

# Dry season management of a beef business

A guide to planning, managing  
and supplementary feeding



Drought and Climate  
Adaptation Program



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A drought and dry season management program needs to consider the effect on land, pasture, animal welfare, property finances and people. Cattle are an asset and must be sold or moved early to minimise the impact on land productivity and business viability, as well as the potential impacts on the health and well-being of beef producers. As a sustainable and profitable beef producer, drought feeding should be avoided. *'No rain – no grass – no cattle'* is the rule-of-thumb for successful beef producers.

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**Drought and Climate  
Adaptation Program**



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# Contents

<b>Introduction</b> .....	<b>2</b>
<b>Planning dry season management</b> .....	<b>5</b>
Management decisions .....	5
Recovery from drought .....	9
Animal welfare .....	11
Assess the current situation .....	13
Consider the available options .....	22
<b>Supplementary feeding</b> .....	<b>26</b>
Digestion in cattle (ruminants) .....	26
Deciding on feeding options .....	31
Seasonal nutritional deficiency supplements .....	34
Supplementation issues .....	42
Drought feeding .....	45
Chemical residues .....	57
Managing bulls .....	58
Managing early weaning .....	58
<b>Appendices</b> .....	<b>64</b>
Appendix 1. Feeding horses .....	64
Appendix 2. Calculations for cost of dry matter and nutrients .....	70
Appendix 3. Volume measures .....	73
Appendix 4. Container weights .....	74
Appendix 5. Analysis of vegetable protein meals .....	75
Appendix 6. Product labels—what are they saying .....	76
Appendix 7. Further information—products and training .....	78
Appendix 8. List of abbreviations .....	80

## Introduction

This guide is for beef cattle producers. The principles of managing pastures and cattle in dry seasons and droughts are the same whether you run 10 head or 10,000 head. Queensland beef operations are diverse in scale, land resource productivity, land condition, business structure, production systems, debt exposure and drought-dry season management expertise. However, there are grazing management and herd structure fundamentals that apply to all beef businesses.

The key challenge for beef producers is balancing cattle numbers with seasonal grass supplies. Decades of set stocking and overgrazing has led to a decline in land condition and productivity across many areas of Queensland rangelands.

Long-term industry experience shows the benefits of establishing 'grass buffers' and restoring land condition through a shift to systematic wet season spelling and more conservative stocking rate management. This includes producers using 'trigger point' decision dates (e.g. end of February and Easter in north Queensland) to respond early to poor seasons by moving or selling-down cattle.

Successful producers make good grazing management decisions by combining their long-term experience with hands-on evaluation of land condition, pasture supplies, water distribution and water permanency.



A property manager or owner with experience spanning several seasons successfully uses his or her critical observations to adjust stocking rates to ensure cattle have adequate grass, and to maintain break of season cover to reduce soil loss and maximise pasture response to storm rains.

Producers new to a region can access indicative safe stocking rates from well-regarded local producers or local Department of Agriculture and Fisheries, Queensland (DAF) staff as a starting point. Producers can also download the long-term carrying capacity report from the FORAGE tab on the website [longpaddock.qld.gov.au](http://longpaddock.qld.gov.au).

Due to the highly variable annual rainfall and pasture growth in western Queensland, producers often have to destock part or all of their properties. Drought and dry season management options become more limited in this region when carrying 'high risk and high maintenance' breeding stock.

Ideally, breeder numbers as a proportion of total cattle carried should decrease as rainfall variability and risk of drought increase. Bowen *et al.* (2020) details the profitability advantage when there is a shift from breeders to a steer turnover operation in north-west Queensland (See page 78 for link to Drought and Climate Adaptation Program (DCAP) Northern Downs report). In addition to the substantial improvement in profitability there are non-monetary benefits associated with transitioning from breeders to steer turnover or a dry cattle trading operation.

The mental stress and emotional price-tag of retaining core breeder herds, drought feeding and risking stock losses during dry years must be compared with the peace of mind of running steers with inherent sell-down flexibility.

Feeding cattle in the absence of paddock feed, even to a core breeder herd, is impossible to sustain financially and psychologically for most producers.

Excluding labour expenses, feeding hay to 500 breeders for one month, three months or six months can cost a droughted property \$63,000, \$189,000 and \$378,000 respectively (based on 2020 costs of \$4.20 per head per day).



### Successful and profitable producers:

1. Recognise the pasture resource is the key profit driver in their business
2. Combine common sense, experience and visual feed assessments to adjust cattle numbers in line with rainfall, water supplies and pasture growth
3. Use systematic wet season spelling every year to maintain and improve land condition and provide a feed buffer during the low rainfall years
4. Use selling and destocking trigger points and don't resort to drought or crisis feeding of livestock
5. Establish, where soils and rainfall allow, areas of sown pasture to boost herd productivity and provide a feed buffer in poor years.

With these principles in mind this booklet describes dry season management and supplementary feeding options available to you as a beef producer.

Animal welfare is paramount and must be considered when making any management decision. Feeding small amounts of protein (urea or protein meal) will only be successful when feeding starts early, there is plenty of dry feed available 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. However, resorting to this strategy for long periods is very costly and will impact land condition and productivity.

Successful drought and dry season management depends on early planning and having an open mind to all options. Regardless of where you are in Queensland '*no rain-no grass-no cattle*' is the fundamental management principle for all beef producers.

A photograph of two men in a rural setting. The man on the left is wearing a light blue button-down shirt and is holding a clipboard and pen, looking towards the other man. The man on the right is wearing a teal button-down shirt and a wide-brimmed hat, smiling back. In the background, several brown and white cows are grazing in a field. The image is overlaid with a dark blue gradient at the bottom.

## Section 1

# Planning dry season management

## Management decisions

### Setting plans and taking early action

Just like a fire plan, having a prepared drought plan already written down, outlining what you are going to do and by when, helps immensely. At the end of the drought, review and improve this plan. What worked well, not so well and what you can do differently. Drought planning requires 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 considers the effects on the land, livestock, property finances and people.

The key components of drought management are:

- assessing the current situation e.g. pasture and water availability, livestock condition, financial situation and markets
- careful analysis of available options and financial implications
- deciding on options and timing
- deciding which livestock are to be sold and when they will be sold
- developing an appropriate supplementation program for livestock being retained.

A sound drought plan has ‘trigger point’ decision dates when management actions will be implemented e.g. if there hasn’t been adequate rain by 31 March, mustering will commence in April and calves will be weaned down to three months of age. Reducing livestock numbers early rather than later is critical, as it reduces grazing pressure and can avoid major falls in livestock values. The pasture saved with early sales can mean less stock need to be sold (*Table 1, Table 2*). Livestock are capital assets that can be sold rather than kept and fed at any cost.

## Example of benefits of timely reduction in stock numbers

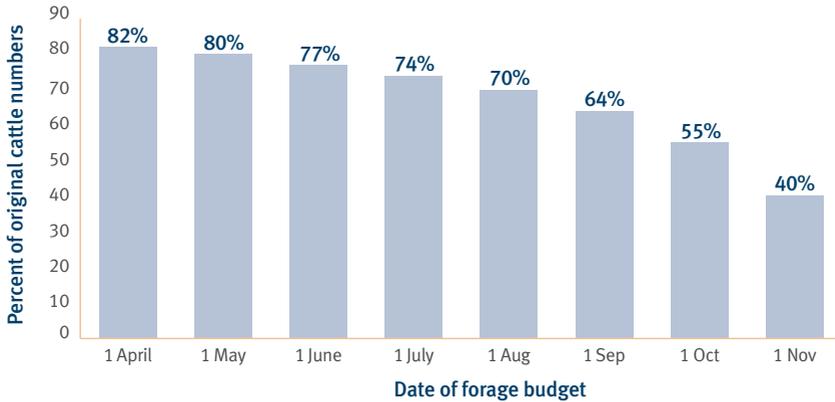
**Table 1.** Completing a forage budget in April requires an assessment of cattle on hand and pasture available for grazing

Example paddock	
Paddock size (ha)	1,000
Pasture on-hand (kg/ha)	1,500
Target residual pasture yield (kg/ha)	1,000
Pasture available for grazing (kg/ha)	500
Cattle at 1 April (AEs)	200
Pasture dry matter intake (kg/hd/day)	10
Forage budget to	31 December

**Table 2.** Early sell-down decisions made in April are more preferable than having to unload large numbers of poor cattle later in the year

Date of forage budget	Days to 31 Dec	Pasture available for grazing (kg/ha)	Carrying capacity for balance of year (AE)	Adjusted stocking rate (ha/AE)	Percent of original cattle numbers (%)
1 April	305	500	164	6.1	82
1 May	275	440	160	6.3	80
1 June	244	378	155	6.5	77
1 July	214	318	149	6.7	74
1 August	183	256	140	7.1	70
1 September	152	194	128	7.8	64
1 October	122	134	110	9.1	55
1 November	91	72	79	12.6	40

**Figure 1.** More cattle can be retained during the dry season if early sell-down decisions, based on forage budgets, are made in April



*Retaining around 800–1,000kg/ha of pasture at the end of the season (like above) maximises storm-rain infiltration and pasture growth, and reduces soil loss*

Recent experience of drought has increased awareness of the damage to pastures from overstocking. Improved feeding techniques and the introduction of *Bos indicus* cattle have also reduced death rates. Because more cattle survive, pastures are often overgrazed, decreasing land productivity 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.

For tropical and subtropical pastures, 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 late spring to early summer. The nutritive value of feed also deteriorates 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 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 cash flow, unless the breeders themselves are sold.

The [Breedcow/Dynama](#)\* herd budgeting software package includes a range of decision support tools to help assess selling options.

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 set-up a more productive herd for the future.

\* Software package can be accessed online: [breedcowdynama.com.au](http://breedcowdynama.com.au)

## Recovery from drought

It may take several years for land, finances and your herd to fully recover from a drought. Decisions taken before, during and immediately after the drought will have a major impact on land condition, productivity and the recovery time of your grazing resource.

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.\*

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 can build 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 before there is enough 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.\* Avoid holding paddocks where there are machinery access or bogging issues.



*Overgrazed paddocks are slow to recover after rain*

\* This strategy is often not practical on extensive beef operations

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. Land condition and productivity recovery will depend on lighter stocking rates and regular wet season spelling of paddocks. *Remember more ground cover and standing dry matter at the end of the year will increase rain infiltration and subsequent pasture growth.*

The time taken for business finances to fully recover from a drought will be greatly impacted by your drought management strategy. Therefore, it is vital to consider the recovery after a drought when deciding on which cattle to sell and the best fit supplementation program for your operation. 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. The [Breedcow/Dynama](#)\* herd budgeting software package has tools to assess restocking options.

After the drought make a thorough assessment of how the drought was managed. Discuss your drought experiences and consider the following questions:

- What worked well?
- What could be improved?
- What would you do differently to better manage future dry spells and drought?

\* Software package can be accessed online: [breedcowdynama.com.au](http://breedcowdynama.com.au)

## Animal welfare

Animal welfare is an important consideration for all livestock industries. Consumers expect that animals raised to produce their food and fibre are treated humanely. As a result, the welfare of livestock is under increasing public scrutiny at all stages of the supply chain, including on farm, in transport, at the saleyards and in the meatworks. It is in the long-term interest of industry and individual producers to demonstrate a commitment to achieving high standards of animal welfare. A basic principle is that it is unacceptable to allow an animal to suffer and/or die due to lack of suitable feed or water.



*Sell or move cattle early to avoid animal welfare issues or stock deaths*

### Animal welfare on property

Good plans are essential to ensure good stock welfare, especially during times of extreme seasonal conditions. In the event of declining seasonal conditions, a responsive management plan will ensure stock numbers are reduced early in the year in line with available feed and water, and supplementary feeding is actioned if necessary.

The *Animal Care and Protection Act 2001* (the Act) places a legal ‘Duty of Care’ on all persons in charge of animals to provide for their needs in an appropriate way. This includes the provision of adequate and suitable feed and water. The ‘Duty of Care’ places a clear obligation on producers to account for variations in rainfall and climate when implementing drought management strategies. When considering what action is appropriate, attention must be given to the type of animal and the likely environmental conditions, the circumstances the animal may be subject to, and the steps that a reasonable person would take.

The *Australian Animal Welfare Standards and Guidelines* were developed nationally in consultation with a broad range of stakeholders to ensure consistent animal welfare standards are applied across all states and territories to practically improve animal welfare outcomes for livestock. These Standards are mandatory and are intended to be adopted by each jurisdiction under their animal welfare legislation. The Queensland Government is currently incorporating cattle and sheep standards into state animal welfare laws. Once completed, it will be mandatory for everyone in Queensland who owns or manages cattle or sheep to meet these Standards. The endorsed *Australian Animal Welfare Standards and Guidelines for cattle* can be found at: [animalwelfarestandards.net.au/cattle](https://animalwelfarestandards.net.au/cattle).

### Animal welfare during transport

The transport of drought affected stock is one of the most common situations where animal welfare problems occur. From an animal welfare perspective, transport management commences before the journey begins and ends after the journey is complete, with the pre-transport phase being critical to ensuring transport success. Any person in charge of livestock at any time carries a duty of care or responsibility for their welfare, and are expected to take reasonable action to minimise welfare risks. Meat & Livestock Australia (MLA) updated the cattle and sheep ‘fit to load’ guidelines in 2019 and they are available at: [mla.com.au/isitfittoload](https://mla.com.au/isitfittoload).

The *Australian Animal Welfare Standards and Guidelines – Land Transport of Livestock* have been adopted under the Act and outline the legal requirements that must be met for livestock transport and provide guidance for those responsible for livestock transport.

### Further information

Further information on animal welfare and your obligations to care for livestock can be obtained from DAF at: [business.qld.gov.au/industries/farms-fishing-forestry/agriculture/livestock/animal-welfare](https://business.qld.gov.au/industries/farms-fishing-forestry/agriculture/livestock/animal-welfare).

## Assess the current situation

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

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

### 1. Climate

Rainfall, temperature and day length, together with land condition and your grazing management, determines how much pasture grows after each rainfall event. Realistic expectations for rainfall and pasture growth are essential. The user friendly [Australian CliMate\\*](#) website and app provide historic rainfall data and probabilities. The website [longpaddock.qld.gov.au](http://longpaddock.qld.gov.au) contains extensive information on climate, rainfall and pasture growth maps. In the 'FORAGE' section you can enter lot-on-plan information and receive free reports including indicative land types, estimates of long-term carrying capacity (native pastures), pasture growth alerts and much more.

The northern Australian dry tropics has a highly variable climate. The higher the rainfall variability for your area, the more flexible you need to be with adjusting cattle numbers to manage for seasonal variability. Visit the [Australian CliMate\\*](#) website to determine your rainfall variability. Rainfall variability is simply the spread of rainfall above or below your average rainfall. Examples of Queensland's rainfall extremes include Birdsville, in the outback, which is highly variable (67%) while for Clifton, on the Darling Downs in south east Queensland, the rainfall is much less variable (23%). So, Birdsville's annual rainfall is three times more variable than Clifton. Likewise, the annual rainfall in outback Boulia (61%) is nearly twice as variable as Mount Surprise in the far north of the state (33%).

The following management principles provide financial rewards and prevent animal welfare problems during extended dry conditions:

- Maintain flexibility in your beef operation by adjusting herd size to match feed supplies.
- The higher your rainfall variability the lower your breeder numbers should be in relation to your total cattle numbers. In highly variable rainfall regions, many producers have transitioned entirely from a breeding enterprise to a more flexible and profitable steer turnover or dry cattle operation.

\* [climateapp.net.au](http://climateapp.net.au)

## Section 1: Planning dry season management

- The higher the rainfall variability the higher the requirement for annual **wet season spelling**.\* For example, in the Mount Surprise area it is recommended to spell 20% of your country per year but in the Boulia region it is recommended to spell 40% of your country per year.
- Establish ‘trigger points’ to reduce cattle numbers based on your rainfall records. For example, in the Northern Gulf a common trigger point is the end of February. If the wet season has been poor, viable options to consider are to sell, agist or send cattle to a feedlot. At Easter, if the season is still poor, sell-down more cattle while they are still in a saleable condition – this is vital in managing your most valuable natural resource: perennial, palatable and productive (3P) grasses.
- Retain break of season stubble and ground cover in paddocks to maximise rainfall infiltration and pasture growth and, minimise runoff. Bare paddocks lose water and soil, and struggle to grow grass when it rains.
- Wean calves off lactating cows to reduce their nutrient requirements and recover body condition.
- Sell dry or aged breeders to reduce feed requirements.
- Cattle must be moved before animal welfare issues prevent transportation, as during extended dry periods some stock may require transporting to ensure their survival and to free-up feed reserves for the stock remaining.



*Establish ‘trigger point’ decision dates in your district for selling, agisting or moving cattle*

\* [futurebeef.com.au/knowledge-centre/wet-season-spelling](http://futurebeef.com.au/knowledge-centre/wet-season-spelling)

- When transporting stock in poor condition it is essential that they are **‘fit to load’**.\*
- If you have valuable stud stock, devise a long-term feeding plan with two to three years of fodder reserved, depending on your location and herd size. Options include hay, silage, whole cottonseed, grain, molasses and irrigation.
- It may also be worth considering options to purchase a property in a wetter northern or coastal area to help support the long-term success of your enterprise.
- **REMEMBER: ‘No rain – no grass – no cattle’** is the rule-of-thumb for successful beef producers and the best way to manage a sequence of dry years.

While all producers would like an accurate forecast of a certain amount of rain on a particular day at their specific property, the variability of weather systems means that it is unlikely that there will ever be such a prescriptive forecast. Forecasts are issued on the basis of probability, and an understanding of how to best use forecasts is important. For example, if the forecast indicates there is a 70% chance of above median rain for July to September there is also a 30% chance of it being below median. It is important to know what the median rain is for your area to use the forecasts. At a location such as Croydon in the Northern Gulf region, the median rainfall for July to September is 0mm, so the forecast is not indicating useful rain for a region that is seasonally very dry. In contrast the same forecast at Dalby in south east Queensland where the median rainfall for July to September is 67mm, the forecast would be very useful for those with a winter oats crop.

The other critical date for decision making is the Green Date. This is the date after the 1 October by which 50mm of rain within three days can be expected in 70% of years. This amount of rain is likely to allow pasture growth to start. On some light soils less rain may be needed and on heavier clay soils more rain is required for growth. Often, producers can be overly optimistic about how soon a break will come in the season. The feed available at the end of the growing season has to support stock through to when pasture growth resumes and there is adequate new pasture available. This is likely to be several weeks after the seasonal break. Setting a safe stocking rate for the pasture available dramatically reduces costs of, and the need for, supplementary feeding.

The *‘How often’* page of the [Australian CliMate](https://www.australianclimate.gov.au/)<sup>†</sup> website is useful to determine Green Dates. This date can be used to calculate the number of days of feed needed from autumn until the Green Date plus two weeks (*Table 3*).

\* [publications.mla.com.au/go/1eS6U05Xcpsbs1JNcGSA](https://publications.mla.com.au/go/1eS6U05Xcpsbs1JNcGSA)

† [climateapp.net.au](https://climateapp.net.au)

**Table 3.** The Green Dates and days of feed required post April for various locations around Queensland

Location	Green Date <i>(Date after 1 October by when 50mm of rain over a maximum of 3 days can be expected in 70% of years)</i>	Number of days feed is needed from 1 April to Green Date + 2 weeks
Charters Towers	27 January	314
Croydon	7 January	295
Cloncurry	11 February	330
Rockhampton	15 January	303
Emerald	15 January	303
Winton	8 March	355
Dalby	27 January	301
Charleville	25 February	344

The Bureau of Meteorology (BOM) have a northern rainfall onset map that looks at when the seasonal break is likely occur in the coming summer. This is a useful tool to review your seasonal planning and herd management. Some weather indicators that can assist in decision making include:

- **Southern Oscillation Index (SOI).** An SOI greater than +5 can indicate a better chance of a good seasons while a negative SOI less than -5 can indicate a drier season
- **Madden Julian Oscillation (MJO).** This pulse of pressure change that moves around the globe every 40–60 days can trigger rainfall events and cyclones
- **Indian Ocean Dipole (IOD).** The IOD can bring extra rainfall to southern Queensland in a negative phase and lower rain in a positive phase.

More information on forecasts and climate drivers in particular areas are available from:

- [bom.gov.au](http://bom.gov.au) including long- and short-term forecasts and northern rainfall onset map
- [longpaddock.qld.gov.au](http://longpaddock.qld.gov.au) for pasture growth forecasts
- [nacp.org.au](http://nacp.org.au) (Northern Australian Climate Program – targeted at helping the grazing industry better manage drought and climate risks through a range of research, development and extension activities)
- [climateapp.net.au](http://climateapp.net.au) for setting Green Dates and assessing the current climatic situation

- [armonline.com.au](http://armonline.com.au) to access ClimateARM to analyse rainfall and other climate variables at individual locations
- [daysbetweendates.com.au](http://daysbetweendates.com.au) is a simple days to Green Date calculator.

## 2. 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. Routinely assess your pasture 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 pasture management 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 perennial grass tussocks. Tussock grasses are particularly vulnerable during the first six to eight weeks of the growing season. Wet season spelling some paddocks during the growing season builds tussock resilience, allows preferred grasses to set seed, helps restore degraded paddocks and increases pasture productivity.

### *Influence of cover on runoff*

Ground cover prevents or slows down rainfall runoff and consequently reduces soil loss. It allows more water to soak into the soil to grow more grass which is greener for longer. Grass that is kept closely cropped loses vigour and the root systems become weak. When it rains these grass tussocks are slower to recover, with the more vigorously growing weeds dominating. A dry season pasture budget (*Table 4*) estimates how many cattle can be carried, and therefore how many should be sold. DAF staff can assist you with dry season pasture budgeting.

Aim to have a pasture residual of at least 800kg per hectare at the end of the grazing period to ensure there is sufficient ground cover (>50%) to protect the soil surface. Assess pasture yield for each paddock relative to stock requirements, for example running breeders or yearling steers.

**Table 4.** A May to December dry season feed budget for an example 100ha paddock

	Example	Your figures
<b>Feed available</b>		
Dry matter estimate (kg/ha) (A)	2,500	
Percentage useful pasture (%)*	70%	
Useful feed (kg/ha)	1,750	
Detachment/trampling (%)	15%	
Amount available (kg/ha)	1,488	
Percentage to be eaten/utilised (%)	25%	
Total available to be grazed (kg/ha) (B)	372	
Residual pasture (kg/ha) (A–B)	2,128	
<b>Feed required</b>		
Current date	31 May 2021	
Date of expected seasonal break	31 December 2021	
Days until seasonal break (days)	214	
Average liveweight start (kg)	250	
Estimated average daily gain (kg/day)	0.30	
Estimated liveweight finish (kg)	314	
Average liveweight (kg)	282	
Intake as % average liveweight	2.0	
Estimated feed required (kg/head/day)	5.6	
Feed needed for period per head (kg) (C)	1,198	
<b>Stocking rate and stock numbers</b>		
Stocking rate (ha/head) (C÷B)	3.2	
Paddock size (ha)	100	
Head supported (head)	31	

\* 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.

### 3. Human resources

Consideration of available labour to carry out any drought plan is vital and is often overlooked. It is important to know exactly what human resources are available, what their skills are and apply realistic expectations to what each staff member can 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 take on more themselves. On the surface this appears sensible, but without adequate planning it can be problematic.

Two main problems arise when the owner/manager is doing too much, which can often set up a vicious cycle of decline:

- tasks that are essential for property management, such as bookkeeping or financial planning, may be neglected
- decision making and objectivity may be compromised as the business operator gets snowed-under and stressed.

When suggestions are made to improve management, the operator who finds themselves in this situation invariably replies, ‘But I haven’t got time to do that!’

#### *How do you work through this problem?*

**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.

**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.

**Prioritise:** work out which jobs are essential to the wellbeing of the business and do these. Making a list of ‘must do’, ‘should do’ and ‘could do’ is useful.

**Maintain health:** take care of your health; a business without its chief executive is likely to fail.

**Work safely:** maintain safe work practices. People under stress and in a hurry have accidents.

**Take a break:** have a day or two off and get away from the workplace. You will work more efficiently and have a better outlook after a break. There are people that are happy to stay on properties for relief periods to offer farm managers a reprieve. Consider searching: [farmarmy.com.au](http://farmarmy.com.au) which has registered volunteers.

#### 4. Finances

What financial resources are available? Financial resources will have a major bearing on your management decisions. Remember you have to survive the drought as well as 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. Your bank manager or financial adviser can provide advice on these bonds. Investing in such bonds in good seasons is one strategy to manage dry seasons and drought, although they must be held for twelve months before they can be used. Bonds can also be transferred as part of an estate.

#### 5. Cattle

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

Critically assess each class of cattle (breeders, steers, weaners, etc.) using the following criteria:

- number
- condition (determine the number of animals that fall into each condition score range, i.e. how many are poor, how many are store condition, etc.)
- pregnancy and lactation status (this will assist with targeted feeding)
- current market value less selling and transport costs
- drought risk (breeders have a higher mortality risk in a drought than steers. See *Table 5* for a guide to the survival of pregnant breeders)
- cost to supplement.



*In dry times you need to assess the condition and class of all stock*

**Table 5.** Survival rates taken from observation on 800 Brahman breeders at Swan’s Lagoon Research Station, north Queensland during the 1982–1983 drought. Cows in poor or very poor condition have a much lower survival rate than those in store condition or better, and stage of pregnancy has a big bearing on survival.

Stage of pregnancy	Survival % for cows in a range of body conditions			
	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

### Pregnancy testing

Pregnancy testing should be used by all beef producers running breeders. Pregnancy testing is even more important in drought when the pregnancy status of a cow has a big bearing on her feed requirements and chances of survival. Knowing the pregnancy status and stage of pregnancy (e.g. early, mid or late) of all breeders allows the owner to draft the cows according to nutritional requirements, making feeding more cost-effective. Equally it makes the decision to sell empty and late conceiving breeders easier.

## 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 drought management plans use a combination of:

- reducing cattle numbers
- feeding supplements
- making no change.

Whatever approach or combination you adopt, it is essential to review your choices regularly. Changes in your situation, your stock, cattle markets or seasonal conditions may require a new strategy. Remember that you have a responsibility to the welfare of your cattle. If your animals suffer 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 early to minimise overgrazing, welfare issues and cattle deaths. Reducing cattle numbers also preserves ground cover, maximises infiltration, reduces erosion and optimises pasture response to rain. Initially it may mean selling normal sale cattle one or two months early. As the drought progresses, the selective and on-going reduction of numbers will be required. Cattle numbers may be reduced by selling, agisting, feedlotting, or buying or leasing another property.



*Reducing cattle numbers should be part of every drought plan*

## 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 ‘Destock’ component of the [Breedcow/Dynama](#)\* herd budgeting software package can help you make destocking decisions. This program has been used successfully to evaluate selling options and the 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 mortality risks during drought).

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 alive during the drought and the effect on recovery after the drought. Options also include selling pregnancy tested empty cows and late conceiving cows.

It has been traditional practice 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 herd performance in future years.

Cattle movements, to sale or agistment, should not be delayed until a property is declared drought stricken. Where kangaroos are not a problem, moving stock early preserves more pasture for those stock remaining.

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](#)<sup>†</sup> are met.

\* Software package can be accessed online: [breedcowdynama.com.au](http://breedcowdynama.com.au)

† [animalwelfarestandards.net.au/land-transport](http://animalwelfarestandards.net.au/land-transport)



*Destock to avoid paddocks getting to this condition*

## 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. A written contract outlining agistment conditions is recommended. Also consider the personal stress on your operation that will be associated with being away from the home property and the regular travel to the agistment block.

As a rule, the total cost of agistment is about twice the actual agistment cost. Before committing yourself, study any 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 currently agisted or are likely to be agisted there. Where a disease problem is suspected, vaccinate cattle before moving them to the agistment property. Critically, it is important to assess if there's enough feed at the agistment block, and if there's any chance you will need to move the stock again.

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 on 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 effectively 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 and financial issues. While the property may be sold, or the lease relinquished after the drought, fluctuating property values may leave you financially exposed.

## Feedlotting

Contract fattening in feedlots is an option for some producers. 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 susceptible groups during drought.

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

- segregate cattle based on their need for supplementation
- segregate breeders on pregnancy and lactation status  
(*Table 5, page 21* 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 to make feeding more efficient and cost effective.

What supplements to feed and how they should be fed is covered later in this booklet.

## 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 as failure to implement drought management strategies, resulting in animal deaths and suffering, predisposes you to legal action.

A photograph of two cows in a dry, wooded area. One cow is brown and the other is white. They are standing in a field with sparse vegetation and trees. The background is a dense forest of thin trees.

## Section 2

# Supplementary feeding

## Digestion in cattle (ruminants)

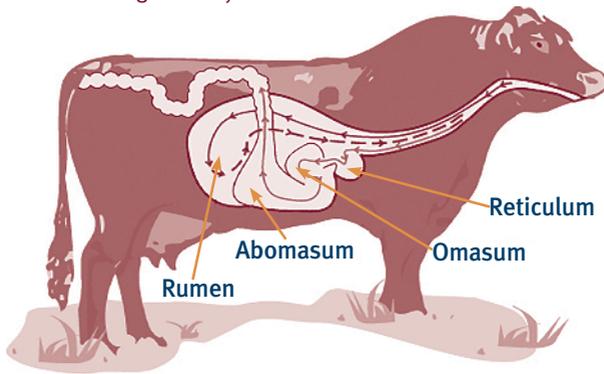
To plan an effective supplementation program for your cattle you will need an understanding of how the digestive system functions and how nutrients are used.

For growth and reproduction, cattle need an adequate supply of energy, protein, minerals, vitamins and water. When the feed 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 for maintenance, growth or reproduction.

### The ruminant digestive system

Ruminants evolved to graze on fibrous grasses and herbage. Their digestive system is more complex than monogastric animals (horses, pigs and humans). In the ruminant, there is a large four chambered organ consisting of the rumen, the reticulum, the omasum and the abomasum (true stomach) (*Figure 2*). From the abomasum onward, the digestive tract and the processes that take place there are very similar to those in monogastric animals. Ruminants rely on micro-organisms to break down the fibrous materials in their diet.

**Figure 2.** The ruminant digestive system



### The rumen and reticulum

The rumen is a large fermentation vat that contains a complex ecosystem of bacteria, protozoa, fungi and archaea. The microorganisms produce enzymes that can break down cellulose (fibre) into smaller components (e.g. glucose, volatile fatty acids). These can be digested and absorbed either across the rumen wall or further down the digestive tract (small and large intestine). The reticulum is smaller than the rumen. Its function is also similar to that of the rumen. The two organs are usually considered as one organ (the rumen-reticulum). The oesophageal opening (for feed entering) and the reticulo-omasal orifice (for feed exiting) are located in the reticulum.

At birth, the rumen is smaller than the abomasum because the calf is only digesting milk. Milk is easily digested and doesn't need microbial help. Early in the calf's life, milk bypasses the rumen-reticulum via the oesophageal groove and drops straight into the abomasum. A young calf needs to suckle with their neck extended (if bottle feeding) for the oesophageal groove to function. As the calf begins to graze or consume rations, the rumen and reticulum grow in volume to accommodate the diet and develops a mixed population of microorganisms from adult cattle (via shared drinking water). The calf has to be about three months of age before its rumen is developed enough for it to survive satisfactorily on high fibre diets.

## Section 2: Supplementary feeding

The rumen-reticulum is muscular and contracts about two to three times per minute. These contractions keep the contents well mixed and keep the microorganisms in contact with feed particles. Regurgitation and re-chewing of the rumen contents (chewing the cud/rumination) assist the mixing and breakdown process. Once the feed has been broken down to a smaller size it flows out of the rumen into the omasum. This 'digesta' contains feed particles that have escaped fermentation, microorganisms that have multiplied within the rumen and the products of rumen fermentation. Fermentation in the rumen produces energy and protein that can be used by the cattle. Thus, feeding cattle is really feeding the rumen microorganisms.



*Mitchell grass in this condition has little feed value*

The type of microorganisms in the rumen depend on the diet of the animal. In grazing cattle, the microorganisms are mainly 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 microorganisms have time to adjust. A rapid change from a fibre (grass/hay) to a starch diet (grain) can result in exponential growth of starch digesting organisms and a swift increase in acidity of the rumen contents. This acidity may reach a level that causes severe metabolic disorders or even sudden death (acidosis), but this is more common in feedlot or dairy situations due to high grain diets.

## Digestion of feed

Grazing cattle eat plant material containing energy, protein, minerals and vitamins. Digestion in the rumen and gastrointestinal tract releases these nutrients from the feed. Nutrients are then absorbed across the gut wall for use by the animal.

### Energy

Energy is made available to cattle from fats, carbohydrates and true protein. Energy sources are fermented by microbes in the rumen. Glucose and volatile fatty acids (VFAs) are products of the fermentation. The VFAs are the main energy source for cattle and are absorbed across the wall of the rumen, although some pass to the abomasum and small intestines where they may undergo further breakdown before absorption.

The most important VFAs are acetic acid, propionic acid and butyric acid. Fermentation of fibrous feedstuffs (grass, hay, some silage) favours 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 converting feed energy to energy used by the animal (with less methane) than fermentation that favours production of other acids. The production of butyric acid is the least significant and is similar across feed types. Increased production of propionic acid relative to acetic acid can 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 contains nitrogen, and ruminants get protein in their diet from either: plant material (grains and protein meals), or 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 (their body). Protein that is broken down in the rumen is referred to as rumen degraded protein (RDP) while protein that escapes breakdown in the rumen (and passes through to the small intestine) is called bypass protein or undegraded protein (UDP).

While there has been a lot of emphasis on the inclusion of bypass protein in rations, in extensive grazing situations it is more important to ensure that there is sufficient protein (nitrogen) for the microorganisms. The microorganisms themselves are eventually washed out of the rumen and their cells (bodies) digested as a major source of protein to the animal in the small intestine. In a grazing setting microbial protein makes up the majority of the protein cattle receive.

### ***Rumen degraded (Microbial) protein***

The rumen microorganisms produce enzymes that breakdown dietary protein to the nitrogen containing compound ammonia, which they then metabolise 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 cattle as a source of ammonia for the microorganisms and, 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 across the rumen wall 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. Excessive amounts of ammonia in the blood is toxic.

### ***Undegraded (Bypass) protein***

Dietary protein that escapes breakdown in the rumen (undegraded, bypass or protected protein) is broken down in the abomasum and small intestine 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 microorganisms. 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. Wet season phosphorus supplementation (and the inclusion of phosphorus in dry season supplements) is necessary across large areas of northern Australia due to low soil phosphorus levels.

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

## **Deciding on feeding options**

If you decide to feed supplements to some of your cattle, the first step is to consider feed availability, suitable rations and prices. Most drought plans involve changes to feeding 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 feeding options:

- capital required, available cash and the budget you are willing to commit
- 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 the condition and productivity of your property.

### **Decide on the desired performance**

Every situation is different. Some people feed for maintenance and others for production. To maintain fertility, it is important for breeders to be going into winter in good condition and staying in at least store condition, preferably better. To assess the body condition score of your cattle, refer to: [futurebeef.com.au/knowledge-centre/body-condition-score-for-beef-cattle](http://futurebeef.com.au/knowledge-centre/body-condition-score-for-beef-cattle).

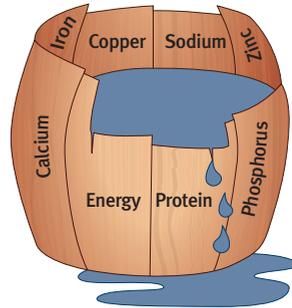
### Determine which nutrients are limiting performance

Targeting ‘the primary limiting nutrient’, which is the one most limiting production, 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 on tropical pastures. Supplementation programs should be aimed at increasing the supply of these nutrients. Protein deficiency often occurs in the dry season when there is no green feed or legumes in the pastures and especially after frost. It 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 enough to satisfy their energy requirements.

A deficiency of protein and energy usually occurs in spring or late in the dry season. Minerals are more likely to become a primary limiting nutrient during the wet season when protein and energy are no longer limiting. In phosphorus deficient country, supplementing phosphorus deficient cattle in the growing season will increase their pasture intake and improve performance. At the start of the dry season they will be in much better condition, and therefore better able to handle drought conditions.

**Figure 3.** Determine which nutrient(s) are limiting performance



## Choose a supplement

While the aim is to choose a supplement that rectifies the primary limiting nutrient and achieves the desired performance, many other factors will influence a suitable choice for your situation such as:

- cost per unit of desired nutrient (e.g. energy, protein, phosphorus etc.)
- transport costs and availability (short- and long-term)
- palatability – will they eat it?
- labour requirements for preparation and feeding out
- infrastructure and machinery (storage, troughs, mixing, feeding etc.)
- risk to self and stock
- 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 cost, condition of the cattle, pasture quality and supply and whether survival or production is the aim.

## Supplementing or feeding?

Supplementation can be divided into two broad categories which blend into each other:

**Supplementation** can be thought of when there is ample paddock feed as the main feed source and the supplement aims to provide the primary limiting nutrient which is holding back improved animal performance. It value adds the paddock feed by helping stock to eat more and perform better. Typical seasonal nutritional deficiencies are protein in the dry season and land type specific mineral deficiencies during the wet season, such as phosphorus.

**Feeding**, such as drought or production feeding, can be thought of when there is insufficient paddock feed available, or it is of a quality that does not support a desired stock performance and a complete feed is provided to meet specific stock requirements. It tends not to increase paddock feed intake and with increasing levels it substitutes for paddock feed.

## Seasonal nutritional deficiency supplements

In the dry season, protein is the most widespread seasonal deficiency. In the wet season, phosphorus is the primary limiting nutrient across large areas of Queensland.

### Protein supplements

Protein supplements commonly use non-protein nitrogen (NPN) from urea (46% nitrogen) and also true protein from protein meal. Target intakes of protein from urea-based supplements is approximately 75g (26g urea) per head, per day for young cattle, and 150g (52g urea) per head, per day for breeders.

Protein stimulates activity of the rumen microorganisms that in turn stimulates intake of dry pasture and increases energy intake. [Near Infrared Reflectance Spectroscopy](#)\* (NIRS) can help identify when protein is deficient in the pasture. 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.

Protein supplements include:

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



*Cattle on pasture like this will benefit from a protein supplement*

\* [futurebeef.com.au/knowledge-centre/assessing-pasture-diet-quality-nirs](http://futurebeef.com.au/knowledge-centre/assessing-pasture-diet-quality-nirs)

There has been little research work done to compare the various supplements, however work at Swan's Lagoon Research Station in north Queensland showed that the roller drum gave similar results to a salt/urea/sulphur lick. All licks in this category probably give similar results (about 200–250g/day live weight gain response) provided that protein is the primary limiting nutrient, the protein intake is the same and they provide adequate sulphur. For any supplement containing urea there is some risk of urea poisoning. For more information on urea poisoning see page 42.

### **Commercial blocks and dry mixes**

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

- convenient, requiring little or no preparation
- low 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; blocks may be eaten too rapidly or too slowly, or not at all
- when trying a new product only buy a small quantity until you are satisfied with intake
- if possible, put blocks under cover.

### **Commercial liquid supplements**

Many commercial liquid supplements are available on the market. Care should be taken to see that intake rates meet animal requirements, i.e. breeders require around 150g protein per head, per day. Over consumption can become very expensive. Commercial liquid supplements are often delivered directly to the trough by the supplier, so these options are very convenient.

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

Some of the disadvantages are:

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

To introduce cattle to roller drums, start by feeding a mixture of 50/50 molasses and water. 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 final mix sufficient for 100 head of breeders for one week might be:

- 150kg (110 litres) molasses
- 225 litres water
- 35kg urea
- 2.5kg 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 seven (or more) molasses to one urea provides sufficient sulphur. Adding GranAm® to mixes that have a ratio of molasses to urea of less than seven to one will provide the necessary sulphur.

If your cattle also need phosphorus supplements, **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*

## Dry licks

Dry licks are used over large areas of Queensland to supply non-protein nitrogen (NPN) to cattle. They have proven effective for seasonal dry season protein deficiency and droughts.

The key components of a dry lick are urea and a sulphur source. Other ingredients such as salt and protein meals influence palatability. Sulphur is added because the rumen microbes require additional sulphur to efficiently utilise the nitrogen being supplied by urea. Sulphur can be supplied by elemental (yellow) sulphur or GranAm® (24% sulphur). GranAm® is more commonly used because it supplies additional NPN (20.5% nitrogen) 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.



*Dry lick being fed out in half tonne bulker bags*

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, check rates with your local nutritional adviser.

On phosphorus (P) deficient country, phosphorus is generally added to dry licks (*Table 6*). Kynofos and dicalcium phosphate (DCP) are commonly used phosphorus supplements. Some phosphorus sources are not suitable due to heavy metal residue risk or excessive fluorine. The recommended supplementary phosphorus intake for breeders in a dry season (NPN supplement) is half the recommended wet season intake. For example, if the recommended wet season intake for a mature breeder on ‘deficient country’ is 6g phosphorus per head, per day, the dry season lick should supply 3g phosphorus per head, per day.

**Table 6.** Typical dry season recipes for breeders and weaners

Ingredient	Phosphorus adequate country		Phosphorus deficient country	
	Breeders (% or kg)	Weaners over 200kg (% or kg)	Breeders (% or kg)	Weaners over 200kg (% or kg)
Urea	30	30	30	30
GranAm®	6	6	6	6
Protein meal	0	25	0	25
Kynofos	0	0	15	10
Salt	64	39	49	29
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Dry licks including 30% urea can be used to supplement normal weaners (>200kg), 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 canola 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, it is important to note that 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 under humid conditions using flossy fine salt may reduce the potential for moisture problems. 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.



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

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, introduced cattle that have not had urea previously.

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

When feeding cattle 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 result in reduced 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 five urea to one 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 150g protein per head, per day for breeders and 75g protein per head, per day for young cattle.

Vegetable protein meals can provide better performance by increasing the daily ration intake. 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. More detail on controlling intakes can be found on page 49.

It is important to note that soybean meal has caused poisoning. It is highly palatable and digestible, and salt can be used to restrict intake. A 50:50 mix of soybean meal and salt is a safe starter ration. Salt can then be increased or decreased in the mix to achieve target intakes. It is important to change protein meals gradually and not feed it 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. *Table 7* includes two suggested mixes.

Mixing can be time consuming, however the advantages of home brews are:

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

**Table 7.** High and low palatability home brew mixes. An intake of 500g of either feed will provide 150g protein

Ingredients	Parts by weight (kg)	
	High palatability	Low palatability
Crushed grain	40	32
Stock salt	18	31
Molasses	20	15
Urea	10	10
Dicalcium phosphate (DCP)	7	7
Protein meal	5	5
<b>Total</b>	<b>100</b>	<b>100</b>
<b>Protein % (approx.)</b>	<b>32</b>	<b>30</b>

To mix, dissolve the urea in 10 litres (2.5 gallons) of water, add molasses, mix thoroughly, and then add all dry ingredients. This brew can be mixed easily 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, pack the lick down in the trough to prevent cattle biting lumps of lick. It is also advised to protect the troughs from rain to reduce the chance of urea poisoning.

## Other supplements

A range of other supplements, particularly those listed under drought feeding on page 45, can be used to overcome seasonal nutritional deficiencies. The level of feeding of these supplements should be calculated to provide 150g/head/day of protein for adult cattle and 75g of protein/head/day for weaners.

## 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 and excess is excreted in the urine.

The aim is to gradually introduce cattle to urea, building up from low levels to desired intakes over several weeks. This allows time for both the rumen microorganisms and the liver to adapt to processing higher levels of ammonia. For efficient use of urea by the rumen microorganisms it is important to have the correct balance of sulphur (S) to nitrogen (N) {1S:10N}. In loose licks this can be achieved by feeding 1 part GranAm® with 5 parts urea; or 1 part yellow sulphur with 20 parts urea.

**Some forms of sulphate 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 the animal and the microorganisms are accustomed to using. Cattle can gorge urea licks when supplement runs out for several days to a week and feeding then resumes. Ensure there is a steady and regular intake of urea to reduce the incidence of urea poisoning.

#### Symptoms of urea poisoning

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

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

### **Treatment**

Treatment of urea poisoning must take place very quickly to be successful, so carry drench in your work vehicle when feeding urea supplements:

- drench with four to eight litres of a mixture of equal parts of water and vinegar
- repeat dose after one hour.

### **Reducing the incidence**

Where urea is supplied in a liquid feed it is important to completely dissolve urea. Granulated urea, which is more readily available in some areas, is more difficult to dissolve than prilled (pellet form) urea. Liquid or water that collects on top of licks containing urea can be highly toxic. Moisture dissolves the urea in the lick and can be quickly consumed by cattle. 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 help absorb moisture in hot humid weather
- using flossy fine salt or kiln dried salt, especially in hot humid conditions. Stock salt is less refined than the other products and contains magnesium chloride as well as sodium chloride. In humid weather, the magnesium chloride and urea can dissolve and the resultant liquid is highly toxic to cattle.

### **Rumen modifiers**

Rumen modifiers are substances that change the balance of microorganisms in the rumen resulting in more efficient rumen fermentation. They improve feed conversion efficiency and weight gains. Some help to control coccidiosis (a parasitic disease of the intestinal tract of animals) making them useful in young weaner rations. Only small quantities are required and should be used according to manufacturer recommendations and mixed thoroughly. Monensin and lasalocid are toxic to horses, dogs and pigs so care is required with their storage, mixing and where the mixed feed is fed.

## Phosphorus

During the dry season, and/or drought feeding situations, phosphorus should be included in the supplement for lactating breeders. 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 block products are used, select a block with high phosphorus content.

More information on phosphorus supplementation is available from:

- *Phosphorus management of beef cattle in northern Australia*, [mla.com.au](http://mla.com.au)
- [futurebeef.com.au/knowledge-centre/phosphorus-supplementation-of-cattle-in-northern-australia](http://futurebeef.com.au/knowledge-centre/phosphorus-supplementation-of-cattle-in-northern-australia).

## Cadmium and fluorine content

Concern over high levels of cadmium and fluorine in phosphorus supplements has caused changes in the recommendations for phosphorus 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.

## Drought feeding

As pasture quality drops, stock may become unable to meet their nutrient requirements, even with a protein supplement. This is particularly the case late in the dry season and for lactating cows with high nutrient demands for milk production. This is when drought supplements, which are high in energy and high/balanced for protein, can help stock to maintain condition.

Drought supplements are typically fed from one to three kilograms per head, per day. Commonly used drought supplements include:

- fortified molasses
- grain
- whole cottonseed
- vegetable protein meal
- roughage (hay and silage).

See *Table 8* for approximate nutrient content of common drought supplements and feeds.

If pasture quantity also becomes limiting, consider further destocking or confinement feeding (i.e. full feeding in a sacrifice paddock) to retain adequate ground cover and reduce paddock degradation. For rumen and animal health it is essential to keep roughage at preferably 20% of the diet or more.

Under normal grazing conditions, the animal's needs for vitamins are either met from the diet or produced by the rumen microorganisms. Where cattle have had **no** green material in their diet for at least three months, it may be beneficial to provide vitamin A and E supplements or a vitamin ADE injection for breeders before calving or for stock going into feedlots.

**Table 8.** Approximate nutrient content of common drought supplements (on a dry matter basis)

Nutrients	Molasses	Grain	Whole cottonseed	Protein meal	Hay or stubble
Dry matter %	75–85	88–93	90–93	90–94	84–93
MJ ME/kg	12–13	10–14	12–14	10–14	5–12
Protein %	3–5	8–14	20–24	15–50	3–30
Calcium %	0.7–1.2	0.01–0.05	0.15	0.2–0.7	0.1–2.5
Phosphorus %	0.07	0.2–0.4	0.6–0.75	0.5–1.5	0.1–0.5
Sodium %	0.1	0.02	0.01–0.3	0.03–0.5	0.01–2.0
Sulphur %	0.5–1.2	0.12	0.27	0.2–0.8	0.06–0.4

## Fortified molasses

Molasses is high in energy but low in protein, so it needs to be ‘fortified’ with protein sources such as urea and/or vegetable protein meals. If a long feeding period is anticipated, it is worth contracting molasses supply early to ensure supply at a known price. 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.

Molasses mixes are fed more commonly in north Queensland due to the close proximity to sugar mills. Producers must consider the cost of equipment and infrastructure required to efficiently handle molasses mixes (e.g. storage tanks, mixers, troughs, trailer and/or truck, and good access tracks).

There are many commercial molasses mixes available. Some are higher energy like fortified molasses. Others are designed mainly as protein supplements with lower energy. These serve a similar role as other protein supplements such as roller drum mixes, vegetable protein meals and dry licks. It is important to know the difference to make sure you are using the right supplement for the right reason, particularly if wanting to supply energy to stock on low quality pasture.

Two commonly used homemade fortified molasses mixes are M8U (molasses + 8% urea by weight) and M3U (molasses + 3% urea + vegetable protein meal + phosphorus + salt + Rumensin™). These mixes are detailed in *Table 9*. Mechanical mixers are needed to ensure the urea is completely dissolved to reduce the risk of urea toxicity.

**Table 9.** Two commonly used fortified molasses mixes

Mix name	Molasses (%)	Urea (%)	Vegetable protein meal (%)	Phosphorus (%)	Salt (%)	Rumensin™ (%)
M8U	92	8	Nil	Nil	Nil	Nil
M3U	84.95	3	10	1	1	0.05

M8U uses urea for protein and intake control. Up to the first 4% of urea balances up the protein-energy ratio and the remaining urea increases bitterness which slows intake. Ad lib (unrestricted) access is recommended to reduce the risk of urea toxicity. Ensuring that troughs don’t run empty helps keep stock adapted to urea and prevents stock overeating when troughs are refilled. Stock may eat from one to three kilograms per head, per day. There must always be adequate pasture available or roughage supplied when using fortified molasses.

M3U can be fed intermittently to control intakes. However, bullying can then be a problem when troughs are refilled. Good trough space and segregation on weight will help. M3U can be used as a drought or production feed. Rumensin™ must be mixed thoroughly at the correct rate. It is toxic to horses and dogs and some markets do not accept cattle fed Rumensin™.

The following figures are useful when calculating molasses rations and feeding quantities:

- 1 UK gallon = 4.54 litres
- 1 litre molasses = 1.4 kilograms
- 1 gallon molasses = 6.36 kilograms
- 714 litres molasses = 1 tonne.

### Storage and mixer

If you plan to use fortified molasses it is worth setting up an efficient system. This includes a bulk storage tank and mechanical mixer. A mechanical mixer (e.g. stationary, truck mounted or trailer) supplies a safer feed and can halve feeding out time. Bulk storage saves time and labour compared with handling 200 litre (44 gallon) drums. Ensure that all taps on bulk tanks and mixers are at least 100mm (four inches) but preferably 150mm (six inches) in diameter. Smaller outlets restrict flow making filling 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 mixer. If this is not possible, guttering should be used in preference to pipe.

### Mixing fortified molasses

- put molasses in the mixer or trough first, then add other ingredients
- mechanical mixing is essential when using urea and should continue until all the urea is completely dissolved (can't feel any granules)
- prilled urea (smaller particle size) dissolves much faster than granulated urea
- mixing the night before and again before feeding works well
- if poorly mixed the urea forms a crust on top of the molasses mix, which can cause deaths, particularly following a light shower of rain
- rain on properly mixed M8U (or similar mixes) is low risk – if stock have not already drunk the water, then bail or siphon it off but do not mix it in as cattle may drink the mix and deaths occur
- it is not recommended to mix the urea in water before mixing with molasses as this can increase intakes and risk of poisoning

## Section 2: Supplementary feeding

- if the urea is completely dissolved, it is not necessary to put mechanically mixed fortified molasses under cover
- if only mixing small quantities of fortified molasses mixing can be done with attachments to chainsaws or brush cutters.

### Intakes

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: 1–1.5kg per head, per day
- Yearlings: 1.5–2kg per head, per day
- Breeders: 2–4kg per head, per day.



*Feeding out fortified molasses*

## Controlling intake

Controlling intake can be a problem. For M&U the high urea content increases bitterness and slows intake. Tests have shown that adding one gram of Rumensin™ 100 Premix (that is 100mg monensin sodium) per kilogram of molasses in a 4% urea-molasses mix reduced intake to the same level as an 8% urea-molasses mix. However, this intake reduction may only be short-term. The total mix used was 650kg (100 gallons) molasses + 26kg urea (4%) + 650g Rumensin™ 100 Premix. The advantages of using Rumensin™, instead of extra urea, are that it is cheaper, it acts as a coccidiostat and being a rumen modifier, it improves feed conversion efficiency. Rumensin™ is toxic to horses and dogs and must also stay mixed thoroughly at correct rates to avoid toxicity in cattle.

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 75mm x 75mm weldmesh on 50mm polythene pipe joined in a circle
- weaners 80mm x 50mm weldmesh on 50mm polythene pipe joined in a circle.

The mesh must be cut to the shape of the trough.

**For more details on *fortified molasses* visit:**

- [futurebeef.com.au](http://futurebeef.com.au) and search for '*molasses*'
- [daf.qld.gov.au](http://daf.qld.gov.au) and search for '*molasses*'.

## Grain

Grain is high in energy (from starch) and usually has a sufficient balance of protein. It is low in calcium and sodium. Adding 1% limestone (1kg in 100kg of grain) and 0.3% salt (300g in 100kg of grain) will correct calcium and sodium. If protein has been tested as low, adding 1% urea will increase protein by 2.8%. Alternatively, vegetable protein meals, cottonseed or pulse grains can be used. Commercial feedlot premixes are also available to nutritionally balance grain for minerals and vitamins, and often include rumen modifiers. Commercially available pellets and feedlot rations are alternatives to grain and are nutritionally balanced for protein, minerals, vitamins and perhaps a rumen modifier. Drought supplement levels are around 1kg per head, per day for weaners and 3kg per head, per day for breeders.

## Starting cattle on grain

To reduce grain poisoning risk (acidosis), introduce grain gradually to let rumen microbes adapt to a starch diet. First, settle stock onto hay until they are all eating. Continue to feed hay and start grain at 0.5kg per head, per day. Feed grain after the hay has been consumed. Increase the grain by 0.5kg per head, every second day and decrease the hay until the desired ration is reached. Be prepared to segregate non-eaters.

If introducing grain as part of a mixed ration, start all stock on hay and then increase grain by 20% of the mix every four to five days. 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 allows all animals to feed at one time. Once settled on grain, feeding can be done every second day. Be aware that if feeding grain on the ground, soil intake increases the risk of intestinal compaction.

For self-feeders start with the shutters opened no more than 12mm. One 3-metre (10ft) self-feeder is sufficient for 50 weaners or 35 breeders. Including some hammer milled hay in the mix can reduce risk. Ensure a continuous supply to avoid digestive upsets. Mild cases of grain poisoning respond to a drench of 120g of baking soda (bicarbonate of soda) in 1 litre of water, followed by a half dose (60g in 1 litre) within a few hours.

## Things to consider to minimise grain poisoning

- introduce grain gradually
- roll or coarse-crack grain (avoid cracking grain too fine)
- feeding whole grain is safer however, there will be some loss in dung. Soaking for 1–2 days is an option
- add 2–4% bentonite or 1% bicarbonate of soda
- call cattle to the feeding points
- pre-feed with hay or mix some hay or other safe feeds such as whole cottonseed with the grain
- allow plenty of room or trough space (50–60cm per head)
- be prepared to segregate non-eaters and cattle doing poorly
- change from one grain to another gradually by blending the grains
- during cold, wet weather, increase feeding levels by 20% using hay
- use greater care with wheat as it ferments faster in the rumen.

## Whole cottonseed

Whole cottonseed (WCS) is high in energy and protein, and moderately high in phosphorus and fibre. Its main limitations are high oil (13–22%) and gossypol.



*Whole cottonseed*

### Advantages of whole cottonseed

- WCS can be used as a protein supplement or an energy feed, and is low in starch so gutsing does not cause acidosis
- WCS is fed whole; hammer milling is not required
- WCS can be mixed with other feeds such as grain or molasses or used up to about 12% in feedlot rations
- WCS can be fed in troughs or in small heaps on hard ground, enough for four head per pile.

Be aware though that if feeding WCS on the ground, soil intake increases risk of intestinal compaction. Special self-feeders with wide shutter space and steep sides are available. Cottonseed may bridge in conventional grain self-feeders. WCS can also be fed out by dumping a load in the paddock and fencing it with an electric fence or portable panels. The cattle can feed under the fence or through the panels.

### Disadvantages of whole cottonseed

- WCS requires bulk handling and it will not auger like grain.
- WCS is high in oil – if total oil in the diet exceeds 6%, fibre digestion in the rumen is reduced.
- If wanting to use WCS as a protein supplement to stimulate pasture intake, then use smaller amounts more regularly, for example daily feeding at 0.5–1.25kg per head or 2–3kg per head fed every three days.
- WCS contains a natural toxin called gossypol. Rumen microbes can detoxify gossypol up to a certain level. Cottonseed must not be fed to pigs, poultry and horses or young calves less than four months old. Suckling calves will not eat enough to present a problem when lactating cows are supplemented at recommended levels, for example less than 30% of the diet.
- Gossypol may cause reduced fertility in bulls however many bulls have eaten WCS during droughts without apparent problems. As a precaution do not feed large amounts of WCS to bulls in the months prior to mating or avoid if concerned. Young developing bulls are more susceptible to gossypol so limit WCS intake to 10% or less of the diet or 15–20% for mature bulls. Cows are less susceptible to fertility problems than bulls though; if doing embryo transfer programs cotton products are best avoided.
- If feeding several kilograms of WCS to lactating cows consider adding 1–1.5% limestone to correct the calcium (Ca) to phosphorus (P) ratio or provide a salt/limestone lick (aiming for about 20–40g of limestone per lactating cow). Recommended feeding rates of WCS are included in *Table 10*.
- Cattle must have access to roughage to avoid sickness.

**Table 10.** Suggested feeding rates of WCS with adequate dry feed available

Stock class	As a protein supplement (kg/head/day)	For energy (kg/head/day)
Breeders	1.0–1.25	1–3
Yearlings: 250–350kg	0.5–0.75	1–2
Weaners: 100–150kg	0.2–0.5	0.5

## Handling and storage

WCS is mostly transported in tip trucks or specialised ‘moving floor’ trailers. 12 tonnes of WCS is equivalent in volume to 20 tonnes of grain. It is best stored in sheds though it can self-combust if stored wet (greater than 14% moisture) or stacked too high (more than five metres) or if there is poor air circulation. WCS can be stored in the open if the site is well drained and the heap is kept in a cone shape with smooth sides to shed water. It can be stored in underground pits for longer periods.

## Vegetable protein meals

While vegetable protein meals such as canola, cottonseed, copra, sunflower, palm kernel and soybean meal are mostly used for protein, they also have energy levels similar to grain, around 10–14 MJ ME per kilogram dry matter. If there is a good supply of low protein pasture, relatively low levels of protein meals (e.g. 250g–2kg per head, per day) will improve rumen function, pasture intake and growth response more so than similar levels of grain. If higher intakes of energy are required then grain/meal mix, grain or other energy sources may be more cost effective.

Feeding out protein meals 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. When used as a protein supplement for low protein pasture, 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.

## Roughage – hay and silage

Roughage is essential in the diet for ruminants. It is best to:

- buy roughage by weight, for example dollar per tonne, as buying by the bale can be very expensive as bale weights are highly variable
- avoid roughage showing signs of mould, as it reduces palatability and may cause deaths.

## Hay

While hay is widely used during drought, it is often – but not always – expensive when compared to other more concentrated energy feeds such as grain, molasses, or vegetable protein meals. It remains essential for specific purposes, such as weaning, where there is no paddock roughage or where cattle have been locked in yards or where paddocks have been sacrificed to reduce paddock degradation.

The feed value of hay varies with stage of growth at cutting. Forages cut before they mature are a higher quality. The feed value of failed crops also varies considerably depending on the stage of growth at cutting. Roughage from crop residues is generally of very poor quality and will require protein and possibly energy supplements. On average, temperate pasture and cereal hays are more digestible than tropical pasture and forages. Hay quality can be highly variable (*Table 11*) and requesting a feed analysis is advised.

**Table 11.** Guide to feeding value of hay sources

Type	Palatability	Energy (MJ ME/kg DM)	Digestible protein (%)	Need more protein?
Good lucerne	good	9.5	13–30	no
Grassy lucerne	good	8.5	8–20	no
Forage sorghum – cut early flowering	good	9.5	8–15	no
Forage sorghum – cut when mature	fair	8.0	2–7	yes
Sorghum stubble	poor	7.0	2–5	yes
Winter cereal stubble	fair	6.0	2–8	yes
Native pasture (mature)	poor	5.5	2–6	yes
Peanut hay – with nuts	very good	10.0	12	no
Peanut hay – leafy	good	8.5	9	no
Peanut hay – stalky	fair	6.0	5	yes
Soybean hay, some seed	good	8.0	10	no
Soybean straw	fair	6.0	2–6	yes

Producers need to do their sums for their circumstances to compare buying higher or lower quality hay. To supply the same energy and protein, less high-quality roughage is needed. A lower quality roughage can limit intake and may also need additional protein and/or energy supplementation (*Table 12*). Transport costs can add significantly to the cost of hay, so it is best to calculate your feed budget on the delivered price per tonne.

**Table 12.** Oaten hay compared with barley stubble when full feeding weaners, dry cattle and lactating cows

	Weaner 200kg gaining 0.25kg/head/day	Dry cattle 450kg maintenance	Lactating cow 450kg maintenance
<b>Oaten hay</b> (9.7MJ ME/kg DM, 9%CP)	3.75kg	5.5kg	9.5kg
<b>Barley stubble</b> (7.5MJ ME/kg DM, 4.9%CP)	3.75kg + 1kg grain (or + 0.5–0.75kg protein meal)	7.25kg + protein lick	8.5kg + 2kg protein meal (or + 2kg grain + protein lick)

The above figures are an example of full feeding. If stock can get about half of their requirements from the paddock, then halve the above rates.

### **Raising the protein content of hay**

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

- feeding a protein supplement to the animal as outlined in seasonal nutritional deficiency supplements on page 34; or
- treating the hay 12–24 hours before feeding with the following mixture:  
9kg urea + 45 litres water + 18kg (13 litres) molasses.

This mixture should be used at the rate of one litre per small rectangular bale. One litre of this mixture contains 150g urea, which is sufficient to treat a 20kg 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

Silage can be a valuable drought reserve. The resultant silage is only as good as the crop it was made from, unless other nutrients were added during the ensiling process. If not done properly at each step of the process, there can be significant losses in quality and quantity. If learning to make silage, it is well worth employing consultants to achieve good results and minimise potential losses.

When purchasing or feeding silage it is important to account for moisture content which can vary from 70–45% water. This means that if you are buying silage for \$150 per tonne with 50% moisture you are actually paying \$300 per tonne of dry matter. Doing the sums is particularly important when carting silage long distances.

For more details on *silage* visit: [dpi.nsw.gov.au/animals-and-livestock/dairy/feed/research-results/successful-silage](http://dpi.nsw.gov.au/animals-and-livestock/dairy/feed/research-results/successful-silage).

## Other roughage

During drought a wide variety of roughage and crop residues are fed to livestock. The nutritive value of these feeds varies considerably, with many being little better than fill. This reinforces the importance to plan the feed year well ahead to match stock numbers with pasture supply and store or order supplements early when supply and prices are favourable.

## Hydroponic fodder (e.g. barley sprouts)

Week old hydroponically sprouted barley is around 85–90% water, for example 10kg 'as fed' is 8.5–9kg water. Spending large amounts of money and time to sprout grain for commercial cattle is not normally considered practical or cost effective.

For more details on *drought supplements* visit:

- State Government websites such as:
  - [daf.qld.gov.au](http://daf.qld.gov.au)
  - [dpi.nsw.gov.au](http://dpi.nsw.gov.au)
- [futurebeef.com.au](http://futurebeef.com.au).

## Chemical residues

During drought, cattle are often fed crop residues or graze paddocks they would not normally graze. This increases the risk of chemical residues.

To minimise the risk of chemical residues:

- use only registered chemicals and veterinary drugs according to label instructions and observe withholding periods and export slaughter interval. (refer to: [apvma.gov.au/node/26531](http://apvma.gov.au/node/26531))
- do not feed stubble or other residue from crops that have been grown on land previously treated with organochlorines
- do not feed stubble or other residue from crops treated with pesticides unless the withholding period has been observed
- purchase fodder from a reputable source, and if possible, obtain a commodity vendor declaration
- beware of grain storage facilities with concrete or earth bases, particularly those that have been treated with organochlorines as these areas may be a source of contamination
- beware clean-up loads of grain containing a significant amount of dust as they may have very high levels of contamination
- do not hold cattle in yards treated for white ants, particularly where organochlorines have been used, and be aware of old dip sites
- pay careful attention to disposal of old chemical containers and prevent cattle from entering disposal areas
- if in doubt about the chemical status of feed or soil, have tests done before cattle are fed or grazed; contaminated soil can cause residues as the cattle will eat dust on plant material
- if in doubt only feed breeders or cattle that are not entering the food chain for at least two months – slaughter withholding periods vary depending on the chemical and the level in the feed
- in most, but not all cases, withholding stock from slaughter on known clean feed for 60 days will be enough
- store chemicals and lead batteries in well-constructed sheds away from grazing cattle (old car and tractor batteries are best recycled for cash).

**Chemical residues, particularly in failed crops or stubble, can present problems. Always check on the chemical treatment of a crop before feeding the residue to any livestock.**

## 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. Also ensure annual vaccinations are up to date such as *7-in-1* and *vibrio* as a minimum.

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 2kg protein meal or 5kg fortified molasses per head, per day. 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. Reduce the risk of fertility problems with whole cottonseed by feeding a maximum of 2–3kg per head, per day or less if concerned.

For more details on **bull management** visit:

- [futurebeef.com.au](http://futurebeef.com.au) and search for 'bulls'.

## Managing early weaning

The major benefit of early weaning is improved reproductive performance of the breeder herd. Weaning early helps keep cows in better condition which improves re-conception rates, subsequent weaning rates for the following mating period, and cattle sales in the long run.

Under usual seasonal and weaning conditions, weaners will be around 150kg. Early weaning may be needed in dry conditions or in any situation where there is a need to prevent cows losing body condition. Weaning removes a significant drain on the energy requirements of cows and lessens the need to supplement breeders. Weaning earlier in the year, while pastures can still support weight gain, can allow cows to gain condition before winter. Having weaners in the yards also provides an opportunity to handle and educate young cattle that will stand you in good stead for husbandry and handling later in life.



*Early weaning saves cow condition and reduces feeding costs*

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. Small calves have small rumens and can only eat a small amount per day. This means that they require very high-quality feed in both protein and energy. Calves less than 60kg should only be weaned in extreme drought conditions. These very young calves need special attention, and it may be easier to feed both cow and calf until the calf reaches 60kg.

For a feeding program to be successful segregation is essential to prevent bullying and smaller calves being prevented from accessing feed. *Table 13* details weaner weight groups and their nutrient requirements.

**Table 13.** Weaner management groups and supplement requirements

Weaner weights and suitable feeds			
Weaner weights	Feed type	Crude protein requirements (%)	Energy requirements (MJ ME/kg)
<b>Under 60kg</b>	Milk replacement powder – teat	20–27	*
<b>60–100kg</b>	Clean water, good hay and weaner pellets or mash	20	12
<b>100–150kg</b>	Good water, hay and weaner pellets. M3U is a cheaper option for weaners over 120kg	14–16	10–11

\* Milk replacement powder contains sufficient energy for weaners under 60kg

## Weaner growth rates

Producers should aim to keep all weaners gaining some weight in their first dry season. This is especially important for weaners under 200kg and replacement heifers. *Table 14* details weaning weights in May and the daily liveweight gain required for either yearly or two year old mating. Severe early nutritional stress will impact future growth and weight gain potential and heifers will always be poor performing breeders later in life. The earlier in life the growth restriction the poorer the subsequent performance. Compensatory weight gain in these small weaners following the dry season is difficult to predict, as it varies depending on the length of the dry season (or nutritional restriction) plus the value of the following wet season and the land condition of the paddock they are grazing.

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

- under 100kg (three months) should grow at a minimum rate of 0.4kg per day (12kg per month)
- 100kg to 150kg (three to six months of age) should grow at a minimum rate of 0.2kg per day (6kg per month)
- over 150kg (six months of age) should grow at a minimum rate of 0.1kg per day (3kg per month).

**Table 14.** Heifer growth rates required to achieve a minimum target mating weight of 300kg

Weaning weight 1 May (kg)	Weight gain to reach 300kg (kg)	Weight gain required for yearling mating on 1 December (kg/head/day)	Weight gain required for 2-year-old mating on 1 December (kg/head/day)
100	200	0.94	0.34
140	160	0.75	0.28
180	120	0.56	0.21
220	80	0.37	0.14
260	40	0.19	0.07

Source: *Weaner Management in Northern Beef Herds (MLA)*

If weaners are to graze pasture only once the drought breaks it is better to grow them at moderate rates (<0.5kg per day) during the dry season/drought. All weaners lose weight when they go onto green feed. Weight loss in weaners going onto green pick can be reduced by continuing to feed a supplement with high levels of true protein (vegetable protein meal) until there is plenty of green feed.

## Feeding

It is important that all calves start feeding as soon as possible after weaning. Good quality hay (high leaf to stem ratio) should be available in the yards immediately at weaning. 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. Well drained yards (3–4m<sup>2</sup> per head) and adequate trough space (15–20cm per head) ensures weaners have ample access to feed and water. Use of hay feeders will minimise waste and reduce the incidence of spoiled hay and disease. Shy feeders should be drafted out for special training. If calves are sick, they should also be removed to avoid spreading disease through shared feed and water troughs.

The addition of a coccidiostat such as Rumensin™ reduces scouring. Use according to manufacturer recommendations. Some commercial mixes will include a coccidiostat.

Young calves do not have a fully developed rumen and they can physically only eat 1–2kg of feed per day. These young cattle require high quality true protein (from a plant), urea is ineffective and should be left out of these rations. The amino acid (protein building block) profile of microbial protein is not of a high enough quality for very young growing animals.

The need for protein and energy supplements once weaners are paddocked depends on weaner weights, quality of available pasture and production targets. Sustainable stocking rates are a **must** and weaner paddocks should be spelled every wet season to maximise feed availability and quality. If country is suitable, stylos are an excellent addition to weaner paddocks. Too often, second round (August to October) weaners perform poorly because they are introduced into overgrazed paddocks. Most weaners, even in reasonable paddocks, will require dry season supplements.

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

### Feeding rate for calves 60–100kg

Feed unlimited pasture if available or 0.25–0.5kg of either 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:*

- 0.5–1kg per head, per day grain mix (3 parts crushed grain to 1 part protein meal)
- 0.25–0.5kg per head, per day protein meal
- high quality (12 MJ energy and 20% crude protein) calf pellets/crumbles/protein meals fed as per manufacturers recommendations.

Calves in this group should be weighed regularly and those over 100kg moved to the heavier group. This will reduce competition in the lower weight group and will help keep costs down, as larger calves can be fed a lower protein and energy supplement.

### Feeding rates for calves 100–150kg

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

- 1–2 kg per head, per day grain mix
- 0.5kg per head, per day protein meal or whole cottonseed if available
- calf pellets/crumbles (10–11 MJ energy and 14–16% crude protein) fed as per manufacturers recommendations
- free access to molasses plus 12–15% protein meal.

### Feeding rate for calves >150kg

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

- 0.5kg per head, per day protein meal or whole cottonseed if available
- 1kg per head, per day molasses plus 3% urea and 5–10% protein meal.

### 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 to avoid spread of disease.

## Cost

The cost of an early weaning program should be considered. Expected branding rates should increase by 5–10% with early weaning.

When considering early weaning ask yourself the following questions:

- How long will weaners need to be fed for until the expected Green Date for the region?
- Can feed ingredients be forward or bulk purchased when feed prices are low?

Replacement heifers should ideally be going ahead from weaning to joining. In some situations, it may be more cost effective to sell them or keep them as store cattle.

### Early weaning tips

Early weaning done correctly can help reduce nutritional stress and loss of body condition on cows during dry times:

- segregation according to weight is essential to ensure all calves can access the trough and avoid bullying
- Rumensin™ is advised in all small weaner mixes to avoid scouring
- the younger and smaller the weaners are, the higher the quality of feed required
- it is important to calculate the cost of feeding and for how long weaners need to be fed and integrate this with your business goals e.g. replacement heifers need to continue going ahead until they reach joining weight
- as well as the feed ration costs, the time and labour required is significant and needs to be considered
- weaner paddocks **must** be wet season spelled every year; it is especially important for second round weaners to go onto a fresh, spelled paddock.

## Appendix 1.

# Feeding horses

### Digestive system

Horses are monogastric (single stomach) animals. They have a small stomach relative to their size (approx. 9% digestive tract) which means that continuous foraging is preferred over large one-off meals. The stomach produces digestive acid continually. Gastric ulcers will occur where horses do not have frequent access to good quality forage (high leaf to stem ratio), and the saliva that is produced when horses are chewing to buffer the acid. The small intestine (approx. 25% digestive tract) absorbs proteins, simple carbohydrates and fats (as well as vitamins and minerals) found in green grass and commercial grain-based feeds. The large intestine (65% digestive tract) is made up of the caecum and colon. The caecum is a vase-shaped vat with narrow openings for both the entry and exit of feed materials. The caecum contains a microbial population and acts as a fermentation vat for digesting cellulose (fibre) from hay and grass.

If too much grain is fed it will pass too rapidly through the small intestine without being digested and arrive in the caecum, where it will be rapidly fermented and may cause colic. From the caecum, feed material flows through the large intestine where water absorption and further microbial digestion of fibre takes place. It is important that there is a steady flow of fibre through the whole digestive tract. Water is critical because if the fibrous material becomes too dry in the large intestine it will cause impaction.

## Feeding

Horses should be fed according to workload, breeding status, weight and body condition score. Consider the type of work (long days mustering, drafting, competition, kids pony or broodmare) and provide additional feed if needed and the horse is losing condition. Mares in late gestation/early lactation will have 12–20% and 70% greater energy requirements in peak lactation compared with those of dry stock. The cost of drought feeding mares for six months in late gestation/early lactation is approximately 70% more than feeding dry stock.

Stallions will use more energy during the breeding season. Ponies are generally better doers than horses and should be monitored carefully for founder (laminitis) when the season breaks.

To calculate nutrient requirements, you need to know your horse's bodyweight (kg), body condition score and activity level (light, moderate, high). *Table 1* shows how to approximate weight from girth measurements using a measuring tape.

**Table 1.** Estimating horse body weight from girth measurements

Girth (cm)	Weight (kg)	Girth (cm)	Weight (kg)
101	45	159	346
108	77	165	380
114	104	171	414
120	132	178	453
127	164	184	486
133	192	190	520
140	234	199	570
146	252	203	593
152	307	206	611

Source: Avery (1996)

## Appendix 1. *continued...*

Monitor body condition (*Table 2*) and adjust ration if needed. Ideal body condition ranges from 2.5 (endurance, polo) to 4 (dressage, western pleasure).

**Table 2.** A body condition score system for horses (0–5 scale)

Body condition score	Neck	Back and ribs	Pelvis
<b>0 – Very poor</b>	<ul style="list-style-type: none"> <li>marked ‘ewe’ neck</li> <li>narrow and slack at the base</li> </ul>	<ul style="list-style-type: none"> <li>skin is tight over ribs</li> <li>spinous processes sharp and easily seen</li> </ul>	<ul style="list-style-type: none"> <li>angular pelvis</li> <li>skin-tight</li> <li>deep cavity under tail and either side of croup</li> </ul>
<b>1 – Poor</b>	<ul style="list-style-type: none"> <li>‘ewe’ neck</li> <li>narrow and slack at the base</li> </ul>	<ul style="list-style-type: none"> <li>ribs easily visible</li> <li>skin sunken either side of the backbone</li> <li>spinous processes well-defined</li> <li>rump sunken but skin supple</li> </ul>	<ul style="list-style-type: none"> <li>pelvis and croup defined</li> <li>deep depression under tail</li> </ul>
<b>2 – Moderate</b>	<ul style="list-style-type: none"> <li>narrow but firm</li> </ul>	<ul style="list-style-type: none"> <li>ribs just visible</li> <li>backbone well covered</li> <li>spinous processes felt</li> </ul>	<ul style="list-style-type: none"> <li>rump flat either side of the backbone</li> <li>croup well defined</li> <li>slight cavity under tail</li> </ul>
<b>3 – Good</b>	<ul style="list-style-type: none"> <li>no crest (except stallions)</li> <li>firm neck</li> </ul>	<ul style="list-style-type: none"> <li>ribs just covered to easily felt</li> <li>no ‘gutter’ along back</li> </ul>	<ul style="list-style-type: none"> <li>spinous processes covered but can be felt</li> <li>covered by fat and rounded</li> <li>no ‘gutter’</li> <li>pelvis easily felt</li> </ul>
<b>4 – Fat</b>	<ul style="list-style-type: none"> <li>slight crest</li> <li>wide and firm</li> </ul>	<ul style="list-style-type: none"> <li>ribs well covered (need firm pressure to feel)</li> <li>‘gutter’ along backbone</li> <li>‘gutter’ to root of tail</li> </ul>	<ul style="list-style-type: none"> <li>pelvis covered by soft fat (felt only with firm pressure)</li> </ul>
<b>5 – Very fat</b>	<ul style="list-style-type: none"> <li>marked crest</li> <li>very wide and firm</li> <li>folds of fat</li> </ul>	<ul style="list-style-type: none"> <li>ribs buried (cannot feel)</li> <li>deep ‘gutter’</li> <li>broad flat back</li> </ul>	<ul style="list-style-type: none"> <li>deep ‘gutter’ to root of tail</li> <li>skin distended</li> <li>pelvis buried (cannot feel)</li> </ul>

\* Adapted from Huntington 1992

## Forage

Horses require approximately 1.5–2.5% (DM basis) of their bodyweight (e.g. 500kg horse = 7.5–12.5kg per day):

- at minimum, 1% bodyweight (50% ration) should be good quality forage (grass/pasture)
- horses require good quality hay – coarse hays/straw with a lot of stem are not suitable because they are bulky for the small stomach (does not move through quickly and intake is reduced) and horses do not have a microbial population in the stomach to help digest tough material
- a better-quality hay will generally be more expensive, but you will need to feed less of it and there will be less waste
- forage generally provides required vitamins and minerals for horses at maintenance.

Activity, including mustering, competition, trail riding, breeding (stallions), late gestation and lactation will all increase the energy and protein requirements of the horse. Rations should be adjusted based on body condition score and workload. *Table 3* provides average energy and protein requirements for horses at maintenance. *Table 4* details commonly fed roughages.

**Table 3.** Nutrient requirements of horses at maintenance

Weight (kg)*	Digestible energy (DE) (MJ/day)	Crude protein (g/day)
400	56	563
500	69	656
600	81	766

\* Adapted from Nash 1999

**Table 4.** Nutrient composition of commonly fed roughages for horses in Australia

Feed type	Digestible energy (MJ DE/kg DM)	Crude protein (%)	Crude protein (g/kg DM)
Good grass hay (e.g. Rhodes)	8.5–11	7.5–10	75–100
Good legume hay (lucerne)	10.5–12.5	12–15	120–150
Flinders and Mitchell grass	6–9	4–7.5	40–75
Sorghum hay	10–10.5	8–10	80–100

## Appendix 1. *continued...*

**Note:** Horses grazing on tropical pastures containing oxalates (e.g. buffel, kikuyu, setaria, green panic) are at risk of big head disease. Big head occurs because calcium is bound to oxalates in the pasture and is unable to be absorbed by horses. Horses will then use calcium from their bones. The bones become porous, and the horse develops a misshapen head where the condition gets its name. If horses are grazing on high oxalate pastures (particularly setaria) and are not supplemented they can have two parts dicalcium phosphate (DCP) and one part limestone mixture to balance calcium levels (24g DCP: 12g lime per 100kg body weight (BW)).

Using the tables on the previous page to calculate a ration for a 500kg stock horse in a day yard.

The horse will eat 1.5–2.5% BW and 1% needs to be forage.

From *Table 3*. A 500kg horse needs 69 MJ DE and 656g protein.

From *Table 4*. Good quality bush hay (Flinders/Mitchell) will be approx. 9 MJ and 75g CP per kg DM.

At 2% BW this is 10kg hay ( $10 \times 9 \text{ MJ} = 90 \text{ MJ}$  and  $10 \times 75 \text{g CP} = 750 \text{g CP}$ ) which is sufficient.

Note that at the lower quality values in *Table 4* for Flinders/Mitchell grass ( $10 \times 6 = 60 \text{ MJ}$  and  $10 \times 40 = 400 \text{g CP}$ ) this is insufficient to meet requirements and some lucerne or concentrate should be fed in addition.

There is a wide range of commercial products available to feed horses. Feed suppliers will have pelleted, extruded or whole feeds to suit a wide variety of different nutritional needs. There will usually be a table containing nutrient composition on the bag. Use this to calculate requirements for your class of horse as in the example above.

## Example horse ration

Where bulk molasses is available, the following ration will keep working horses in good condition when feed is poor. A similar ration could be fed to brood mares and young horses.

### *Per horse per day:*

- Molasses: 1–2kg
- Protein meal: 200–400g
- Dicalcium phosphate (DCP): 50g

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 founder and the need to feed individually.
- The ration is easier to distribute through the mob than grain feeding.

***Many commercial molasses and grain rations designed for cattle contain rumen modifiers. Do not feed horses feeds that contain rumen modifiers. Some of these (monensin and lasalocid) are toxic to horses. Gossypol, found in cottonseed, is also poisonous to horses.***

Horses do not have microbes in the foregut capable of converting urea, so there is no value in adding urea in mixes for horses. Horses can eat supplements containing urea but care is required.

**Note:** Nitrate poisoning can occur where there is a build-up of pigweed or button grass around yards and other degraded areas when little other feed is available. Horses consuming large quantities are at risk of nitrate poisoning.

## References

- Avery, A. (1996). Pasture for Horses – A winning resource. Rural Industries Research and Development Corporation, Canbe
- Huntington, P. and Cleland, F. (1992). Horse Sense – The Australian Guide to horse husbandry, Agmedia. Department of Natural Resources and Environment, Vic, Australia.
- Nash, D. (1999). Drought feeding for horses. Rural Industries Research and Development Corp.

## Appendix 2.

### Calculations for cost of dry matter and nutrients

Calculations using copra meal as an example:

Dry matter: 90%  
 Price: \$780 per tonne as fed  
 Protein: 21% DM  
 Energy: 10.8 MJ ME per kg DM

#### Dry Matter

*How much dry matter in 1kg of feed?*

$$\frac{\text{Weight of feed} \times \% \text{ DM}}{100} = \frac{1 \text{ kg} \times 90}{100}$$

$$= 0.9 \text{ kg or } 900 \text{ g}$$

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

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

$$= 1.111 \text{ kg as fed}$$

*Cost per tonne of dry matter*

$$\frac{\$/\text{tonne as fed} \times 100}{\% \text{ DM}} = \frac{\$780 \times 100}{90}$$

$$= \$780 \times 1.111$$

$$= \$867 \text{ per tonne DM}$$

*Dollars per tonne to cents per kg: As fed or dry matter*

$$\begin{aligned} \$/\text{tonne as fed} \div 10 &= \$780 \div 10 &= 78 \text{ c/kg as fed} \\ \text{or} & & \\ \$/\text{tonne DM} \div 10 &= \$867 \div 10 &= 86.7 \text{ c/kg DM} \end{aligned}$$

*Cent per megajoule of metabolisable energy (c/MJ ME)*

$$\text{Cents/kg DM} \div \text{MJ ME/kg DM} = 86.7 \text{ c} \div 10.8 = 8 \text{ c/MJ ME}$$

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

$$\frac{\text{Cost per kg DM} \times 100}{\% \text{ of nutrient in the feed}} = \frac{86.7 \text{ cents} \times 100}{21}$$

$$= 413 \text{ cents per kg}$$

**Cost of 150g protein**

$$\frac{\text{Cost of 1kg of protein} \times 150}{1,000} = \frac{413 \times 150}{1,000}$$

$$= 62 \text{ cents}$$

**How much supplement to feed to get required amounts of protein**

If you need to feed 150g of protein using copra meal

$$\frac{\text{Required grams of protein} \times 100}{\% \text{ of protein in feed (as fed)}} = \frac{150 \times 100}{18.9^*}$$

$$= 793\text{g of copra meal to be fed}$$

\* Note: Copra meal is 90% dry matter and on a dry matter basis copra meal is 21% crude protein.  
As fed copra meal is 18.9% crude protein (21% DM x 90%)

Appendix 2. *continued...*

## Cost of a ration

## Example

Fortified molasses (ration details)				
Ingredient	\$ per tonne	%	Weight (kg)	Cost
Molasses	\$200	87	870	\$174
Urea	\$700	3	30	\$21
Copra	\$780	10	100	\$78
<b>Total cost per tonne</b>				<b>\$273</b>
<b>Cost per kg</b>				<b>27.3 cents</b>

## 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*
<b>Commercial blocks</b>	\$27 per 20kg block* (80% crude protein)
Daily cost for 150g protein (cost per kg of nutrient and cost of 150g protein)	25.3 cents <sup>#</sup>
Cost for 120 days (A)	\$30.37 <sup>#</sup>
<b>Fortified molasses costs (from table above)</b>	27.3 cents per kg <sup>#</sup>
Daily cost at 3kg per head, per day (cost of a ration)	81.9 cents <sup>#</sup>
Cost for 30 days (B)	\$24.57 <sup>#</sup>
<b>Total cost per head for 150 days (A + B)</b>	<b>\$54.94 per head<sup>#</sup></b>
<b>Cost for 100 breeders</b>	<b>\$5,494<sup>#</sup> (excluding labour)</b>

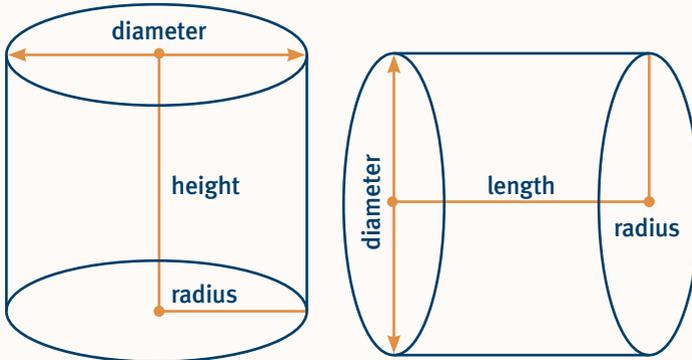
Notes: \* These figures are assumptions for the purpose of the calculation

# These figures are calculated

## Appendix 3.

### Volume measures

Accurate calculation of the volume of a mixing tank will lead to a more accurate ration formulation.



The volume of a cylinder =  $\Pi r^2 h$

$\Pi = \text{Pi} = 3.141$

r = radius

h = height or length

For example, if a tank is 1m diameter (0.5m radius) and 2m long.

$$\begin{aligned}
 \text{Volume} &= \Pi \times r^2 \times h \\
 &= 3.141 \times 0.5^2 \times 2 \\
 &= 3.141 \times 0.25 \times 2 \\
 &= 1.57 \text{ cubic metres (1,570 litres or 345 UK gallons)}
 \end{aligned}$$

**Note:** 1 cubic metre = 1,000 litres  
1 UK gallon = 4.546 litres

## Appendix 4.

### Container weights

These weights are provided as a guide only. There is variation in the bulk density of all the ingredients, so it is best to weigh all your own measuring containers for the ingredients you are using.

Using accurate measurements improves cost-effectiveness of supplementation and reduces the risk of toxicity problems.

**Table 1.** Amounts of common feeds contained in recycled product containers

Container	Weights in kg					
	Molasses*	Urea	Copra meal	Grain	GranAm®	Salt (medium coarse)
20 litre container	25.0	15.5	12.4	11.5	18.0	24.0
9 litre container or 2 gallon bucket	11.5	7.0	5.6	5.0	8.0	11.0
5 litre container e.g. bucket	6.5	4.0	3.1	3.0	4.5	6.0
4 litre container e.g. square ice cream container	5.0	3.0	2.5	2.0	3.5	4.8

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

## Appendix 5.

# Analysis of vegetable protein meals

**Table 1.** Analysis of common vegetable protein meals on an ‘as fed’ basis

Vegetable protein meal	Protein (%)	Ca (%)	P (%)	Energy (MJ ME/kg)
Sunflower	30–38	0.40	1.03	10.0
Copra	15–20	0.06	0.50	12.5
Palm kernel	18	0.21	0.50	11.5
Peanut	46	0.15	0.60	12.1
Canola	38	0.65	0.95	10.1
Soybean	44–48	0.25	0.70	12–14
Linseed	37	0.45	0.90	12.1

Note: The analysis of meals may vary depending on the processing method

## Appendix 6.

### Product labels—what are they 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 from urea and GranAm®:** The rumen microbes use the nitrogen from these products to form their own 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 derived from NPN sources.
- **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 (S) and nitrogen (N) 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. Generally, the higher the salt content the less palatable the supplement. However, in some country a higher salt content can increase intakes.
- **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 NPN sources.

e.g. Urea with 46% N x 6.25 = 287% equivalent crude protein  
 GranAm® with 20.2% N x 6.25 = 126% equivalent crude protein

In our example label, if you multiply the urea 0.08 (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.

Example lick label	
Crude protein	30%
Equivalent crude protein	23%
Urea	8%
Calcium	8%
Phosphorus	4%
Salt	2%
Sulphur (S)	2%
Copper (Cu)	300mg/kg
Iodine (I)	30mg/kg
Zinc (Z)	500mg/kg

## Further information

For more information on product labels, visit: [futurebeef.com.au](http://futurebeef.com.au) and search for 'product labels'.

## Appendix 7.

# Further information—products and training

### Websites

- [futurebeef.com.au](http://futurebeef.com.au)
- [daf.qld.gov.au](http://daf.qld.gov.au)
- [mla.com.au](http://mla.com.au)
- [dpi.nsw.gov.au](http://dpi.nsw.gov.au)
- [breedcowdynama.com.au](http://breedcowdynama.com.au).

### Reports

Department of Agriculture and Fisheries, Queensland staff have investigated a range of strategies and technologies aimed at making Queensland grazing businesses more profitable and drought resilient.

The project, ‘Delivering integrated production and economic knowledge and skills to improve drought management outcomes for grazing enterprises’ was funded by the Queensland Government’s [Drought and Climate Adaptation Program](#).\*

Economic analyses were conducted for five Queensland regions and a range of relevant management strategies and technologies were assessed.

The regions analysed included:

- Fitzroy
- Northern Gulf
- Northern Downs
- Rangelands of central-western Queensland
- Mulga Lands of south-western Queensland.

These reports are available from: [futurebeef.com.au/projects/improving-profitability-and-resilience-of-beef-and-sheep-businesses-in-queensland-preparing-for-responding-to-and-recovering-from-drought](http://futurebeef.com.au/projects/improving-profitability-and-resilience-of-beef-and-sheep-businesses-in-queensland-preparing-for-responding-to-and-recovering-from-drought).

\* *The Drought and Climate Adaptation Program can be accessed online:*  
[longpaddock.qld.gov.au/dcap](http://longpaddock.qld.gov.au/dcap)

## Books

All books listed below are available from **Meat & Livestock Australia**.

Phone: **1800 023 100** or visit: [mla.com.au](http://mla.com.au)

- *A guide to best practice husbandry in beef cattle – branding, castrating and dehorning*
- *Beef cattle nutrition – an introduction to the essentials*
- *Grazing land management – sustainable and productive natural resource management*
- *Heifer management in northern beef herds 2nd edition*
- *Improving the performance of northern beef enterprises – key findings for producers from the Northern Beef Report*
- *Managing the breeder herd – practical steps to breeding livestock in northern Australia*
- *Phosphorus management of beef cattle in northern Australia*
- *Water medication – a guide for beef producers*
- *Weaner management in northern beef herds.*

## Workshops

To view upcoming workshops in your area visit:

- [futurebeef.com.au/events](http://futurebeef.com.au/events)
- [mla.com.au/news-and-events/events-and-workshops](http://mla.com.au/news-and-events/events-and-workshops).

Key workshops include:

- Nutrition EDGE
- Grazing Fundamentals EDGE
- Grazing Land Management EDGE
- Stocktake.

## Appendix 8.

### List of abbreviations

<b>AE</b>	Adult Equivalent
<b>BOM</b>	Bureau of Meteorology
<b>Ca</b>	Calcium
<b>CP</b>	Crude Protein
<b>DAF</b>	Department of Agriculture and Fisheries
<b>DCP</b>	Dicalcium Phosphate
<b>DE</b>	Digestible Energy
<b>DM</b>	Dry Matter
<b>IOD</b>	Indian Ocean Dipole
<b>MAP</b>	Mono-Ammonium Phosphate
<b>ME</b>	Metabolisable Energy
<b>MJ</b>	Megajoules
<b>MJ DE</b>	Megajoules Digestible Energy
<b>MJ ME</b>	Megajoules Metabolisable Energy
<b>MJO</b>	Madden Julian Oscillation
<b>MLA</b>	Meat & Livestock Australia
<b>M3U</b>	Molasses + 3% urea + other ingredients (page 46)
<b>M8U</b>	Molasses + 8% urea by weight
<b>N</b>	Nitrogen
<b>NIRS</b>	Near Infrared Reflectance Spectroscopy
<b>NPN</b>	Non-Protein Nitrogen
<b>P</b>	Phosphorus
<b>RDP</b>	Rumen Degraded Protein
<b>S</b>	Sulphur
<b>SOI</b>	Southern Oscillation Index
<b>UDP</b>	Undegraded Protein (Bypass Protein)
<b>VFA</b>	Volatile Fatty Acids
<b>WCS</b>	Whole Cottonseed





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