grain and fragments of the hull not removed in milling. Levels of up to 15 per cent have been fed successfully to livestock. At these levels, it is roughly equivalent to wheat brain in nutritional value.

Wheat bran and other wheat by-products Wheat bran consists of the coarse outer coatings of wheat kernels. It is a bulky feed which is relatively high in protein and phosphorus. It is highly palatable to livestock and is utilised efficiently when included up to 25 per cent of the concentrate mix. About 10 - 20 per cent of wheat bran and other wheat by-products can be used in feedlot diets.

The bulky nature of wheat bran and its high phosphorus content make it a popular by- product feed for livestock.

Whey

Whey is the residue from cheese production and consists primarily of lactose, minerals and water. It can be fed dry or liquid. Pollution control regulations and the high cost of drying have resulted in increasing amounts being used as feed liquid in recent years.

Dried whey is a major component of many dry milk replacers fed to calves. It is usually too expensive to be included in rations for older animals, but sometimes is included at low levels in pelleted feeds because of its binding characteristics and nutrients.

Liquid whey contains only 6 - 7 per cent solids and must be fed quickly or it will spoil. In cool climates it can be stored for 3 - 4 days before feeding. In warm climates it should be fed the same day that it is delivered.

Liquid whey is frequently available for only the hauling costs, making it an inexpensive source of nutrients for animals located near cheese plants. However, supplies are often variable and storage of whey attracts fly problems.

Tomato pomace

The feeding value of tomato pomace on a dry basis is comparable to good-quality hay.

Variability (especially moisture content) is one of the main problems associated with the use of this by-product feed. In one study, dry matter varied from a high of 27.5 per cent to a low of 11.9 per cent. Pesticide contamination can also be a problem with tomato pomace.

By-product protein concentrates

Many crops grown for oil production also produce by-products high in protein. These by-products are the primary source of supplemental protein in livestock rations.

These include coconut meal, corn gluten meal, cottonseed meal, linseed meal, safflower meal, soybean meal and sunflower meal. Some of these have high fat levels and so should not be fed as the whole diet.

Additionally, such by-products as distillers' grains are used extensively as protein supplements in livestock rations. Brewers' grains, previously discussed as an energy feed, are also relatively high in protein content.

Coconut meal

Coconut meal, popularly known as copra, is one of the most palatable feeds available for livestock. It is high in energy and contains about 20 per cent protein. Rancidity can be a problem during storage if the meal is high in fat but high- fat copra contains considerably more energy than copra produced by the solvent process.

Cottonseed meal

Cottonseed meal is a by-product of the production of cotton lint and cottonseed oil. It contains about 40 per cent protein and is well liked by livestock. The amount of oil left in the meal affects its energy value (amounts vary according to the method of processing).

However, energy levels are somewhat lower than those found in some other protein supplements such as coconut meal, soybean meal and linseed meal.

Linseed meal

Linseed meal, the by-product of the extraction of linseed oil from flaxseed, is an excellent protein supplement for livestock. Protein content varies from about 30 - 38 per cent depending on the source of processing method. When reasonably priced, it can be used as the only protein supplement in livestock rations because it is very palatable.

Poultry litter and manure

Poultry waste (litter and or manure) has been included in the diets of sheep and cattle but is now prohibited under the Ruminant Feed Ban.

Safflower meal

Safflower meal has increased in availability and importance as a protein supplement in recent years because of the popularity of safflower oil in human diets. Safflower meal from unhulled seeds, has about 20 per cent protein, is high in fibre and is relatively low in energy. Meal made from well-hulled seeds has about 40 per cent protein and is much higher in energy.

However, safflower meal from either source is not as palatable to livestock as the more common protein supplements and is usually restricted to 20 per cent or less of concentrate mix.

Soybean meal

Soybean meal contains from 40 - 50 per cent protein, is high in energy and is highly palatable to livestock.

Sunflower meal

Protein levels vary from 20 - 25 per cent, depending on the processing method and whether the seed is hulled or not. It is roughly equivalent to cottonseed meal as a protein supplement for livestock.

By-product roughage

Canola hay and silage

Canola hay and silage are likely to be available as a fodder source in droughts where frost damage has occurred. In this situations it is likely that lengthy withholding periods will apply (15 weeks in some situations eg. pre-emergent uses). Vendor declarations must be sought from feed suppliers in these situations to manage the risks.

Canola hay that has not been aggressively conditioned may have sharp stalk ends and these can pose a problem to animals by piercing the rumen. There have been reported instances of nitrate poisoning from canola products and it is recommended that canola hay or silage is not fed as a sole ration or to starving animals.

Table 14 – Canola hay and silage FeedTest® results 2006

	Digestibility DDM%		Crude protein CP%		Energy ME MJ/kg		Fibre Neutral detergent fibre %	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Silage (21 samples)	60.5	44.3- 71.4	17.4	6.6 - 25.5	8.8	6.1 – 10.4	46.9	33.3 – 58.2
Hay (79 samples)	59.2	41.7- 82.1	13.9	5.5 - 22.9	8.4	3.6-12.1	49.0	26.9 – 68.6

Rice hay

Rice hay is generally a good, palatable roughage of equivalent feed value to cereal hays. Rice hay is known to contain significant levels of silica and oxalate, both of which may cause problems to livestock. High dietary silica levels can predispose animals to urinary calculi.

If rice hay is fed as the roughage in a hay and grain diet, it is suggested that 1.5 per cent limestone and 0.5 per cent salt be fed to correct the calcium: phosphorus balance and levels in the ration. Rice hay can contain a range of weeds, such as umbrella sedge, barnyard grass, starfruit and wild millet.

Rice hulls

Rice hulls have practically no feed value but can be useful as bedding material for livestock.

They are very high in crude fibre and silica and the fibre is largely indigestible. However, up to 15 per cent of unground rice hulls can be included as a roughage source in drought rations being fed to livestock.

Sawdust

Sawdust has virtually no feed value for sheep or cattle due to its high level of lignification, although its has been shown to be useful when feeding high concentrate diets to sheep or cattle during droughts. Sheep survival rates in drought have been shown to be better when 15 - 20 per cent sawdust (hoop pine and spotted gum) was included in the wheat rations.

Sawdust has also been successfully used as a diluent for adapting cattle to concentrate diet. The inclusion of 5 - 15 per cent sawdust in maize-based diets for cattle was found to maintain better rumen function as evidenced by fewer cases of bloat and liver lesions and less ruminal perakeratosis.

Coarse sawdust was better than fine sawdust in maintaining rumen function. Sawdust from treated timber should not be used.

Seaweed

Kelp represents the most common type of seaweed that might be available for feeding. The dry matter of kelp contains about 30 per cent minerals (compared to 5 - 6 per cent in hay, pasture, etc). Kelp contains 0.15 - 0.2 per cent iodine. Seaweed is sometimes used as a mineral source for livestock.

Kelp can be fed quite satisfactorily at up to about 25 per cent of the diet of livestock. The composition of dried kelp is: Dry matter 91 per cent, Crude protein 6 per cent, Minerals (ash content) 30 per cent; ME value is about 5 MJ per kg DM.

The rich mineral content of seaweed, especially salt, can make the material quite palatable to livestock.

Waste paper

Waste paper has little or no feed value for sheep or cattle unless it is treated in some way to improve its digestibility and palatability. It has been fed as a roughage source, on some occasions.

However, due to its poor feed value and the risk of the paper containing contaminants such as lead, cadmium, polychlorinated biphenyls and other toxic substances, the feeding of waste paper to sheep or cattle is not recommended.

Treating straw with urea

Where straw is widely available and relatively cheap there has been some success in improving the nutritional value by adding urea. This can improve the protein level significantly (e.g. 2 -14 per cent) but is likely to be low in energy and will require supplementation with grain or other high energy ration.

To treat 1 tonne of straw, dissolve 50 kg of urea fertiliser in 850 litres of water and spray the solution onto the straw. The straw needs to be contained airtight (covered in plastic) and left 7 - 10 days in summer (longer in winter). Animals will take a while to adapt and caution must be exercised to avoid urea toxicity.

Table 15 – Energy and protein compositions of unusual feedstuffs

If known, ranges in feed values are given in brackets. It is likely that most of these feedstuffs will vary and values are a guide only.

Feed	Approx. dry matter (DM)%	Metabolisable energy (ME) (MJ/kg DM)	Crude protein % dry matter
Acorns	70	7	5
Almond hulls, 15% CF	90	8	2
Almond hulls and shells, 20% CF	90	7	2
Apple pomace, dried	89	10	5
Apple pulp silage	21	11	8
Apples	17	10	3
Apricots, dried	90	12	6
Bakery waste, dried	92	13	11
Banana skins, dried, ground	88	9	8
Bananas	24	13	4
Bread, dried	92	13	13
Brewers dried grains	92	9	22
Brewers dried grains, 25% protein	92	10	25
Brewers grains, wet (range)	28 (14-61)	11 (8-14)	22 (10-29)
Broccoli	11	10	33
Brussel sprouts	15	11	33
Buckwheat	87	11	12
Cabbage	9	13	25
Cabbage leaves	15	10	14
Canola meal (range)	91	12 (10-16)	38 (27-42)
Carrot pulp (range)	10 (8-16)	13 (9-14)	10 (6-15)
Carrots	13	12	10
Cauliflower	9	10	30
Citrus pulp (range)	14 (11-17)	13 (10-15)	9 (6-12)
Copra (coconut) meal	90	11	21
Corn cobs, ground	90	7	3
Cottonseed meal, 41% protein mech-extd	93	3	44
Cottonseed meal, 41% protein, solv-extd	91	11	46
Cottonseed, whole	92	14	23
Grape marc or pomace (range)	55 (20-94)	6 (2-12)	12 (5-17)
Grape/pear/apple pomace, dried	92	6	7
Grapefruit	14	13	8
Kelp, dried	91	5	7
Lemon pulp, dried	93	12	7
Lettuce	5	8	22
Linseed meal, 36% protein, solv-extd	90	12	38
Linseed meal, 37% protein, mech-extd	91	12	38
Melons	4	11	11
Milk, cattle, skim, dried	94	13	36
Milk, cattle, whole, dried	94	15	27
Milk, colostrum	25	15	46
Molasses, cane	75	11	6
Oat hulls	93	5	4
Oat straw	92	7	4
Oats, sprouted 5 days	13	10	18
Onions	11	13	10
Orange pulp, dried	88	12	8
Orange pulp, wet	25	12	9
Oranges	13	12	7
Palm kernal meal	88	11	17
Pea hay	88	9	14
Peaches	10	12	9
Peanut meal, mech-extd	93	12	52
Peanut meal, solv-extd	92	12	52
Peanut skins	94	10	17
Pears	17	13	6
Pineapples	15	12	3
Potato meal, dried	91	12	11
Potatoes	23	12	9
Pumpkins	9	13	16
Raisin pulp, dried	89	8	11
Raisins, cull	85	7	4
Rice bran	90	14 (9-15)	16 (13-20)
Soyabean meal	85 (12-94)	15 (13-16)	44 (30-54)
Sunflower meal	91	10 (8-14)	34 (20-39)
Whey	8 (2-27)	14 (12-14)	30 (20-40)

It is important to assess the risk of these feedstuffs and take appropriate precautions to ensure the quality and integrity of the meat or other end product is not jeopardised.

CHAPTER 8.

Other online resources:

Note these may change location and availability over time.

Water

Farm Water Solutions (Package)

http://agriculture.vic.gov.au/agriculture/farm-management/soil-and-water/water/farm-water-solutions

Dams

http://agriculture.vic.gov.au/agriculture/farm-management/managing-dams/how-long-will-my-dam-water-last

http://agriculture.vic.gov.au/agriculture/farm-management/managing-dams/organic-pollution-in-farm-dams

Farm Water Calculator

http://agriculture.vic.gov.au/agriculture/farm-management/soil-and-water/water/farm-water-solutions/farm-water-calculator

Water Quality

http://agriculture.vic.gov.au/agriculture/farm-management/managing-dams/water-quality-for-farm-water-supplies

Water Supply for Stock Containment areas

http://agriculture.vic.gov.au/agriculture/farm-management/managing-dams/water-supply-for-stock-containment-areas

Livestock

NSW DPI handouts

Water quality and resources for livestock

http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0018/111348/water-for-livestock-interpreting-water-quality-tests.pdf

http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0009/96273/Water-requirements-for-sheep-and-cattle.pdf

http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/91617/Stock-water-a-limited-resource.pdf

Sheep

Feed Budgets

Lifetime Wool – Feed Budgeting for Ewes in dry http://www.lifetimewool.com.au/Tools/dryfeedbud.aspx

NSW DPI Drought Feed Calculator app

http://www.dpi.nsw.gov.au/agriculture/emergency/drought/drought-feed-calculator-app

AWI – Drought Resources

This site has a range of publications and tools for managing drought and recovery

http://www.wool.com/search/?q=drought

This includes publications and relevant links such as:

- Managing Sheep in Drought lots
- Feeding and Managing Sheep in dry times (WA)
- Managing Fodder Prices for drought
- Which Sheep do I keep?

Animal welfare and codes of practice

Code of Accepted Farming Practice for the Welfare of Sheep

http://agriculture.vic.gov.au/agriculture/animal-health-and-welfare/animal-welfare/animal-welfare-legislation/victorian-codes-of-practice-for-animal-welfare/code-of-accepted-farming-practice-for-the-welfare-of-sheep-victoria-revision-number-2

Australian Animal Welfare Standards and Guidelines- Land Transport of Livestock

http://www.animalwelfarestandards.net.au/files/2011/02/Land-transport-of-livestock-Standards-and-Guidelines-Version-1.-1-21-September-2012.pdf

Is it fit to load

http://www.mla.com.au/News-and-resources/Publication-details?pubid=5873

Beef

Drought Feeding and Management of Beef

http://agriculture.vic.gov.au/agriculture/livestock/beef/handling-and-management/drought-feeding-and-management-of-beef

Feed Budget

http://www.mla.com.au/News-and-resources/Tools-and-calculators

MLA (More Beef from Pastures)

http://www.mla.com.au/Research-and-development/Extension-and-training/More-beef-from-pastures

Tools and calculators

Cost of Production/ Health Cost Benefit/Feed Demand/Stocking Rate/Rainfall to [pasture outlook Tool/ Feed Budget and Rotation Planning

http://www.mla.com.au/News-and-resources/Tools-and-calculators

NSW Drought Feed Calculator (Sheep and Beef)

Nice little calculator (App) that compares feed values easily

http://www.dpi.nsw.gov.au/agriculture/emergency/drought/drought-feed-calculator-app

APPENDIX 1:

Use of Firearm and Captive-bolt Stunner (Pistol): Recommended Position and Direction for the euthanasia of sheep

1. Using a firearm

Hornless sheep and rams

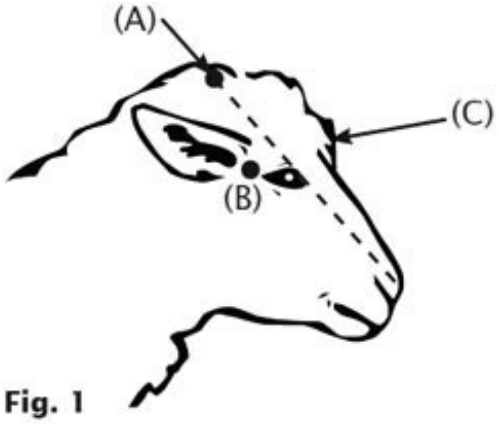


Fig. 1

aim just behind the poll in the direction of the animal's muzzle (A):

or

aim from the side of the bead at a point midway between the eye and the base of the ear (B):

or

aim at a point in the middle of the face just above the level of the eyes while aiming along the neck (C).

Horned sheep and rams

Fig. 2

Aim at a point in the middle of the face just above the eye while aiming along the neck (C).

2. Using a captive bolt stunner

Hornless sheep and rams

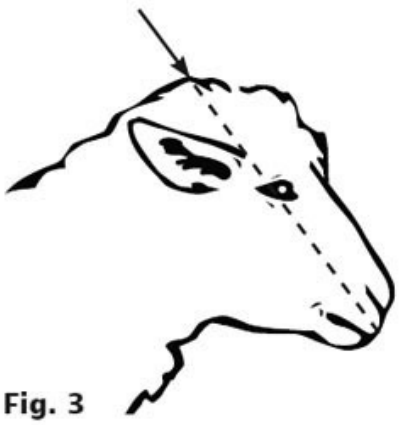


Fig. 3

Horned sheep and rams

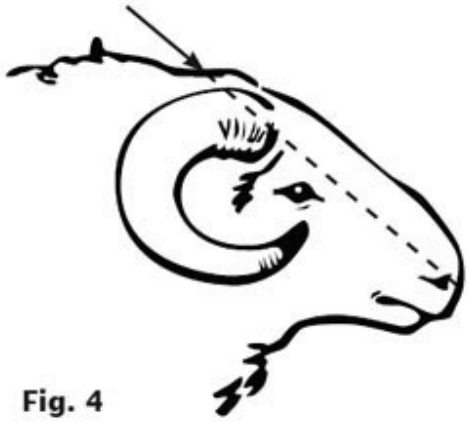


Fig. 4

Place captive bolt stunner fi rmly on top of head aiming behind the poll in line with the animal's muzzle.

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