Dry season management of a beef business

A guide to planning, managing and supplementary feeding

A dry season management program should firstly consider the effect on land, pasture, property finances and people. Cattle are an asset that can be sold to keep the land and business in good heart, ready for restocking after a drought.

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Introduction

Dry seasons that may extend to droughts are a common feature of climatic conditions throughout Queensland. There is a wide range of opinions on the difference between a normal dry season and a drought. The often slow onset of drought conditions provides an excellent opportunity for sound planning. These plans should be flexible to account for unforeseen changes in seasonal conditions. Lack of early planning and preparation for drought is often the biggest contributor to drought management problems.

This book has been written for all producers who own beef cattle. The principles of managing pastures and cattle in dry seasons and droughts are the same whether you live in south east or western Queensland and whether you own 10 head or 10 000 head. What will change with the location and number of cattle are the options you choose to manage the situation.

Successful drought management depends on early planning. The plan should take account of the long-term effect of the drought on the land, pasture, finances, people and cattle.

Reducing cattle numbers should be a major part of any plan. Assessing pasture quantity and quality and adjusting stock numbers accordingly will reduce the need for high-cost feeding.

Animal welfare is a very important issue particularly during drought and must be taken into account when making any management decisions.

Efficient feeding depends on segregating cattle according to their feed requirements, identifying the nutrient most limiting production and selecting the right feed for the situation.

Feeding small amounts of protein (urea or protein meal) will only be successful if feeding starts early when there is plenty of dry feed and cattle are in store condition or better. Supplements high in energy and protein (fortified molasses, grain, whole cottonseed) can be used when paddock feed is limiting and cattle are poor.

Management decisions

To manage a drought successfully decisions must be made early.

An effective drought management program starts with two things: a sound understanding of your current position, and a clear idea of the position you want to be in at the end of the drought. It should consider the effects on land, pasture, property finances and people before the effect on cattle. In a sound plan, cattle should be considered as capital assets that can be liquidated, not kept and fed at any cost.

Recent experience of drought has increased awareness of the effect of heavy grazing on pasture. Improved feeding techniques and the introduction of *Bos indicus* cattle have reduced annual death rates and deaths due to drought. Because more cattle survive, pastures are often overgrazed, degrading the pasture and leaving the soil open to wind and water erosion. Pastures that have been heavily grazed take longer to recover which reduces profitability over the medium to long term.

The quantity of feed available in Autumn (or the end of the wet season) is generally all that will be available until the season breaks in Spring/ early Summer. It must also be assumed that the nutritive value of feed will deteriorate as the dry season/winter progresses.

The effect of winter rain will vary considerably: in some areas it may produce growth of herbage which will contribute significantly to the available feed; in others it may improve the quality of the feed but not the quantity; in many areas winter rain will cause mould growth on standing dry feed which will reduce its feed value and palatability.

The logic of selling all dry cattle first to save the breeders should be questioned. Breeders are the most difficult and expensive cattle to keep alive in a drought. Dry cattle are easier and less expensive to keep alive and will generally provide a cash flow sooner after the drought. If breeders survive it is usually some time before they or their progeny provide a cash flow unless the breeders themselves are sold. A lot of producers who manage to survive a drought financially have difficulty surviving the recovery years because of decisions made during the drought.

Making decisions for drought management will be easier if a logical process is followed.

1400 kg dry matter provides a good ground cover

1. Assess the current situation.
2. Consider the available options, including financial options.
3. Decide which option/s to adopt.
4. Decide which cattle are to be sold and what will trigger selling, i.e. rainfall, time, pasture condition.
5. For cattle that are to be kept, either at home or on agistment:

- decide on the desired performance;
- determine what nutrients are limiting or are most likely to limit performance; and
- choose a supplement that rectifies the deficiency and achieves the desired performance economically.

Making decisions early allows access to better market prices and reduces grazing pressure.

A sound drought plan should also have points in time nominated when decisions are to be made i.e. if there hasn't been adequate rain before the end of the year, the calves will be weaned down to six weeks of age.

Recovery from drought

It may take several years for land, finances and the cattle herd to fully recover from a drought. Decisions taken before, during and immediately after the drought will have a major impact on the time taken to recover.

- Poor, hungry cattle have a limited ability to generate heat to keep themselves warm and many die from hypothermia when it rains. This is a major problem in showery weather in winter. Feeding high energy supplements or reasonable quality hay will help to overcome this problem, as the heat generated by digestion will help to warm the animal.

Over grazed pasture should be destocked to allow it to recover

- Weak cattle on heavy clay soil should, where possible, be confined in small holding paddocks or yards, or removed to sandy or sandy loam paddocks as soon as possible after rain starts. Heavy clay soil builds up on the animals' hooves after rain and the stress of carrying the extra weight can cause deaths.
- It is generally several weeks after useful rain is received before there is sufficient pasture available for animals to satisfy their hunger and nutrient requirements. Cattle will often stop eating supplement and 'chase' the green pick. This can cause severe weight loss and death because the animals use more energy walking than they get from the grass. To overcome this problem, confine animals to holding paddocks where practical, and continue supplementary feeding until there is sufficient paddock feed available.
- Pastures that have been heavily grazed during a drought may take several years to fully recover. Such pastures should be lightly stocked until they have recovered. The time taken for a pasture to fully recover will depend on the grazing management applied. Lighter stocking will ensure a quicker recovery.
- The time taken for business finances to fully recover from a drought will be greatly affected by your drought management strategy. Therefore it is vital to consider the recovery after a drought when deciding on which cattle to sell and a supplementation program.

  For example, if you sell all steers it will be some years before your breeding herd will produce significant numbers of sale animals. Since the income from the sale of steers has probably been spent on supplementing breeders, you may find yourself left with no financial reserve and limited opportunity to generate income.

You should review your drought plan as soon as good rains are received while still fresh in your memory

- Droughts are the perfect time to get rid of aged cows and animals with defects such as poor temperament or undesirable udders. Many producers who have used drought periods to cull for these reasons have gained a far more productive herd for the future.
- When restocking is necessary, use the 'Breedcow/Dynama' software package (available from the DPI&F Bookshop) to help decide what classes of cattle will produce the best returns on the money invested.
- Planning and preparation for the next drought should begin immediately good rain falls.
- Learn from your experience. Make a thorough assessment of how the drought was managed. Look at your plan with the following points in mind:

- what worked well
- what could be improved
- what would you like to do differently next time?

Record important points so that they can be referred to in the future.

Animal welfare

Animal welfare is an increasingly important issue for all livestock industries. This is highlighted when seasonal conditions predispose animals to greater animal welfare risk. Consumers now seek assurances that the animals used to produce their food have been treated humanely. As a result the welfare of livestock during extended dry periods is coming under increasing public scrutiny.

The Animal Care and Protection Act 2001 (the Act) places a legal 'Duty of

Animal welfare is an issue when cattle are in this condition

Care' on all persons in charge of animals to provide for their needs in an appropriate way. This includes the provision of (suitable) food and water.

The 'Duty of Care' places a clear obligation on producers to implement reasonable drought management strategies to address the welfare of their animals.

When considering what action is appropriate, regard must be given to the animals, the environment, the circumstances of the animal and the steps that a reasonable person would take.

What is the role of the Codes with regard to 'Duty of Care'?

The Australian Model Codes of Practice for the Welfare of Animals (the Codes) have been developed to help define appropriate animal care and determine acceptable animal welfare standards.

These codes assist people in understanding what standards are acceptable in meeting their 'Duty of Care' obligation to livestock. These Codes are formally recognized under the Act as either 'adopted codes' or 'compulsory codes'.

Adopted codes are not compulsory, but if you are in charge of livestock you should refer to them to assist you to meet your 'Duty of Care' obligations.

A basic principle is that it is unacceptable to allow an animal to die due to lack of suitable feed and/or water. The key industry bodies endorse this principle.

You can read more about the 'Duty of Care' for livestock and download copies of the codes from the DPI&F website at www.dpi.qld.gov.au. Alternatively you can phone DPI&F on 13 25 23 for copies of the codes.

Over grazed pasture is slow to recover after a drought

Assess the current situation

Assessing the current situation early in the dry season/drought puts you in a better position to make good decisions. To do this effectively assess all the major elements of your business:

1. Climate
2. Land: pasture, soil and water
3. Human resources
4. Finances
5. Cattle.

Climate

Climate will have a major influence on any management decision. Although we cannot influence weather and climate, and therefore have to live with what happens, we are now able to predict it much more accurately.

Using long-term weather forecasts to predict seasonal conditions is becoming more common, with Bureau of Meteorology and DPI&Fs issuing forecasts for up to three months ahead. They use long-term forecast information to predict the probability of certain weather events occurring. For example, there may be a 70% probability of receiving average rainfall for a certain location in the next three months. Remember that this also means there is a 30% probability of not receiving this amount of rainfall.

These forecasts are based on the use of the Southern Oscillation Index (SOI), which reflects sea surface temperatures and air pressure in the Pacific Ocean, a major contributor to our weather variability. As research continues these long-term forecasts will have greater lead times and better accuracy.

It is important to remember that the SOI has varying effects in different locations at different times of the year. To make the best use of these forecasts,

Assess pasture quantity and quality at the end of the wet season

use a computer program such as 'Rainman' to see how the SOI affects weather in a particular location. 'Rainman' also gives you the option to enter your own rainfall records to assess the effect of the SOI on your property.

Internet web sites such as *The Long Paddock* (www.dnr.qld.gov.au/longpdk) and the Bureau of Meteorology (www.bom.gov.au) can provide useful information on historical rainfall and rainfall probabilities.

Long range weather forecasts are not perfect, but they provide useful information on a factor that has a major influence on your enterprise.

Land: pasture, soil and water

The quantity and quality of pasture available at any time is a result of past weather conditions and management. While you cannot influence the weather you can adjust your management to influence pasture quantity and quality.

Consider your pastures' quantity and quality as well as the water situation and time of year.

Doing a simple pasture budget in March/April, in conjunction with assessing the current situation, will make it easier to decide which option/s to adopt. Optimum utilisation of pastures will vary between pasture communities.

For rapid recovery after drought, it is important to maintain good ground cover as well as strong grass tussocks.

Influence of cover on runoff

Ground cover prevents or slows down runoff of rain and consequently reduces loss of soil. Slowing down water runoff allows the water more chance to soak into the soil.

Grass that is kept closely cropped loses vigour. The root system becomes weak. When rain does fall, these grass tussocks are slower to recover, with

Dry season feed budget

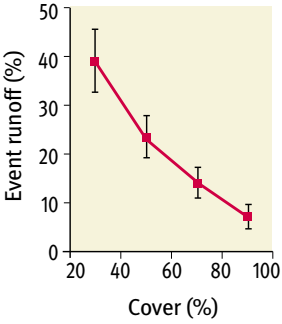
		Example	Your figures
Feed available			
Dry matter estimate **(A)**	kg/ha	2500	_____
Percentage useful pasture (See note below)	%	70%	_____
Useful feed	kg/ha	1750	_____
Detachment/trampling	%	15%	_____
Amount available	kg/ha	1488	_____
Percentage to be eaten/utilised	%	25%	_____
Total available to be grazed **(B)**	kg/ha	372	_____
Residual pasture **(A–B)** Will this be enough for ground cover or burning? If not, the percentage to be eaten must be reduced.	kg/ha	2128	_____
Feed required			
Current date		31 May 01	_____
Date of expected good rain		15 Nov 01	_____
Days till good rain	days	168	_____
Average weight start	kg	250	_____
Est. average daily gain	kg/d	0.3	_____
Est. weight finish	kg	300	_____
Average weight	kg	275	_____
Intake as % average live weight		2%	_____
Est. feed required / head / day	kg	5.5	_____
Feed needed for period per head **(C)**	kg	924	_____
Estimated carrying capacity			_____
(C) divided by **(B)**	ha/head	2.5	_____
Paddock size	ha	100	_____
Head supported	head	40	_____

Note: Percentage useful pasture is an estimate of how much of the pasture cattle will graze. It discounts the total pasture yield by the amount of unpalatable pasture such as wiregrass, weeds, etc.

the more vigourously growing weeds dominating. They also are less able to tap into soil moisture so become more susceptible to dry spells.

Stocktake workshops provide training in assessing pasture quality and quantity and so will help develop the skills necessary to do a pasture budget.

A dry season feed budget (the calculation opposite), will indicate how many cattle can be carried, and therefore how many have to be sold.



Aim to have a residual of 1000 kg/ha to 1500 kg/ha at the end of the grazing period to ensure there is sufficient ground cover (> 40–50%) to protect the soil surface.

It may be necessary to assess each paddock, as the feed situation and therefore the management options may vary from paddock to paddock. Even if paddocks are similar, feed requirements will vary from one class of cattle (e.g. breeders) to another (e.g. two-year-old steers).

Human resources

Consideration of the human (labour) resources available to carry out any drought management plan is vital to the success of any plan. It is often overlooked. Ask yourself: What human resources are available? What are their skills? Realistically, how much can each person do?

When droughts, poor prices or economic recessions occur, many beef producers - like other business owners - try to reduce costs by cutting casual and/or permanent labour and doing more themselves. On the surface this appears sensible, but without adequate planning it is fraught with danger.

Two main problems arise when the owner/manager is doing too much, and they feed off each other, setting up a vicious cycle of decline:

- Tasks that are essential for property management, such as bookkeeping or financial planning, may be neglected.
- Decision making may become faulty as the business operator gets snowed under and stressed.

When suggestions are made to help management, the operator suffering from this condition invariably replies: ‘But I haven’t got time to do that!’

How do you beat this problem?

1. Stop: Have a rest and collect your thoughts. Assess what you are doing and how many hours a day you are working. Ask someone else for their opinion of your workload.
2. Plan: Time is a resource and so is the operator. Plan the use of both. Again, call on someone else to help: your judgement is probably already affected.
3. Prioritise: Work out which jobs are absolutely essential to the wellbeing of the business and do these. Making a list of 'must do', 'should do' and 'could do' is useful.
4. Maintain health: Take care of your health. A business without its chief executive is likely to fail.
5. Work safely: Maintain safe work practices: people in a hurry have, and cause, accidents.
6. Take a break: Have a day or two off, and get away from the place. You will work more efficiently and have a better outlook on the situation after a break.

Finances

What financial resources are available? Financial resources will have a major bearing on management decisions. Remember you not only have to survive the drought but also the recovery period afterwards, when income may be reduced due to forced sales during the drought.

Are property management bonds available to you? Increasingly, producers will be expected to fund their own drought management programs. Property management bonds offer a scheme to do this. (Talk to your bank manager or financial adviser to find out how to take out these bonds.) Investing in such bonds in good seasons can prove worthwhile. Although they must be held for twelve months before they can be used, they can be an important part of a longer term strategy to manage dry seasons and droughts. They can be transferred as part of an estate.

Cattle

As with pastures, the condition of cattle is a direct result of past weather conditions and management.

Critically assess each class of cattle using the following criteria:

- Class (breeders, steers, weaners, etc.)
- Number

You need to critically assess the condition and class of all stock

- Condition (Determine the number of animals that fall into each condition score range, i.e. how many are poor, how many are store, and so on)
- Pregnancy and lactation status (this will allow better targeted feeding)
- Current market value less selling and transport costs
- Drought risk (Breeders are more likely to die in a drought than steers. See Table 1 for a guide to the survival of pregnant breeders)
- Cost to supplement.

Pregnancy testing

Pregnancy testing is a tool that should be used by all beef producers who run breeders. Its use is even more important in times of drought, when the pregnancy status of a cow has a big bearing on her feeding requirements and chances of survival. Knowing the pregnancy status of all breeders allows the owner to draft the cows according to nutritional requirements, thus making feeding more cost-effective.

Table 1. Survival rates of cows in drought (40% of average rainfall)

Stage of pregnancy	Body condition			
	Very poor %	Poor %	Store %	Prime %
Non-pregnant	45	50	79	99
Early pregnancy	36	41	70	90
Mid-pregnancy	23	28	57	77
Late pregnancy	10	14	44	64

Taken from observation on 800 Brahman breeders at Swan's Lagoon Research Station, north Queensland in 1982–1983 drought. The table shows that cows in poor or very poor condition have a much lower survival rate than those in store condition or better, and that stage of pregnancy has a big bearing on survival.

Consider the available options

Now that you know the details of your current situation, and the position you want to be in at the end of the drought, it is time to consider how to get there. Most effective drought management plans use a combination of three main approaches:

- reduce cattle numbers
- feed supplements
- make no change.

Whatever approach or combination you adopt, it is essential to review your choices regularly. Changes, especially to seasonal conditions, may require a new strategy.

Remember that at all times you have a responsibility to your cattle. If your animals suffer and/or die because you did not implement appropriate drought management strategies you may find yourself facing legal action under animal welfare legislation.

Reduce cattle numbers

All drought plans should include reducing cattle numbers to minimise the effect of grazing on droughted pasture. It is essential to preserve adequate ground cover to reduce erosion and ensure optimum pasture response to rain.

Initially it may mean selling normal sale cattle one or two months early. As the drought progresses, it will develop into a program of selective reduction of the herd carried on the home property.

Cattle numbers may be reduced by selling, agisting, buying or leasing another property or feedlotting.

Selling

Selling is one of the easiest drought management options to adopt, but it is often not used, as operators hold out in the hope of rain. The old adage is very true: 'Sell and regret but always sell'.

What to sell will depend on the extent of the drought and the current market. Collect as much market information as possible before deciding to sell. Traditional markets may not always be the best place to take your excess stock. The computer program 'Destock', part of the 'Breedcow/ Dynama' package (available from the DPI&F Bookshop), can help you make decisions about destocking. This program has been used successfully to evaluate selling options and their implications on herd recovery and cash flow during recent droughts.

When deciding what to sell consider:

- the extent of the drought
- relative feeding costs of various classes of cattle (e.g. breeders cost more to feed than male cattle)
- risk of death of various classes of cattle (e.g. cows on their first calf and those eight years and older are high drought risks).

Depending on current prices, normal sale cattle may be sold off first, followed by breeders over eight years of age. The decision of what to sell next should be made after considering the cost implications of keeping various groups

Reducing numbers should be part of every drought plan

Destock before pastures get to this condition

alive during the drought and the effect on recovery after the drought.

It has been traditional to sell male cattle and preserve the breeder herd to breed up after the drought. But this may not always be the best solution, as male cattle are the bulk of sale cattle in years immediately following the drought and have a far lower demand for feeding during a drought. Forced selling during a drought may present a good opportunity to cull breeders heavily and improve overall performance in future years.

Cattle movements, to sale or agistment, should not be held up until a property is declared drought stricken. Weak cattle are less saleable and there is a high risk of mortalities during handling and transport. Ensure that all cattle are strong enough to be successfully transported to their proposed destination and that the requirements of the *Land Transport of Cattle* Code of Practice are met.

Agisting

As you are relying on the property owner's management skills and honesty for the welfare of your cattle, the person who owns or controls the agistment country is more important than the country itself.

As a general rule, the total cost of agistment is about twice the actual agistment cost. Before committing yourself, study the husbandry problems and the precautions to take in the area where your cattle are to be agisted. Assess the tick, weed, poisonous plant and disease status of the property, and any other cattle that are agisted or are likely to be agisted there. Where a disease problem is suspected, vaccinate cattle before moving them to the suspect property.

All cattle returning from an agistment property should be quarantined in yards or a small paddock for one week after arrival to avoid spreading weed seeds.

Cattle on agistment usually receive less attention than those on the home property therefore it is better to agist steers than breeders. Agistment of steers should be to better country and preferably closer to markets.

Remember that if your property is EU accredited you can only agist cattle on another accredited property.

Buying or leasing another property

This is virtually buying agistment, and you will need to study the land in the same way.

Buying or leasing the property gives you more control over the property and your cattle, but may cause different management concerns, and financial concerns later on. While the property may be sold or the lease relinquished after the drought, fluctuating property values may cause you concern.

Feedlotting

Contract fattening in feedlots is a popular option, and in some cases has proved financially rewarding. It is important to do a budget before feedlotting cattle. In many cases it is better to sell the cattle as stores.

Feed supplements

Feeding is expensive and time consuming so it must be done efficiently for best results. Because of the expense involved, only selected groups of cattle should be fed. Weaners and breeders are the most drought susceptible groups.

Attention to the following points will improve the efficiency of your feeding program:

- segregate cattle on their need for supplementation
- segregate breeders on pregnancy and lactation status (Table 1 on page 11 shows how this affects survival rate of cows in a drought)
- control parasites
- utilise available paddock feed
- ensure paddocks with limited water and those where water becomes salty are used first
- weigh additives accurately. This makes feeding more efficient and cost effective.

What supplements to feed and how they should be fed is discussed in detail later.

Make no changes

After making a thorough evaluation of the current and predicted situation you may decide that your 'normal' management does not need to change. If you take this approach, make sure you set a date to review the decision.

Be aware of your legal responsibilities under animal welfare legislation: failure to implement drought management strategies, resulting in animal deaths and suffering, predisposes you to legal action.

Green pick following rain may not provide sufficient feed to satisfy nutrient requirements

Digestion in cattle (ruminants)

To plan an effective supplementation program for your cattle you will need an understanding of how the digestive system functions and how nutrients are used.

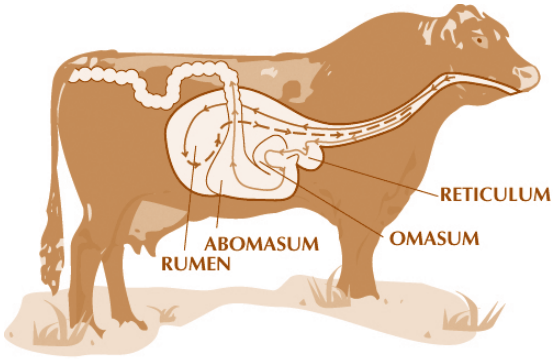
For growth and reproduction, cattle need an adequate supply of energy, protein, minerals, vitamins and water. When the food supply is of insufficient quantity or quality, it may be necessary to supplement the supply of these nutrients. The type of supplement and how much to feed depends on the nutrients needed and whether the aim is to maintain the animal's weight, minimise its weight loss or produce weight gain.

The ruminant digestive system

Ruminants have evolved to get their nutrients from fibrous material such as grass and herbs. Their digestive system is more complex than monogastric animals, such as horses, pigs and humans that have a single stomach similar to the abomasum or fourth stomach in cattle. In the ruminant, three organs precede the abomasum (true stomach): the rumen, the reticulum and the omasum (see Figure 1). From the abomasum onward, the digestive tract and the processes that take place there are very similar to those in monogastric animals.

Understanding the ruminant's digestive system largely depends on understanding the functions of the rumen and reticulum.

Figure 1. The ruminant digestive system. Source: Jeffery and McIntosh (2000)



The rumen and reticulum

The rumen is a large fermentation vat that contains microorganisms (a natural ecosystem of bacteria, protozoa and fungi) capable of breaking down the fibrous components of the diet into substances that can be digested and absorbed further along the digestive tract. The reticulum is much smaller than the rumen. Its function is so similar to that of the rumen that the two organs are usually considered as one organ. The oesophageal opening and the omasal orifice are located in the reticulum.

At birth the rumen is smaller than the abomasum because the calf is only digesting milk. Milk passes directly into the abomasum via the oesophageal groove. As the calf begins to eat dry food, the rumen and reticulum grow in volume and acquire a mixed population of microorganisms from adult cattle. The calf has to be about three months of age before it can survive satisfactorily on high fibre diets.

The rumen–reticulum contracts about two to three times per minute. These contractions serve to keep the contents well mixed and keep the micro-organisms in contact with the food. Regurgitation and rechewing of the rumen contents (chewing the cud) assist the mixing and breakdown process. The material that flows out of the rumen contains food that has escaped fermentation, microorganisms that have multiplied within the rumen and the products of rumen fermentation. This material passes through the omasum where moisture is extracted into the abomasum.

Fermentation in the rumen produces energy and protein that can be used by the cattle. Thus feeding cattle is largely a matter of attending to the needs of the rumen microorganisms.

The proportions of the various species of microorganisms present in the rumen depend on the animal's diet. In grazing cattle, the microorganisms

Pasture in this condition has little feed value

are mainly those adapted to breaking down plant fibre. In cattle on grain diets, the microorganisms are mainly those that use starch.

Diet changes must be made slowly, so that the numbers and types of micro-organisms have time to adjust. A rapid change from a fibre to a starch diet can result in increased acidity of the rumen contents. This acidity may reach a level that causes severe metabolic disorders or even sudden death (acidosis).

Digestion of feed

Grazing cattle eat plant material that is made up of a range of nutrients, particularly energy, protein, minerals and vitamins. Digestion releases these nutrients and converts them to a form that can be used by the animal.

Energy

Energy is available to cattle from fats, carbohydrates and true protein. Most of these are broken down in the rumen to form glucose and volatile fatty acids (VFAs). Most of the VFAs are absorbed across the wall of the rumen; some pass to the abomasum and small intestines where they may undergo further breakdown before being absorbed.

There are a number of VFAs. The most important of these are acetic acid, propionic acid and butyric acid. Fermentation of fibrous feedstuffs favours the production of acetic acid, with methane as a by-product. The methane produced is lost by belching and represents lost energy. Grain feeding increases the production of propionic acid relative to acetic acid. Fermentation that produces propionic acid is more efficient in terms of

utilising energy in a feed to produce energy that is used by the animal than the production of other acids. The proportion of butyric acid produced is similar on both feed types.

Increased production of propionic acid relative to acetic acid can also be obtained by the addition of rumen modifiers. Rumen modifiers alter the microbial population of the rumen to encourage the development of microorganisms that produce propionic acid and reduce the population of those that produce methane.

Protein

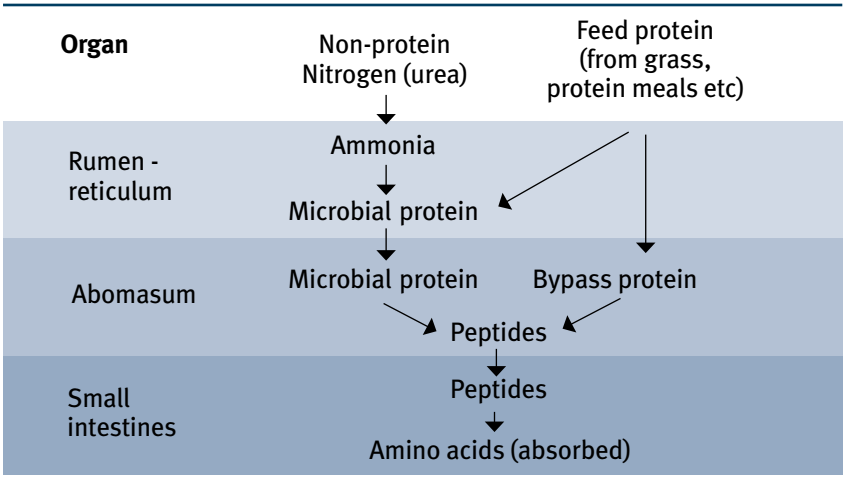
Protein used by the ruminant is derived from two sources: plant material, such as grains, and protein meals derived from plants and non-protein-nitrogen (NPN) such as urea.

The rumen microorganisms breakdown these two sources of nitrogen to ammonia that they then use to form microbial protein.

Protein that is broken down in the rumen is referred to as rumen degraded protein (RDP) while protein that escapes breakdown in the rumen is called bypass protein or undegraded protein (UDP).

While there has been a lot of emphasis on the inclusion of bypass protein in rations, it is more important to ensure that the protein requirements of the rumen microorganisms are met. The breakdown of these microorganisms once they leave the rumen is the major source of bypass protein to the animal.

Figure 2. The digestion of protein (nitrogen) in ruminants



Adapted from 'Northern Nutritional Update Workshop' Jeffery and McIntosh 2001

Microbial protein

The rumen microorganisms breakdown dietary protein to ammonia that they then use for growth and reproduction. The microorganisms pass out of the rumen and are broken down in the abomasum and small intestines into amino acids that are absorbed into the body.

Provided sufficient energy is available, non-protein nitrogen (NPN) such as urea can be fed to the cattle as a source of ammonia for the microorganisms and so, ultimately, protein (amino acids) for the animal.

When protein and NPN (urea) are broken down in the rumen, some of the ammonia produced may be absorbed into the blood stream and so is unavailable for use by the microorganisms. This ammonia is converted to urea in the liver. Some is excreted (wasted) in urine while a portion is recirculated to the digestive tract via saliva.

Undegraded (Bypass) protein

Dietary protein that escapes break-down in the rumen (undegraded, bypass or protected protein) is broken down in the abomasum and small intestines, into amino acids that are then absorbed into the body.

The rumen degradability of proteins varies with different feeds and the rate of passage through the rumen.

Minerals and vitamins

Just as the body needs minerals to function so do the rumen micro-organisms. The most important minerals required by the microorganisms are phosphorus and sulphur. They also need low levels of essential trace elements (copper, zinc, molybdenum, and cobalt). Sufficient quantities of these minerals are generally available from pasture.

Under normal grazing situations, the animal's needs for vitamins are either met from the diet or produced by the rumen microorganisms.

Deciding which feeding option/s to adopt

Once you have decided to feed supplements to some of your cattle, you need to decide which of the many feeding options to use.

Most drought plans involve different feed plans for the various classes of cattle, whether on the property or on agistment. You need to decide on the desired performance, determine what nutrient/s are limiting performance, and choose a supplement that will rectify the deficiency and achieve the desired performance.

Consider the following points as you assess your options:

- capital required and available cash
- human resources including time, labour and skills required (particularly if you are thinking of adopting a new management option)
- property development and facilities
- long-term effect on your property.

Decide on the desired performance

The desired performance may vary with the time of year and the class of cattle. Early in the dry season maintenance or slight weight loss maybe all that is required, whereas late in the dry season when animals are in poor condition and/or approaching calving, maintenance or weight gain may be preferred.

The main emphasis in the past has been on survival, with any additional performance a bonus. In recent times, some producers have taken a different view. If money is spent to ensure survival, then it may be worthwhile spending a little extra to achieve a higher level of performance. For example, this could be better growth in weaners or increased conception rates in first-calf cows (usually a difficult group to get back in calf).

Determine which nutrient/s are limiting performance

Targeting the nutrient most limiting production — the primary limiting nutrient – is the priority for a cost-effective supplementary feeding program.

Supplying nutrients other than the primary limiting nutrient will have no effect on performance until the primary limiting nutrient deficiency is corrected.

Inadequate energy and protein intakes are the major obstacles to achieving higher production levels in cattle grazing tropical pastures. Supplementation programs should be aimed at increasing the supply of these nutrients.

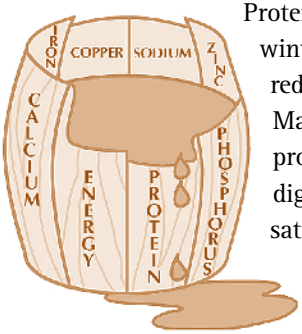


Figure 3. Determine which nutrient/s are limiting performance

Protein deficiency, which often occurs early in winter/dry season, reduces feed intake and therefore reduces availability of energy to the animal. Mature native grasses are normally too low in protein to support cattle growth and have very low digestibility. Cattle are unable to eat sufficient to satisfy their energy requirements. A deficiency of protein and energy usually occurs in spring/late in the dry season.

Other nutrient deficiencies, such as phosphorus, occur in specific areas. Such deficiencies need to be considered in the overall context of cattle performance. For example supplementing phosphorus-deficient cattle in the growing season will ensure they make good use of available feed. At the start of the dry season they will be in much better condition, and therefore better able to handle drought conditions.

Choose a supplement

There is no single supplement that can fit all situations. To decide on the best supplementary feeding for your cattle you will need to consider the condition of the cattle, the state of available grazing and your aims. Choose a supplement that rectifies the identified deficiency, starting with the primary limiting nutrient, and achieves the desired performance.

You will probably still have a number of options to choose between. Remember to weigh up:

- cost
- availability (short and long term)
- labour requirements for preparation and feeding out
- palatability
- availability of machinery
- ease of controlling intake
- ease of feeding (particularly in relation to parts of the property that are difficult to get to)
- skill and experience with various feeding systems.

The levels of feeding suggested in this book are provided as a guide only. The final decision on the level of feeding for individual groups of cattle is up to the individual producer, who should consider the condition of the cattle, the state of available grazing and whether survival or production is the aim.

Supplementation can be divided into two broad categories: those aimed at overcoming seasonal nutritional deficiencies and those aimed at maintaining or improving weight during drought conditions.

Seasonal nutritional deficiency supplements

These supplements are generally formulated to provide protein. This is usually in the form of non-protein nitrogen (NPN) such as urea but may be a true protein from protein meal. Target intake of protein is 75 g (30 g urea) per head per day for young cattle, and 150 g (60 g urea) per head per day for breeders.

Protein stimulates activity of the rumen microorganisms that in turn stimulates intake of dry pasture and therefore increases energy intake. For best results this type of supplementation should start early in the dry season/winter when there is plenty of dry feed available and cattle are in store condition or better. If feeding starts early the supplements will maintain liveweight and may give slight weight gains. As paddock feed deteriorates the best performance that can be expected is to maintain liveweight.

As the name suggests, these supplements may be fed to overcome nutritional deficiencies that occur each winter/dry season. Supplements are generally fed at less than 1 kg per head per day for a long period, usually three to four months. They are usually less expensive, on a per head per day basis, than drought supplements.

Drought supplements

Drought supplementation is generally implemented when the producer decides that cattle are not to lose any more weight. Therefore they must be fed at a level where animals will maintain weight or make slight weight gains. To achieve this aim the supplement must provide both protein and energy. This supplementation is usually not necessary until late in the dry season when paddock feed quantity and quality is at its lowest point. The level of feeding will determine the ultimate performance. Drought supplements are generally fed at greater than l kg per head per day, are fed for a shorter period than seasonal supplements and are more costly on a per head per day basis.

Supplementation issues

Feeding urea

In the rumen urea is broken down into ammonia and carbon dioxide. The ammonia is used by the rumen microorganisms to form microbial protein. Excess ammonia is absorbed into the blood stream and converted back to urea in the liver. Some of this urea is recycled into the digestive system via saliva excess is excreted in the urine.

When cattle are introduced to a supplement containing urea their intake is generally low at first and builds up to the desired intake over several days. This allows time for the rumen microorganisms to build up to a level capable of utilising much of the ammonia released from urea thus reducing the amount of ammonia in the blood stream.

For efficient use of urea by the rumen microorganisms it is important to have the correct balance of sulphur to nitrogen (1 S to 10 N). In loose licks this can be achieved by feeding one part of *GranAm* with five parts of urea or one part yellow sulphur with 20 parts urea.

SOME FORMS OF SULPHATE OF AMMONIA CONTAIN UNACCEPTABLE LEVELS OF HEAVY METALS.

CHECK THE LABEL BEFORE PURCHASE.

Urea poisoning

Urea poisoning occurs when the amount of ammonia in the blood is above that which can be converted back to urea by the liver. This situation is more likely to occur when urea intake is faster or at a higher level than what the animal and the microorganisms are accustomed to using. Therefore reducing the incidence of urea poisoning should aim to ensure a steady regular intake of urea.

Symptoms of urea poisoning

- severe stomach pain
- proppy gait
- muscular tremor
- slow, deep and laboured breathing
- weakness and collapse
- bloating
- frothing at mouth
- regurgitation of rumen contents
- violent struggling just before death.

Poisoned cattle usually die quickly and very close to the source of urea.

Treatment

For treatment to have any chance of success it must be done quickly therefore, when feeding supplements containing urea, carry the drench in the work vehicle.

- drench with 4 – 8 litres of a mixture of equal parts of water and vinegar
- repeat dose after one hour.

Reducing the incidence

Where urea is fed in a liquid feed it is important that it is completely dissolved before it is fed. Granulated urea, which is more readily available in some areas, is more difficult to dissolve than prilled urea.

Liquid that collects on top of licks containing urea can be highly toxic. Moisture dissolves the urea in the lick and, being a liquid, can be quickly consumed by cattle. Therefore every effort should be made to stop liquid collecting on a lick.

Salt-urea licks, commercial blocks and homemade blocks should be checked regularly during showery weather to remove water, alternatively they could be placed under shelter.

Homemade salt/urea licks can be made safer by:

- Adding protein meal or cracked grain at up to 5–10%. These additives reduce the chance of pools of moisture forming in the lick in hot, humid weather by absorbing the moisture.
- Use flossy fine salt or kiln dried salt especially in hot humid weather. Stock salt is less refined than the other products and contains magnesium chloride as well as sodium chloride. In hot, humid weather, the magnesium chloride and urea can dissolve; the resultant liquid is highly toxic to cattle.

Rumen modifiers

Rumen modifiers are substances that affect the digestive processes by altering the balance of microorganisms in the rumen. They improve the feed conversion efficiency on nutritionally adequate diets and promote cattle growth. It is questionable whether rumen modifiers improve cattle performance in drought feeding situations where cattle are only maintaining weight or making slight weight gains.

Only small quantities are required. They should be fed according to manufacturers' recommendations.

DO NOT FEED TO HORSES

Monensin and lasalocid can be toxic to horses and dogs and should be used carefully.

Phosphorus

Where phosphorus is deficient, add a phosphorus supplement to achieve a daily intake of 4 g phosphorus per head.

Technical grade Mono-Ammonium Phosphate (MAP) and food grade Phosphoric Acid are the only sources of phosphorus suitable to use in urea-molasses roller drum mixes.

Where commercial preparations are used, select a block with high phosphorus content.

More information on phosphorus supplementation can be obtained by reading *Phosphorus nutrition of beef cattle in northern Australia*, compiled by Terry McCosker and Lyle Winks available from DPI&F Bookshops.

Cadmium and fluorine content

Concern over high levels of cadmium and fluorine in phosphorous supplements has caused changes in the recommendations for phosphorous feeding. Fertiliser grade MAP and Di-Ammonium Phosphate (DAP) are no longer recommended to feed to livestock. Prolonged feeding of these fertilisers can cause fluorine toxicity and/or unacceptable residue levels of cadmium. Only products registered as stock feed should be used in cattle supplements.

FERTILISER GRADE MAP AND DAP ARE NOT REGISTERED FOR FEEDING TO LIVESTOCK

Seasonal nutritional deficiency supplements

These supplements are generally formulated to provide protein. This is usually in the form of non-protein nitrogen (NPN) such as urea but may be a true protein from protein meal. Target intake of protein is 75 g (30 g urea) per head per day for young cattle, and 150 g (60 g urea) per head per day for breeders.

For best results this type of supplementation should start early in the dry season/winter when there is plenty of dry feed available and cattle are in store condition or better. They are fed to overcome nutritional deficiencies that occur each winter/dry season.

Supplements that are usually used to overcome seasonal nutritional deficiencies are:

- commercial blocks and dry mixes
- commercial liquid supplements
- urea molasses roller drums
- dry licks (based on salt and urea)
- urea supplementation via the drinking water
- vegetable protein meals
- home brew.

Cattle on pasture like this will benefit from a protein supplement

There has been little research work done to compare the various supplements. Work at Swan's Lagoon Research Station showed that the roller drum gave similar results to a salt/urea/sulphur lick. All licks in this category probably give similar results provided the protein intake is the same and they provide adequate sulphur.

Appendix 2 provides a formula to calculate the cost per kilogram of the required nutrient.

Commercial blocks and dry mixes

The composition of commercial products varies markedly. The following comments are common to all.

- Convenient, requiring little or no preparation and little if any storage and feeding out cost.
- High cost. To assess the cost, compare prices of the primary limiting nutrient you require, for example the cost per kilogram of protein or phosphorus.
- Mixture of blocks cannot be altered to manage intake. This often results in blocks being eaten too rapidly or too slowly.
- When trying a new product only buy a small quantity until you are satisfied with intake.
- If possible, blocks and dry mixes should be put under cover.

Commercial liquid supplements

Several commercial liquid supplements are available on the market. Care should be taken to see that intake rates meet animal requirements, i.e. adult animals require 24 g N (150 g protein)/hd/day.

Commercial liquid supplements are often delivered directly to the trough by the companies so these options are extremely convenient. As with all supplements containing urea, care is required after rain as there is a potential risk of poisoning. Poisoning occurs when rain dissolves the urea in the supplement, increasing the opportunity for dangerously high intakes, for more information see page 25.

Urea-molasses roller drums

Urea-molasses roller drums have been used for many years. Some of the advantages are:

- a relatively safe way to feed urea
- the mixture can be adjusted to suit an individual property or paddock on a property

- the palatability of a mix can be adjusted by varying the molasses to water ratio.

Some of the disadvantages are:

- the cost of mixing equipment and feeding out
- the maintenance requirements of vehicles delivering lick over rough tracks on large properties
- mixtures with a high percentage of water ferment easily.

To introduce cattle to this form of feeding start by feeding a mixture of 50/50 molasses and water to get them used to using the rollers. The level of urea should be built up gradually over two to three weeks. Add about one quarter of the quantity of urea in the second mix, working up to full urea over four or five mixes.

A mix sufficient for 100 head of breeders for one week might be:

- 150 kg (110 L) molasses
- 225 L water
- 35 kg urea
- 2.5 kg *GranAm* (do not feed sulphate of ammonia to cattle as it contains unacceptable impurities).

For efficient use of urea by the rumen microbes it is important to have the correct balance of sulphur to urea. Molasses provides some sulphur, however the level of molasses in some mixes is too low to provide sufficient sulphur. A ratio of 7 (or more) molasses to 1 urea provides sufficient sulphur. Adding *GranAm* to mixes that have a ratio of molasses to urea of less than 7 to 1 will provide the necessary sulphur.

If your cattle also need phosphorus supplements, remember that technical grade Mono-Ammonium Phosphate (MAP) and food grade Phosphoric Acid are the only sources of phosphorus suitable to use in urea-molasses roller drum mixes.

Example of a molasses roller drum

Old tyres are a way of feeding out dry lick

Dry licks

Dry licks are used over large areas of Queensland to supply non-protein nitrogen (NPN) to cattle. They have proved effective in managing both the annual dry season protein deficiency and droughts.

The key components of a dry lick are urea, the principal source of NPN and a sulphur source. Sulphur is added because the rumen microbes require additional sulphur to efficiently utilise the NPN being supplied by urea.

Sulphur can be supplied by elemental (yellow) sulphur or *GranAm*. *GranAm* is more commonly used because it supplies additional NPN and generally helps restrict intakes. *GranAm* is a form of sulphate of ammonia, which is suitable for feeding livestock. Other forms of sulphate of ammonia may not be suitable due to potential heavy metal residue problems.

GranAm is used at a ratio of 1 *GranAm* to 5 urea and elemental sulphur at 1 sulphur to 20 urea. Higher rates of *GranAm* are often used to control intakes, however this should be checked with your local nutritional adviser.

On phosphorus deficient country, phosphorus is generally added to dry licks. *Kynofos* is the most common form of phosphorus supplement used. Other sources principally dicalcium phosphates may be available but it is important to ensure they are suitable for stock feed. Some phosphorus sources such as fertilizers present a heavy metal residue risk or contain excessive fluorine.

The recommended supplementary phosphorus intake for breeders on a dry season NPN supplement is half the recommended wet season intake. For

Ingredient	Breeders (phosphorus adequate country)		Breeders (phosphorus deficient country)	
	%	kg to make 100 kg mix	%	kg to make 100 kg mix
Urea	30	30	30	30
GranAm	6	6	6	6
Kynofos	0	0	15	15
Salt	64	64	51	51
Total	**100%**	**100 kg**	**100%**	**100 kg**

Table 2. Recipes for typical breeder licks

example, if the recommended wet season intake for a mature breeder on 'deficient country' is 4 g phosphorus/hd/day the dry season lick should supply 2 g phosphorus/hd/day.

For dry cattle i.e. steers and unjoined heifers inclusion of phosphorus in dry season licks is generally not recommended. However, there are situations where inclusion of phosphorus is recommended.

Dry licks can be used to supplement normal weaners (>160 kg), provided adequate dry matter is available. Under very poor conditions they will require a higher quality supplement before older cattle. Achieving suitable intakes can be a problem with weaners. Adding protein to the lick i.e. copra or cottonseed meal at 10–30% will usually enable the desired intake to be achieved. If protein meal is added the salt content is reduced.

Protein meal will also help reduce the accumulation of moisture in pools from light rain, dews and saliva. In drier western areas 10% protein meal is usually enough to maintain a dry mix. However, adequate trough drainage is still critical.

Two types of salt are used in licks, flossy fine or kiln dried and stock salt. Stock salt is less refined and attracts more moisture. In wetter areas and

Ingredient	Weaners	
	%	kg to make 100 kg mix
Urea	30	30
GranAm	6	6
Copra meal or cottonseed meal	25	25
Salt	39	39
Total	**100%**	**100 kg**

Table 3. Example of a weaner lick in areas with adequate phosphorus

Cows in forward store condition will maintain weight on a urea lick

under humid conditions using flossy fine salt may reduce the potential for moisture problems.

Adequate trough drainage is critical. Drums and other fully enclosed troughs require drainage holes and slits. Open ended troughs such as concrete troughing and hollow logs generally offer good drainage and particularly if they are raised at one end.

Gradual introduction to urea is recommended to prevent poisoning if cattle are salt, phosphorus or protein 'hungry'. This is typically done with one to two weeks' salt feeding then feeding a salt and lick mix with the proportion of lick being gradually increased i.e. 25, 50, 75, 100%. Many producers successfully commence with straight lick however caution should be exercised with cattle that have had little exposure to licks, 'hungry' cattle or where the producer has had little experience with a particular land type.

Commencing feeding early reduces the potential for poisoning because cattle are less run down and 'hungry'.

Urea supplementation via the drinking water

Administering urea in the drinking water combines the advantage of low cost while ensuring consumption by all cattle. However, it may not be successful where surface water is available. You will also need to exercise caution with thirsty cattle, and, once the full urea level has been reached, cattle that have not had urea previously.

It is essential to determine the pH of the water. Urea will breakdown to ammonia and be lost in the atmosphere where the pH is 7 or higher. A full analysis of water is essential when other nutrients are to be added.

When feeding supplements via the drinking water it may be necessary to lower the water level in the trough to reduce evaporation. It may also be necessary to clean the trough more often to remove algae growth.

Troughs should be flushed regularly in hot, dry weather as evaporation will cause a build up in urea and reduce water intake.

It is best to build up to full urea intake over 14 days. *GranAm* (to provide sulphur) should be added to urea at the ratio of 5 urea to 1 *GranAm*.

Vegetable protein meals

Required daily intake of vegetable protein meal varies depending on the protein level of the particular meal. To overcome seasonal nutritional deficiencies daily requirements should be calculated to give 150 g protein per head for breeders and 75 g protein per head per day for young cattle.

Vegetable protein meals give the option of getting better performance by increasing the daily ration. This option is not available when using urea as the only source of protein.

Regulating the intake of vegetable protein meals can be a problem as most are very palatable. Because only relatively small amounts are fed it is possible for one animal to eat much more than its daily ration. To overcome this ensure there is adequate trough space available and only feed once or twice a week. You can also place weldmesh on top of the meal so that animals have to lick rather than eat the supplement. See the separate section on regulating intake.

Soyabean meal has caused poisoning. It is highly palatable and digestible. Salt or *GranAm* should be used to restrict intake.

It is important to change protein meals gradually and do not feed too quickly to hungry stock.

Home brew

Various forms of homemade licks have been used over the years. They are generally based on grain and/or molasses as the energy source, and vegetable protein meal and/or urea as the protein source.

Advantages of home brew are:

- intake is controlled by adjusting the level of salt and/or molasses
- mixes can be tailor made to meet particular requirements
- intakes can be varied to obtain the desired performance.

Disadvantages of home brew are:

- mixing can be time consuming.

Two suggested mixes are shown in Table 4.

An intake of 500 g will give a of intake 150 g protein.

To mix, dissolve the urea in 10 litres (2.5 gal) of water, add molasses, mix thoroughly, and then add all dry ingredients. This can easily be mixed in a cement mixer. Once thoroughly mixed it can be poured into bags for transport to the paddock. To reduce the risk of urea poisoning, tamp the lick down in the trough to prevent cattle biting lumps of lick.

Protect the troughs from rain, to reduce the chance of urea poisoning.

Table 4. High and low palatability home brew mixes

Ingredients	Parts by weight (kg)	
	High palatability	Low palatability
Crushed grain	40	32
Stock salt	20	32
Molasses	20	15
Urea	10	10
Dicalcium phosphate (DCP)	7	7
Protein meal	5	5
Total	**102**	**101**
Protein % (approx)	**32**	**30**

Other supplements

A range of other supplements, particularly those listed under drought supplementation, can be used to overcome seasonal nutritional deficiencies. The level of feeding of these supplements should be calculated to provide 150 grams of protein for adult cattle and 75 grams for weaners.

Drought supplements

To maximise survival rates during a drought it is important to manage cattle carefully. If weaker animals are bullied by stronger ones they will not get their share of supplement. You may need to draft weaker animals into a 'hospital paddock', space feeders so that dominant animals cannot keep others away from more than one feeder, use devices to limit intake, or combine a number of these management strategies.

Whole cottonseed

Animals requiring higher levels of feeding to those recommended should be fully hand fed in yards.

Supplements that are usually fed as drought supplements are:

- Fortified molasses
- Grain
- Whole cottonseed
- Protein meal
- Home brew.

The feeding levels recommended below are for cattle still in the paddock with some paddock feed available.

Under normal grazing conditions, the animal's needs for vitamins are either met from the diet or produced by the rumen microorganisms. Under extreme situations such as prolonged drought where cattle have not had **any** green material in their diet for at least three months, it may be beneficial to provide cattle with Vitamin A and E supplements.

Fortified molasses

Fortified molasses combines a low cost energy source (molasses) with a nitrogen source (urea, protein meal or a combination of the two). Addition of protein meal may improve weight gain where this is desired.

If a long period of feeding is anticipated, it is worth 'tying up' molasses supply early in the feeding period. This will ensure the molasses supply and may mean cheaper molasses. The risk is that if the drought finishes sooner than anticipated you may have to take delivery of the molasses whether you want it or not.

Feeding out fortified molasses

There are a number of proprietary molasses fortifying concentrates available. These products have the advantage of convenience but are often dearer than home-made mixes. They should be used according to manufacturer's recommendations.

Advantages of fortified molasses are:

- intake and mixture can be varied to obtain the desired intake and performance
- can be used as a finishing ration.

Disadvantages of fortified molasses are:

- storage and feeding equipment is costly
- controlling intake can be a problem.

Experience has shown that the following basic rules should be followed when feeding fortified molasses:

- Cattle can make most efficient use of the supplement if it is always available.
- Molasses has virtually no protein and is of little value if used as a drought feed on its own. Adding 3% urea or 10 to 15% protein meal will provide sufficient protein to be in balance with the energy available in the molasses. An extra 2% urea or 5 to 10% protein meal is required to provide protein to balance the energy available in the pasture.
- Fortified molasses can be fed when pasture quality is very poor as the molasses supplies additional energy to the cattle.
- Adding urea can control intake. Mixes of up to 8% urea are commonly fed, provided a mechanical mixer is used.

Heifers on molasses

- If you plan to use fortified molasses for drought feeding, it is worthwhile setting up an efficient feeding out system. This includes a bulk storage tank and mixing trailer. A mixing trailer gives a safer feed and it can halve feeding out time. The bulk tank saves time and labour associated with handling 200 L (44 gallon) drums.
- Ensure that all taps on bulk tanks and trailers are at least 100 mm (4 inches) in diameter. Smaller outlets will restrict the flow of molasses and make filling mixing tanks and troughs very slow.
- When erecting a bulk tank, place the tank as close to the edge of the stand as possible. Direct flow is the quickest method to get molasses from the bulk tank to the mixing trailer. If this is not possible, guttering should be used in preference to pipe.

Mixing fortified molasses

- Thorough mechanical mixing of the supplement is essential when using urea.
- Mixing should continue until all the urea is dissolved. Urea will form a crust on top of poorly mixed brews. This crust can be fatal, particularly following a light shower of rain.
- Mixing for at least 20 minutes ensures that the urea **prills** are fully dissolved. **Granulated** urea takes much longer to dissolve.
- Mixing can be done in a mixing trailer where large quantities are to be mixed. Small quantities can be mixed with attachments to chainsaws or brushcutters.
- When mixing, put molasses in the trailer or trough first, then add the other ingredients.

Table 5. Suggested fortified molasses mixes

Mix No.	Molasses %	Urea %	Vegetable protein meal %
1	95–92	5–8%	Nil
2	87	3	10
3	85	Nil	15

It is not necessary to mix the urea in water before mixing with molasses. If you do, ensure that the added water does not make the molasses too runny and that the water is thoroughly mixed with the molasses. Also, it is not necessary to put mechanically mixed fortified molasses under cover.

For example: Using Mix No 1, Mix 650 kg (100 gal) of molasses with 56 kg urea to give a mix of 8% urea and 92% molasses.

The following intakes are provided as a guide. Actual intake should be varied according to the condition of the cattle, the quantity and quality of available pasture and desired performance.

- Weaners – 1 to 1.5 kg per head per day
- Yearlings – 1.5 to 2.0 kg per head per day
- Breeders – 2 to 4 kg per head per day.

Grain

The protein content of grain can vary widely depending on growing conditions, and should be tested. Grain with a protein level above 7% can be fed to adult cattle without the addition of extra protein. As a guide, intakes should be approximately 1 kg per head per day for weaners and 3 kg per head per day for breeders.

Preparation, for example, hammer-milling is usually done but is not essential. If grain is hammermilled it should only be coarsely cracked. Milling grain too fine will cause sickness.

Advantages of feeding grain are:

- Can be fed alone if protein is above 7%.
- May be fed on the ground thus giving unlimited feeding space.

Disadvantages of feeding grain are:

- Grain engorgement can cause poisoning. Problems with grain engorgement can be reduced by adding 3% bentonite or 1% bicarb soda.

Steam flaked grain

- In many areas grain is a more expensive form of energy than molasses.

Experience has shown that maintaining an even distribution of supplement throughout the mob requires good preparation and management:

- If grain self-feeders are used they should be fitted with slides on the outlet so that flow can be controlled. One 3 m (10 ft) self-feeder is sufficient for 50 weaners or 35 breeders.
- When open troughs are used allow enough trough space so that all cattle can feed at one time.
- Feeding on the ground is a viable option on clay soils. This allows the feed to be spread out and allow all animals to feed at one time.

Whole cottonseed

Supply of whole cottonseed varies from year to year depending on the size of the cotton crop. It has 22% protein (about half that of cottonseed meal) and 20% more energy than grain.

The most common form of cottonseed is the white lint-covered seed. Other forms are available from time to time: 'lint free' seed (the same seed as above with the lint removed by ginning); and brown or pima cottonseed. This form of cottonseed contains higher level of gossypol than the white seed and should be fed with caution. The higher gossypol levels may cause scouring.

Whole cottonseed should be fed at the following rates:

- Breeders 2 to 3 kg/head/day; and
- Weaners 0.5 to 1 kg/head/day.

Advantages of feeding whole cottonseed:

- The seed can be fed whole. Hammermilling is not required.
- Whole cottonseed can be stored in the open if the site is well drained and the heap is kept in a cone shape. It can be stored in underground pits for longer periods.
- Whole cottonseed can be fed out by dumping a load in the paddock and fencing it with an electric fence. The cattle can feed under the fence but cannot walk on the heap. Portable yard panels can be erected around a heap and the animals allowed to fed through the panels.
- Cattle usually regulate their own intake (breeders eat about 2 to 3 kg/head/day).

Disadvantages of feeding whole cottonseed:

- Intakes will vary according to the availability of paddock feed.
- Weaned calves less than six months old should not be given free access, due to problems with gossypol that may cause poisoning.
- Cattle must have access to roughage to avoid sickness problems.
- Whole cottonseed is difficult to handle:
  - it must be handled in bulk
  - it will not flow or auger like grain.

Gossypol

GOSSYPOL IS ALSO POISONOUS TO HORSES. SEE APPENDIX 1

Whole cottonseed contains gossypol, which may cause digestive upsets in younger cattle. Do not feed above the recommended rates.

Gossypol may also cause infertility in bulls. (This has been suggested, but not proven.) To avoid any possible problems restrict feeding to no more than 4 kg per head per day.

Vegetable protein meals

See comments under seasonal nutritional deficiency supplements. Feeding level would have to be a minimum of 1 kg per breeder per day and 250 g per weaner per day.

Home brew

See comments under 'seasonal nutritional deficiency supplements' (page 27). Intakes of 1 to 2 kg per head per day would be required when using home brew for drought supplementation. This will almost certainly necessitate a change in the recipe.

Roughage

While roughage such as hay or silage are widely used during drought they are generally an expensive feed when compared to other forms of supplementation. For this reason they should only be used for specific purposes, such as where there is absolutely no paddock roughage available or where cattle have been locked in yards to reduce degradation in paddocks. In these situations roughage should only be used as filler; cattle should receive their main nutrients from more cost-effective forms of supplements such as molasses, grain, urea or vegetable protein meals.

The feed value of hay and silage will vary depending on the stage of growth of the crop at cutting and the effectiveness of the curing or ensiling process. Lucerne, which is generally grown specifically for conserving, provides high quality feed. Forages cut before they mature also provide good feed. The feed value of failed crops will vary considerably, depending on the stage of growth of the crop when it was cut. Hay made from crop residues is generally of very poor quality and should be fed in conjunction with protein and possibly energy supplements. With appropriate

Table 6. Feeding value of hay sources

Type	Palatability	Digestible protein %	Need more protein?
Good lucerne	good	13	no
Grassey lucerne	good	8	no
Peanut hay			
– with nuts	very good	10	no
– leafy	good	6	no
– stalky	fair	5	yes
Soybean, some seed	good	10	no
Soybean straw	fair	2 – 4	yes
Navy bean straw	poor	1 – 3	yes
Forage sorghum			
– cut at flowering	good	10	no
– cut when mature	fair	2 – 5	yes
Sorghum stubble	poor	3 – 5	yes
Winter cereal stubble	fair	2 – 4	yes
Winter cereal hay	good	7 – 9	no
Native pasture (mature)	poor	2 – 4	yes

Table 7. Feeding rate in kg/head/day for different cattle classes

	Weaners	Pregnant breeders Early	Pregnant breeders Late	Dry cattle over 18 month
Treated stubbles (sorghum, wheat or barley)	2.0	3.5	3.0 - 6.0	3.0
Legume hay	1.5	3.0	2.5 - 5.0	2.5

CHEMICAL RESIDUES, PARTICULARLY IN FAILED CROPS OR STUBBLES, CAN PRESENT PROBLEMS.

ALWAYS CHECK ON THE CHEMICAL TREATMENT OF A CROP BEFORE FEEDING THE RESIDUE TO ANY LIVESTOCK.

SEE THE SECTION ON CHEMICAL RESIDUES.

supplementation, feeding poor quality roughage may be more cost effective than feeding high quality hay or silage.

Always buy roughage by weight, for example $/tonne. Buying by the bale can be very expensive as bale weights vary tremendously.

Avoid any roughage showing signs of mould development. Mould will reduce palatability and may cause deaths.

Hay

The information in Table 6 is a guide to the feed value of most common hays.

Medium to high protein hays (6%+) can be fed at the rate of 1 to 2 kg per head per day when there is plenty of paddock feed available.

When paddock feed becomes scarce, feeding rates for maintenance are as shown in Table 7.

Raising protein content of hay

The protein intake of cattle fed poor quality hay can be lifted by:

(a) feeding a protein supplement to the animal as outlined in Seasonal nutritional deficiencies or

It is important to weigh up the nutritional requirements of the stock with price availability and protien levels of the different supplements

(b) treating the hay 12–24 hours before feeding with the following mixture.

- 9 kg urea - 45 L water - 18 kg (13 L) molasses.

DO NOT FEED THIS MIXTURE DIRECT TO ANY LIVESTOCK

Use this mixture at the rate of one litre per small rectangular bale.

One litre of this mixture contains 150 g urea, which is sufficient to treat a 20 kg bale.

To treat a bale, stand it on its side with cut ends upwards, cut the top string and pour the mixture evenly over the surface. Round bales can be treated by pumping the mixture into the bale with a spear.

Silage

While silage is a valuable form of roughage there is no magic in the ensiling process. The resultant silage is only as good as the crop it was made from, unless other nutrients were added during the ensiling process.

When purchasing or feeding silage it is important to make allowances for the moisture content, which can vary from 30% to 70%. This means that if you are buying silage for $150/tonne with 50% moisture you are actually paying $300/tonne of dry matter. This is particularly important when carting silage long distances.

Other roughage

During times of drought a wide variety of roughage and crop residues are fed to livestock. The nutritive value of these feeds varies considerably, many are little better than fill.

Chemical residues

As feed is often in short supply during times of drought, cattle often graze paddocks they would not normally graze or are fed crop residues that are not usually used. This can lead to an increase in the problem of chemical residues.

The following points may help to minimise the risk from chemical residues:

- Contamination can occur by using banned chemicals, by incorrect use of registered chemicals or by not observing correct withholding periods and export slaughter intervals. Use registered chemicals and veterinary drugs according to label instructions.
- Do not feed stubble or other residue from crops that have been grown on land previously treated with organochlorines.

- Feed stubble or other residue from crops treated with pesticides only after the withholding period has expired.
- Purchase fodder from a reputable source. If possible obtain an enforceable guarantee that it is free from residues and/or a vendor declaration.
- Beware of grain storage facilities with concrete or earth bases, particularly those that have been treated with organochlorines. These areas may be a source of contamination.
- Clean up loads of grain containing a significant amount of dust. They may have very high levels of contamination.
- Do not hold cattle in yards treated for white ants, particularly where organochlorines have been used.
- Pay careful attention to disposal of old chemical containers and prevent cattle from entering disposal areas.
- If there is any doubt about the chemical status of feed or soil have tests carried out before cattle are fed or grazed. Contaminated soil can cause residues in grazing cattle as the cattle will eat dust on plant material.
- Store chemicals in well constructed sheds away from grazing cattle.

Regulating intake

Maintaining supplement intake at the desired level is often a problem. With palatable supplements, such as those based on molasses or protein meal, cattle often eat too much. With dry licks, such as those based on salt, it is often a problem to get cattle to eat sufficient.

It is impossible to give a recipe that will ensure a given intake of a supplement in all paddocks on all properties.

Replacing *GranAm* with either yellow sulphur or agricultural sulphur can make licks more palatable. Otherwise, increasing palatability generally depends on using protein meals or molasses; suggestions are included in the supplement sections. Recommended inclusion rate for *GranAm* in dry licks is 1 *GranAm* to 5 urea. Higher rates of *GranAm* are often used to control intakes, however this should be checked with our local nutritional adviser.

The following are suggestions to restrict intake.

Urea

Urea can be used to control intake in fortified molasses licks. A level of 4 to 5% urea is usually required before any intake control is achieved.

Rumensin

Rumensin premix contains 10% monensin a coccidiostat (will kill the organism that causes coccidiosis), which also serves as a rumen modifier. See section on 'rumen modifiers' page 26.

MIXES CONTAINING MONENSIN SHOULD NOT BE FED TO HORSES

Tests have shown that adding 1 gram of Rumensin Premix (that is 100 mg monensin) per kilogram of molasses in a 4% urea/molasses mix reduced intake to the same level as an 8% urea/molasses mix.

The total mix used was 650 kg (100 gallons) molasses + 26 kg urea (4%) + 650 g Rumensin Premix). The advantages of using Rumensin, instead of extra urea, are that it is cheaper, and being a rumen modifier, it may improve feed conversion efficiency.

Rumensin may also control intake of other supplements but this has not been proven.

Salt

Salt is best used in dry licks. The quantity to add has to be determined to suit the individual group of cattle. Start by adding a small amount of salt and gradually increase the amount until the desired control is achieved. Be aware that 'salt hungry' cattle may increase their intake of a supplement if salt is included.

Cattle that are 'salt hungry' may eat large quantities of a supplement in an endeavour to satisfy their craving. In extreme cases they may eat large, potentially toxic, levels of salt. In these situations salt should be fed close to water until the craving has been satisfied. This may take 10 to 14 days.

Intermittent feeding

Feeding once or twice a week will control overall intake. While the entire supplement is eaten in one or two days, cattle then have to go without until the next feeding day.

This is a useful method of feeding protein meals. Trials have shown that feeding once a week gave similar performance to daily feeding and resulted in better distribution as there is still some supplement left when the dominant animals have eaten their fill.

This method of intake control is not generally recommended with licks containing urea as problems with urea toxicity may be incurred if animals gorge on the supplement after a period without supplement.

Weldmesh

Placing weldmesh on top of a lick will make cattle lick rather than eat the supplement. This method has been successfully used to control intake of protein meals. The feed trough must have regular shaped sides so that the mesh can move down and sit on top of the supplement. As a guide, 25 mm to 40 mm (1–1½") square mesh controlled the intake of protein meal by two-year-old heifers to the desired level.

Weldmesh has also been successfully used to control intake of fortified molasses by tying it to polythene pipe that floats on the molasses. Cattle have to lick through the mesh to get the supplement.

Determining the size of weldmesh that will control intake to the desired level is a matter of trial and error. The following is a guide: adult cattle 75 mm x 75 mm; weaners 80 mm x 50 mm on 50 mm polythene joined in a circle. The mesh has to be cut to the shape of the trough.

Hardening blocks

Cement has been used successfully to harden home-brew blocks and licks, and reduce intake. The amount of cement to include will vary with the particular mix. Start by including a small amount of cement and increase the amount until the desired hardness is achieved.

Managing bulls

Where possible, special attention should be paid to the care of bulls during a drought. If separated from the breeder herd bulls will usually survive a drought, but they need to be in forward store condition at the beginning of the mating season.

Supplements for bulls are the same as for the rest of the breeder herd but intakes should be twice that of a breeder, that is 2 kg protein meal or 5 kg fortified molasses per head. Take care when feeding grain to bulls to ensure they do not develop acidosis, with associated founder and lameness.

Feeding higher quantities of supplement to bulls will not add significantly to the cost of the feeding program, as their numbers are generally small.

Sufficient feeding space should be available to allow all bulls to feed at one time and prevent bossing.

Avoid possible fertility problems with whole cottonseed by feeding a maximum of 4 kg per head per day.

Managing early weaning

Calves under six months old can be weaned successfully and suffer no ill effects provided they are fed and managed well. Weaners not adequately supplemented fail to thrive and may be poor doers all their lives. For a feeding program to be successful calves should be drafted by weight to the following groups:

- 60 to 100 kg
- 100 to 150 kg
- over 150 kg.

Calves less than 60 kg should only be weaned in extreme drought conditions. These very young calves need special attention and it may be easier to feed the cow and calf until the calf reaches 60 kg.

Weaner growth rates

The following minimum growth rates are recommended for weaners of various weights and/or ages:

- under 100 kg (three months) should grow at a minimum rate of 400 g per day (12 kg per month).
- 100 kg to 150 kg (three to six months of age) should grow at a minimum of 200 g per day (6 kg per month).
- over 150 kg (six months of age) should grow at a minimum of 100 g per day (3 kg per month).

If weaners are to graze pasture only once the drought breaks it is better to grow them at moderate rates (<0.5 kg per day) during the dry season/drought. All weaners lose weight when they go onto green feed. Weaners on high gain supplements (growing at up to 1 kg per day) lose so much weight when the wet season starts that by the end of it, they are not as well grown as

Early weaning saves cow condition and reduces feeding costs

weaners that were gaining at a moderate rate during the dry season/drought.

Weight loss in weaners going onto green pick can be reduced by continuing to feed a supplement with high levels of true protein (protein meal) until there is plenty of green feed.

Feeding

It is important that all calves start feeding as soon as possible after weaning. Training calves to eat supplement in the yards while being weaned is essential. Putting a couple of older cattle in with the weaners may assist in the initial stages of training by teaching them to go to a trough for feed. Shy feeders should be drafted out for special training.

The levels of feeding shown should hold weight or give slight weight gains but **is a guide only**. The performance of the calves is the best indication of how much supplement is required and intakes should be varied accordingly.

Whole cottonseed contains gossypol which can cause digestive problems and in extreme cases death in young calves. Therefore do not feed more than the level indicated. If more supplement is required combine whole cottonseed with one of the other supplements.

The addition of a coccidiostat such as Rumensin or Bovatec may benefit all calves. Use according to manufacturer recommendations. Some commercial feeds include a coccidiostat in the mix.

Calves that reach the threshold weight for a higher weight group should be drafted into that group. This will reduce competition in the lower weight group and may reduce the cost of feeding.

Feeding rate for calves 60 to 100 kg

Feed unlimited pasture if available or 0.25 to 0.5 kg of grassy lucerne, good quality grass or good quality forage hay per head per day. Beware of scouring, particularly when feeding lucerne hay.

Plus one of the following supplements:

- 0.5 to 1 kg/head/day grain mix (3 parts crushed grain to 1 part protein meal)
- 0.25 to 0.5 kg/head/day protein meal
- calf pellets/crumbles/meals fed as per manufacturers recommendations
- free access to molasses plus 12 to 15% protein meal (beware of scouring).

Calves in this group should be weighed regularly and those over 120 kg moved to the heavier group.

Feeding rates for calves 100 to 150 kg

Feed unlimited pasture or hay plus one of the following supplements:

- 1 kg/head/day grain mix
- 0.5 kg/head/day protein meal
- calf pellets/crumbles fed as per manufacturers recommendations
- free access to molasses plus 12 to 15% protein meal
- 0.5 kg/head/day whole cottonseed.

Feeding rate for calves > 150 kg

Feed unlimited pasture or hay plus one of the following supplements:

- 0.5 kg/head/day protein meal
- 1 kg/head/day of molasses plus 3% urea and 5 to 10% protein meal
- 0.5 kg/head/day whole cottonseed.

Parasites

Treat all calves for internal and external parasites four to six weeks after weaning. Young calves are susceptible to parasites. A few parasites, that cause no problem when a calf is suckling, can become a major problem when it is stressed. Hay should be fed in racks to avoid contamination from dirt and dung which may contain parasite eggs.

Water

A supply of good clean water is essential. Where calves are fed in yards it will be necessary to clean the troughs regularly, especially when feeding grain.

Appendix 1.

Feeding horses

There is a wide range of commercial products available to feed horses. Where bulk molasses is available a ration of 1 to 2 kg molasses, 200 to 400 g protein meal and 50 g dicalcium phosphate (DCP) per horse per day will keep working horses in good condition when feed is poor. A similar ration could be fed to brood mares and young horses. This ration is not sufficient where there is no paddock feed.

The advantages of feeding molasses to horses are:

- a week's supply can be fed out at one feeding
- horses do not gorge on the feed as they would with grain, therefore avoiding the problem of founder and the need to feed individually
- better distribution through the mob than with grain feeding.

Cottonseed meal contains gossypol, a substance that is poisonous to horses if fed at more than 15% (0.75–1.5 kg/hd/d) of the total daily feed intake. Feeding up to 10% cottonseed meal in molasses does not usually cause any problems.

Horses are monogastric (single stomach) animals. This means that they cannot use urea, so there is no value in adding urea in mixes for horses. Horses can eat supplements containing urea but care is needed as it is for feeding urea to cattle. Do not feed horses feeds that contain rumen modifiers. Some of these (notably monensin and lasalocid) are toxic to horses.

Appendix 2.
Calculations for cost of dry matter and nutrients

Calculations using cottonseed meal as an example:

Dry matter: 90%
Price: $350 per tonne
Protein: 37%
Energy: 11 MJ ME/kg.

Dry matter

How much dry matter in 1 kg of feed?

$\frac{\text{Weight of feed x \% dry matter}}{100}$	$\frac{1 \text{ kg} \times 90}{100}$	= 0.9 kg or 900 g

How much to feed to get 1 kg of dry matter?

$\frac{\text{Weight of dry matter required} \times 100}{\text{\% dry matter}}$	$\frac{1 \text{ kg} \times 100}{90}$	= 1.1 kg

Cost of 1 tonne of dry matter

$\frac{(1 \text{ tonne} \times 100) \times \text{cost of 1 tonne as purchase}}{(\text{\% dry matter})}$	$\frac{1 \times 100}{90} \times \$350$	= 1.1 x $350 = $385 per tonne of dry matter

Dollars per tonne to cents per kg

$\frac{\text{Cost of 1 tonne in cents}}{1000}$	$\frac{35\,000}{1000}$	= 35 cents

Nutrient

Cost per kg of nutrient (on dry matter basis) e.g. protein

$\frac{\text{Cost per kg of dry matter} \times 100}{\text{\% of nutrient}}$	$\frac{38.5 \text{ cents} \times 100}{37}$	= 104 cents/kg

Cost of 150 g protein

$\frac{\text{Cost of 1kg of protein} \times 150}{1000}$	$\frac{104 \times 150}{1000}$	= 15.6 cents

Cost of a ration

Example:

Ingredient	$ per tonne	Inclusion in ration		Cost
		%	Weight kg	
Molasses	$100	87	870	$87
Urea	$500	3	30	$15
Cottonseed meal	$350	10	35	$35
Total cost per tonne				**$137**
Cost per kg				**13.7c**

Costing a feeding program

Example:

Number of cattle to supplement	100*
Supplement period	May to October*
Number of days	150*
Supplement/s to use	
Commercial blocks	120 days*
Fortified molasses	30 days*
Commercial blocks	$20 per 20kg block*(80% protein)
Daily cost for 150 g protein (Cost per kg of nutrient and cost of 150g protein)	18.75cents#
Cost for 120 days (A)	$22.50#
Fortified Molasses	13.7 cents per kg#
Daily cost at 3 kg/h/d (Cost of a ration)	41.1 cents#
Cost for 30 days (B)	$12.33#
Total cost per head for 150 days (A + B)	**$34.85 per head#**
Cost for 100 breeders	**$3485# (excluding labour)**

N.B. * These figures are assumptions for the purpose of the calculation.
These figures are calculated.
Formulas used in the calculations are shown in brackets.

Appendix 3.

Volume measures

Accurate calculation of the volume of a mixing tank will lead to more accurate ration formulation. The following volumes may assist with calculations:

Volume of a cylinder that is 300 mm long/deep

Diameter (mm)	Litres	Gallons
300	21	4.6
500	59	13
1000	236	52
1250	368	81
1500	530	116
1750	721	158
200	942	207
2500	1472	324
3000	2120	600

Volume of a cylinder = Pi X R^2 X depth/length (Pi = 3.141).

Note: There are 1000 litres in 1 cubic meter and 4.55 litres in one gallon.

Appendix 4.

Container weights

These weights are provided as a guide only. It is preferable for producers to weigh all their own measuring containers.

Using accurate measurements helps to provide the most cost-effective supplementation.

Amounts of common feeds contained in recycled product containers

Container	Weights in kg					
	Molasses*	Urea	Cottonseed meal	Grain	*Gran Am*	Salt (medium coarse)
20 litre container	27.0	15.5	13.5	11.5	18.0	24
9 litre container or 2 gallon bucket	13.0	8.5	7.0	6.0	8.0	11
5 litre container e.g. bucket	6.5	4.0	3.0	3.0	4.5	5
4 litre container e.g square ice cream container	4.5	3.0	2.5	2.0	3.5	4

* Actual weights of molasses are higher. Approximately 10% stays in the container unless it is drained for a long time. Molasses weighs approximately 1.4 kg per litre (6.5 kg per gallon).

Appendix 5.
Analysis of vegetable protein meals

Analysis of common vegetable protein meals on an 'as fed' basis

Vegetable protein meal	Protein %	Ca %	P %	Energy (MJ ME/kg)
Cottonseed	38–43	0.17	1.27	10.5
Sunflower	30-38	0.40	1.03	12.5
Copra	15–20	0.06	0.50	12.5
Palm kernel	18	0.21	0.15	11.5
Peanut	46	0.15	0.60	12.1
Canola	38	0.65	0.95	10.1
Soybean meal	44-48	0.25	0.70	13.5
Linseed	37	0.45	0.90	12.1

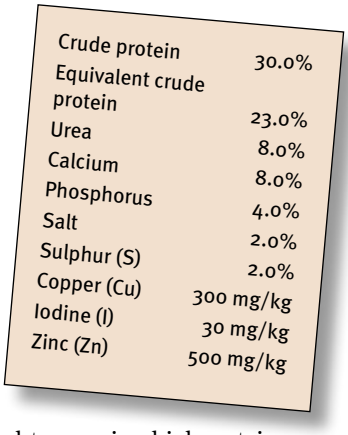
Analysis of meals may vary depending on the processing method.

Appendix 6.

Product labels – what they are saying

When buying feed it is often difficult to understand the information on the label attached to the product. This information is generally a combination of what the manufacturer legally has to tell you and what they want to tell you about the product.

Many labels on protein supplements will look something like this:



Crude protein: The total amount of protein in the feed. Crude protein includes true protein (from protein meals, grain, etc.) as well as protein derived from urea and *GranAm*. Crude protein may also be listed as protein and total protein. (Protein contains nitrogen).

Protein from urea and *GranAm*: The rumen microbes use the nitrogen from these products to form protein. This protein is referred to as microbial protein. The nitrogen from these products is referred to as non protein nitrogen (NPN) indicating that it has been derived from a source that is not a protein. The microbes also use the nitrogen from the true protein in grass, protein meals and grains to form microbial protein.

Equivalent crude protein: The proportion of crude protein that is derived from sources of NPN.

Urea: The total percentage of urea included in the ration.

Sulphur: Used in conjunction with nitrogen by the rumen microbes to form some amino acids. Sulphur and nitrogen are required in the ratio of 1S to 10N.

Calcium: Included in most commercial licks but rarely, if ever, deficient in grazing cattle.

Phosphorus: An important ingredient in phosphorus-deficient areas.

Salt: Generally included to control intake of the supplement. The higher the salt content the less palatable the supplement.

Other minerals: Included to maintain a mineral balance.

Minerals are generally divided into two broad categories.

1 Macro minerals: needed by animals in grams per day:
Calcium, Phosphorus, Magnesium, Sulphur, Potassium, Sodium.

2 Micro (trace) minerals: needed by animals in milligrams per day: Copper, Cobalt, Selenium, Zinc, Iodine, Iron, Manganese.

Calculating protein in a feed:

The protein in any feed is calculated by determining the amount of nitrogen in that feed and multiplying it by 6.25. This formula can also be used to calculate the protein equivalent of urea and other sources of NPN.

e.g. Urea with 46% N X 6.25
= 287% protein

GranAm with 20% N X 6.25
= 126% protein

In our example label, if you multiply the urea, 8%, by 287% it comes to 23% (rounded), which is the amount of equivalent crude protein shown on the label.

This demonstrates that of the total 30% crude protein, 23% is due to urea and the remaining 7% comes from true protein such as protein meals or in some cases grains that have been included in the feed.

Appendix 7.

Further information – products and training

Books

Water medication: a guide for beef producers
ISBN 1 74036 604 2
Phone 1800 023 100

Phosphorus Nutrition of Beef Cattle (McCosker and Winks)
Contact DPI&F on 13 25 23

Workshops

Nutrition EDGE
Grazing Land Management
Better Decisions in the Business of Beef
Stocktake
Managing Climate