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Feeding dairy stock during drought

NSW Department of Primary Industries

Livestock Officers (Dairy)

Feed requirements

Water

Dairy cattle need more water as temperature, humidity and production levels increase. Water requirements also increase as the dry matter content of the ration increases. Water intake is greatest when water is constantly available and stock show less distress when there is no competition for water.

Dairy cows require large volumes of clean water, about 120-150 L per day for lactating cows producing 20 L per day. This requirement increases with hot weather, humidity and with the increase in dry feed intake. Dry cows and young stock require 5-7 L/kg DM intake.

Rule of thumb water requirements
Dry cows: 35-60L/day
Heifers to calve: 35-60L/day
Heifers to mate: 30-50L/day
Heifers >12 mths: 20-25L/day
Heifers <12 mths: 15-20L/day

Water quality and fouling of water supplies

Water quality for dairy stock drinking water is important. Dairy stock may refuse to drink poor quality water. If the only drinking supply is stagnant water, there is increased risk of disease and death due to botulism and blue-green algae. Vaccination against botulism should be discussed with your veterinarian.

When water supplies are limited, milk quality issues should not be compromised; milking machines, vat and milking area should be cleaned as normal. An increased risk of udder infections can occur if poor quality water is used to clean udders or wash milking equipment such as cups and liners.

Considerable quantities of water can be conserved by dry scraping holding yards.

Nutrients

The relative quantities of energy, protein and minerals required by stock depend on class of stock, age, growth rate, stage of pregnancy and level of production as shown in Table 1:

Table 1: The importance of major nutrients for different stock

	Energy	Fibre	Protein	Minerals
Milkers				
Early (18-30 litres)	high	medium	high	high
Mid (10-17 litres)	high	medium	medium	medium
Late (5-9 litres)	medium-low	medium-low	low	low
Dries (backward)				
Maintenance large breeds	low	low	low	low
Maintenance small breeds	low	low	low	low
Dries (forward)				
Maintenance large breeds	medium	medium	medium	medium
Maintenance small breeds	medium	medium	medium	medium
Replacements				
Calves	medium-high	low	high	high
Weaners	medium-high	medium	medium-high	medium
Unmated heifers	medium	medium	medium	medium

Energy

Energy deficiencies limit liveweight gain and milk production. A deficiency shows up as poor body condition, reduced peak milk production, lowered milk composition and poor fertility.

The main sources of energy are carbohydrates, including starches, sugars and fibre. Protein may also be a source of energy.

The metabolisable energy (ME) system can be used to formulate rations to meet the energy requirements of stock. All energy requirements of cattle for maintenance, milk production and reproduction are measured in MJ per day.

The energy in feeds is expressed as megajoules (MJ) of metabolisable energy (ME) per kilogram of dry matter (MJ/kgDM).

The ME of a feed is the energy available for maintenance, milk production, pregnancy and liveweight gain, as outlined in the DairyLink Realistic Rations booklet, available from NSW DPI Livestock Officers, Dairy Products.

Maintenance requirements include energy needed for walking and eating. Maintenance requirements vary with the size of the animal.

$$\text{Feed for maintenance (kg DM/day)} = \frac{\text{Maintenance needs (MJ/day)}}{\text{Energy of feed (MJ/kg DM)}}$$

Table 2 shows the increase in energy requirements of dairy cows during the latter stages of pregnancy.

Table 2. The energy requirement of dairy cows, additional to maintenance, during pregnancy

Month of pregnancy	Additional metabolisable energy needed per day (MJ/day)
6	7-8
7	10
8	14
9	19-20

Source: DairyLink – Realistic Rations booklet (available from NSW DPI Livestock Officers, Dairy Products)

Production requirements include the energy required to produce a litre of milk. This varies with the composition of the milk, as indicated in Table 3.

$$\text{Feed for milk production (kg DM/day)} = \frac{\text{Production needs (MJ/day)}}{\text{Energy of feed (MJ/kg DM)}}$$

Protein

Low concentration of protein in feed reduces feed intake, energy utilisation and contributes to low levels of milk production. Protein requirements are greatest during early lactation and growth. Protein deficiencies – less than 80 % of requirement – reduce milk protein, particularly with stock in poor condition.

Protein is usually the most expensive nutrient. Feeding more than is required, or can be used, is wasteful.

Urea can be used to replace protein meals for cows producing up to 20L of milk per day and save costs. However, it is important to follow the recommendations in the section ‘Urea as a supplement’.

Table 3. Metabolisable energy requirement (MJ/day) of dairy cows to produce milk of various fat and protein compositions

Milk fat (%)	Milk protein (%)					
	2.6	2.8	3.0	3.2	3.4	3.6
3.0	4.5	4.5	4.6	4.7	4.8	4.8
3.2	4.6	4.7	4.7	4.8	4.9	5.0
3.4	4.7	4.8	4.9	4.9	5.0	5.1
3.6	4.9	4.9	5.0	5.1	5.1	5.2
3.8	5.0	5.1	5.1	5.2	5.3	5.3
4.0	5.1	5.2	5.3	5.3	5.4	5.5
4.2	5.3	5.3	5.4	5.5	5.5	5.6
4.4	5.4	5.5	5.5	5.6	5.7	5.7
4.6	5.5	5.6	5.7	5.7	5.8	5.9
4.8	5.6	5.7	5.8	5.9	5.9	6.0
5.0	5.8	5.8	5.9	6.0	6.1	6.1
5.2	5.9	6.0	6.0	6.1	6.2	6.3

Source: DairyLink – Realistic Rations booklet (available from NSW DPI Livestock Officers, Dairy Products)

Roughages

The main roughage supplements are hay and silage. Additional roughage sources available may include a variety of by-product feeds such as rice hulls, cottonseed hulls and cereal straws.

Hay. Good quality hay contains enough energy and protein for mid to late milkers (8-12L/ day). Poor quality hay may not even be suitable for maintenance, but it can provide the necessary fibre for high grain diets if good hay supplies are short.

Three kilograms of good hay is equivalent to about 2kg grain, whereas 4kg of poor hay equals 1-2kg of grain. Rations of 100% hay are unsuitable for high producing cows, as the cows are unable to eat enough to maintain production. Hay is best fed to these cows in combination with concentrates.

Silage. Silage is usually included in diets in combination with other feeds. It is important to have silage samples analysed and balance the ration with the addition of concentrates to ensure that energy, protein, fibre and mineral contents are adequate for the desired level of production. For example, maize silage has a low protein content and requires protein supplements when maize silage is a significant component of the diet.

A kilogram of good silage (i.e. ME >10MJ/kg DM) is equivalent to 0.5kg of good quality hay or 0.3kg of grain. A ration based on good silage must be supplemented with concentrates for production above 10L.

The ME content of a silage influences the milk production response to silage. Aim for ME levels of above 10 MJ/kg DM and good silage fermentation quality if silage is to be a major component of the diet.

Straw. Straw is a relatively poor source of energy, protein and minerals. Small amounts of straw (i.e. 2-3 kg) can be used as a fibre source, but it must be suitably supplemented with cereals, protein and minerals.

Minerals

Mineral levels vary between feed types. For example, pastures provide less phosphorus but more calcium than grains and tropical pastures are low in sodium.

Depending on the class of stock and production targets, mineral supplements may be needed for a herd to reach the production potential of the ration. Minerals are necessary on poor roughage/low grain diets.

Feeds low in calcium and phosphorus should be supplemented. Limestone provides calcium only. Common salt is the cheapest source of sodium. Magnesium oxide provides magnesium, and potassium bicarbonate, potassium.

Buffers such as magnesium oxide, potassium bicarbonate and sodium bicarbonate can reduce the incidence of grain poisoning – see the section ‘grain poisoning’ below.

Formulating rations

Milkers

Grain is usually the major component of drought

Table 4. High grain rations: *Jerseys (400 kg) in early (E) and mid-lactation (M).*

Milk Yield (L/day)	Stage of lactation	Requirement* (MJ/day)	Roughage ME 8.5(kg DM)	Concentrate** ME 12.5 (kg DM)
10	E	88	4.1	4.3
	M	102	4.4	5.2
12	E	99	4.2	5.1
	M	113	4.4	6.1
14	E	111	4.2	6.1
	M	125	4.5	7.0
16	E	122	4.2	7.1

Table 5. High grain rations: *Holstein-Freisians (550 kg) in early (E) and mid-lactation (M).*

Milk Yield (L/day)	Stage of lactation	Requirement* (MJ/day)	Roughage ME 8.5 (kg DM)	Concentrate** ME 12.5 (kg DM)
15	E	120	5.7	5.8
	M	134	6.1	6.6
20	E	145	6.0	7.6
	M	159	6.3	8.5
25	E	170	6.3	9.4
	M	184	6.5	10.3
30	E	195	6.4	11.3

* Requirements = total daily energy requirements of cows. ** Concentrate used for early-mid lactation contains 16-18% crude protein (CP) and for mid-late lactation 12-14% CP. Note: Stock are maintaining weight in early-mid lactation, and gaining half condition score per month in late lactation.

rations. When grain is the major component roughage should provide at least 30 % of the diet to avoid grain poisoning, 'off-feed' situations and to prevent reduced butterfat levels in the milk. Rations for milking cows are outlined in Tables 4, 5, 6, 7, 8 and 9. These rations are a guide only, as the nutrient content of feeds varies. All feed used in rations should be analysed so that a balanced ration can be formulated.

Dry cows and replacement and growing stock

Forward springers and suitable replacement stock require attention even though they are not producing income. Appropriate feeding gives them a greater earning potential when they calve. Table 10 shows the feed requirements for dry and replacement stock. Table 11 provides a guide for silage rations for growing stock.

Table 6. Hay rations – unlimited hay and assuming medium quality pasture provides 1.5kg DM per cow per day.

Box - bottom	Early			Mid			Late	
Milk yield (L/day)	25L			20L			10L	
Feed	kg DM	kg DM	kg DM	kg DM	kg DM	kg DM	kg DM	kg DM
Good hay (>9.5 MJ/kg DM & >15% CP)	7	-	-	7	-	-	7	-
Medium hay (8.5-9.5 MJ/kg DM & 12-15% CP)	-	6	-	-	6	-	-	8
Poor hay (<8.5 MJ/kg DM & <12% CP)	-	-	5	-	-	6	-	-
Cereal grain supplement *	6	7	8	5	6	7	2	2
Protein meal	1	1	2	1	1	2	-	-

*Mineral supplement required to balance diets will depend on the source of forage. High grain diets need to be introduced gradually over two weeks. Note: cows in early lactation are losing half a condition score per month, and not gaining weight in mid-late lactation.

Table 7. Hay rations – limited hay and assuming medium quality pasture provides 1.5kg DM per cow per day: Daily allowance of feed (kg DM/550 kg cow/day)

Stage of lactation	Early	Mid	Late
Milk yield (L/day)	25	20	10
Medium hay (8.5-9.5 MJ/kg DM & 12-15% CP)	4	4	4
Grain supplement	8	7	4
Protein meal	2	2	1

Table 8. Silage rations for milkers and assuming medium quality pasture provides 1.5kg DM per cow per day: Daily allowance of feed (kg DM/550 kg cow/day)

Stage of lactation	Early	Mid	Late
Milk yield (L/day)	25	15	10
Silage as fed*	4	4	4
Grain supplement	8	7	4
Protein meal	2	2	1

* Pasture silage (30% DM and 60% digestibility – estimated ME 9.0 MJ/kg DM) Note: Cows in early lactation are losing half a condition score per month and not gaining weight in mid-lactation.

Table 9. Straw rations for milkers, assuming medium quality pasture provides 1.5kg DM per cow per day and medium quality pasture provides 1.5kg DM per cow: Daily allowance of feed (kg DM/550 kg cow/day)

Stage of lactation	Early	Mid	Late
Milk yield (L/day)	25	15	10
Cereal straw*	3	3	3
Cereal Grain supplement**	10	8	5
Protein meal	2	1.5	1

* Due to appetite limits, particularly in early lactation, straw is best chaffed to a length of 300mm. **High grain diets need to be introduced gradually over two weeks. (See 'Nutritional issues with high grain diets' below) Note: cows in early lactation are losing half a condition score per month, and not gaining weight in mid-late lactation.

Table 10. Feed requirements for dry and replacement stock – both grain and roughage (kg DM/day)

Class of stock	Grain (12.5 MJ/kg DM)	Roughage (8.5 MJ/kg DM)
Backward springers (gaining 0.25 kg/day)		
Jersey	3	0.75
Holstein-Freisian	5	1.2
Replacements (gaining 0.25 kg/day)		
6-12 months	2-3	1.5
12-24 months	3-5	2.5

Table 11. Silage rations for growing stock, with an indication of the amount of concentrate required for each grade of silage: Daily allowance of feed (kg DM/550 kg cow/day)

Liveweight (kg)	Good quality silage*	Concentrate	Poor quality silage**	Concentrate
200	22	nil	7	3.5
300	27	nil	19	2.7
400	32	nil	29	2.4
500	37	nil	30	3.5

* Good quality silage is defined as having ME > 10 and crude protein (CP) content >15%. **Poor quality silage has ME and CP levels below these.

A growth rate in excess of 0.7kg/day can be achieved with good silage, but medium or poor silage must be supplemented with energy and protein.

Rations for calves

Birth to two months

Calves under eight weeks should receive whole milk or milk replacer, clean water, straw and have access to calf pellets or starter rations of 20–22% crude protein. Calves may be weaned when they are eating 0.75–1kg of pellets or starter ration a day.

Two to six months (or as weaned, as above)

At 12–14 weeks calves can be switched to a lower protein meal or pellets i.e. 15–16% crude protein – fed at 2–3kg/day and a minimum of 20% hay. Coarsely ground hay can be included in the starter ration

Quality assurance

Whenever purchasing feed, remember the need to maintain your Quality Assurance program. Always ask for a feed declaration from the feed supplier.

You may have to buy feed from a variety of new suppliers or there may be a number of unusual feeds available in times of shortage. In all cases with feeds that you have not used before be careful of contamination from any source that will jeopardise your QA standing or the health of your stock. It is advisable to have a laboratory analysis of feed prior to purchase.

Take care when purchasing hay or silage as toxic plants may have been harvested with the forage which could cause health problems when fed.

Suitability of feedstuffs

Be particularly cautious when sourcing materials not commonly used as animal feeds. Chemical residues may be present. Before purchasing feed check with the supplier as to what chemicals the crop or pasture has been, or may have been, exposed to during its production, harvest, storage, processing and transport. If the feed has been raked and baled in the field, or if it may contain soil, additional assurances should be sought that it was harvested from land which had no previous applications of persistent organochlorides. Ideally obtain a signed Vendor Declaration Form from the supplier stipulating that the materials have been tested free of all chemical residues.

When buying any feed, you should:

- tell the seller what you are purchasing the feed for;
- ask if any chemicals have been applied to the feed
- check that time of harvesting of the material complies with the chemicals' withholding periods;
- ask if the feed was grown on suspected contaminated country; and
- obtain a signed Vendor Declaration Form from the supplier.

Unusual feeds

As the drought worsens and feed becomes more scarce, some dairy farmers feed by-products or unusual feeds to stock. There is often limited knowledge of how these feeds can best be fed to dairy stock.

This section aims to help you make decisions on the purchase and use of unusual feeds.

Whether to use unusual feeds depends on their availability, cost, nutritional value, palatability and, most importantly, the absence of undesirable contaminants, such as pesticides. Unusual feeds can be cost-effective supplements, if used properly. Have by-products analysed, correct nutrient imbalances and carefully assess the cost of these feeds.

By-product feeds are generally available in large quantities seasonally and frequently vary in composition. They often have nutrient imbalances or contain less than adequate levels of nutrients.

Brewers grain

Brewers grain is an energy and protein supplement. Its high crude protein (20%) and crude fibre (17%) and moisture content (78%) makes it a very suitable supplement to high grain/low roughage diets. With an ME content of 8.5–9.5 MJ/kg DM, brewers grain is lower in energy than grain.

The real cost of brewers grain must be determined on a dry matter basis due to its high moisture content.

Warning – Chemical Residues

To ensure the quality of milk products dairy farmers must assess the chemical residue status of any material fed to stock. This is particularly critical for any material that was not produced for use as stockfeed. To feed any material without a full residue risk assessment is contrary to the requirements and intentions of the Safe Food Quality Assurance Program.

Refer to Primefact 311 *Dangers in Feeding Waste Material to Livestock,* which details the associated risks, and Primefact 315 *Buying stockfeeds: minimising chemical residue risks*

Some sources of fodder have been linked with an increased risk of chemical residues in slaughter animals. While many problems have been linked to persistent chemicals such as the organochlorines (OCs), any chemical contaminant in feed can cause unacceptable residues in livestock products if present in sufficient concentration. Residues will persist after feeding of contaminated material.

For further residues information, or for submissions of samples, contact:

NSW DPI Diagnostic and Analytical Services
1243 Bruxner Highway
Wollongbar NSW 2477
(Telephone: 02 6626 1103)

Example:

$30–$40 per wet tonne is equal to between $136–181/tonne on a dry matter basis.

When using brewer's grain also consider:

- Brewers grain should be introduced gradually;
- It is not recommended for stock under the age of four months;

- Poor storage can cause moulds, which produce toxins causing scouring and digestive disorders;
- Brewers grain can cause bacterial contamination of milk (and udders) and must be stored away from the milking shed;
- Brewers grain can be ensiled and stored for long periods: and
- Salt and calcium supplements are needed to rectify mineral imbalances when brewer's grain is included in rations

Molasses

Molasses is an energy supplement and is usually cheaper than grain. Molasses has a ME content of 10–12 MJ kg/DM but virtually nil protein. Molasses is sticky, heavy and difficult to handle, but is a suitable carrier of unpalatable feeds such as urea, minerals and protein meals. Points to consider when using molasses include:

- Milk responses to molasses are about 70% that of grain;
- Molasses should be should be no more than 25% of the diet to minimise risk of digestive disorders – i.e. less than 4kg per day for adult stock;
- It can be fed at higher levels (i.e. 40%), if introduced gradually and supplemented with adequate levels of crude fibre and crude protein; and
- Molasses is an important source of potassium, copper and calcium, but it is low in phosphorus

Whole cottonseed (WCS)

Commonly known as white or fuzzy cotton seeds, WCS is a useful energy (14 MJ/kg DM) and protein (21% CP) supplement.

Like many by-product feeds, WCS has certain properties which restrict its use in dairy cow diets:

- WCS is a major chemical residue risk;
- It is a potential source of gossypol poisoning, which causes damage the liver and even death;
- Feeding more than 15% of the total dry matter intake (i.e. approximately 2 kg DM/day for Jersey and 3 kg DM/day for Holstein-Friesians) for extended periods of time can lead to gossypol poisoning;
- As gossypol is highly toxic to calves, WCS should not be fed to calves of less than four months;
- WCS should be introduced gradually and not fed at high levels for long periods (i.e. 2–3kg for six months);
- It has a high oil content (20–22%), so make sure the whole ration contains no more than 6% fat;
- WCS is not a miracle feed that automatically improves milk production and composition; and
- It has high fibre levels but has a low 'chewing index' and is not a suitable replacement for long roughage.

For further information see Primefact 303 *White Cottonseed – a supplementary feed for beef cattle*.

Caution: Genetically modified cottonseed

Farmers using cottonseed products should consider the impact this may have on marketing their product.

Most varieties of cotton grown in NSW/Queensland are genetically modified (GMO). Cotton received at gins is not segregated, which means that cotton seed purchased is likely to be a mix of GMO and non GMO seed.

Check the guidelines of the market you supply regarding acceptability of GMO stock feeds, before purchasing cottonseed products.

Cottonseed meal

Cottonseed meal is very palatable, high in energy and crude protein (about 42% CP). Over half of this protein is protected from the rumen (and is known as 'bypass' protein).

Cottonseed hulls

Although virtually a waste product with a low ME (5.5 MJ/kg DM) and protein content (6% CP) hulls are excellent 'fillers' in high grain/low roughage diets.

Rice by-products

Rice bran contains 12.5% CP, 12 % crude fibre and 13.5% oil and is an attractive, palatable feed when fresh. 'Rice polishings' is a finely powdered material with similar energy and protein values but is lower in fibre than rice bran.

Both bran and polishings can replace up to 25% of the grain supplement. However, polishings have to be fed with caution. Polishings are easily digested and there is increased risk of grain poisoning when fed in diets with a high wheat component. This is discussed in more detail in the section 'Grain poisoning' below.

Rice hulls are not recommended for dairy cow diets. They contain high levels of indigestible fibre and are low in ME (3.5 MJ kg/DM) and CP (2%). The hulls also have sharp edges that cause irritation to the digestive tract

Warning – White Cottonseed

White cottonseed (WCS) and de-linted cottonseed (black cottonseed) may contain residue of chemicals applied to the cotton crop during the growing season. The Australian Pesticides and Veterinary Medicines Authority (APVMA) calculates maximum residue levels (MRLs) on the basis of a 30% maximum DM intake of cottonseed (WSC and black cottonseed) in the diet. This means that using WCS at levels above 30% of the total DM intake could result in excessive residues in cattle.

If you have fed WCS from crops treated with chemicals within 60 days of harvest (all cotton would be in this category), to cattle within 60 days of sending them for sale/slaughter, then you must disclose this at Question 7 of the National Vendor Declaration (Cattle). NSW DPI does not recommend the use of cottonseed at more than 30% of the total DM intake, even in severe droughts.

Sugar cane

Farmers have fed sugar cane for many years during droughts and floods. Actual availability depends on surplus to mill contracts, with increased amount available after the cane harvest in December.

Sugar cane diets have much in common with molasses-based diets. The principal energy source is sugar, protein content is low (2% CP). With 60% digestibility, an ME content of 8 MJ kg/DM and low levels of all major minerals, the benefits of feeding sugar cane depend on the accompanying supplements.

Sugar cane is basically a source of fibre and sugar and can comprise 25-30% of the ration of milking cows. High levels of sugar cane can modify rumen fermentation patterns, which affect digestion, milk production and composition. As sugar cane already contains high levels of sugar, precautions should be taken when feeding it with molasses.

Levels of milk production from cows fed sugar cane depend on the type and amount of grain, protein and minerals fed in conjunction with the sugar cane.

Sugar cane silage

Sugar cane silage can comprise up to 20% of the diet but needs to be introduced to stock gradually.

Sugar cane ferments immediately after it is chopped, resulting in the conversion of sugar to alcohol and organic acids (acetic). The rate of fermentation is accelerated by fine chopping. There should be minimum delays between chopping and ensiling to minimise loss of quality due to this pre-fermentation.

Its high sugar content means sugar cane does not need inoculants. Actually high levels of sugar may contribute to alcoholic fermentation, which reduces the quality of the silage and can lead to toxic shock. Additives such as urea (10kg/ tonne) and slaked lime can control the breakdown of sugars. Aqueous ammonia is an alternative to urea.

Additives such as urea and ammonia improve the protein content of the silage.

Milk production from sugar cane silage depends on the supplements included in the ration, but production levels are likely to be less than diets based on traditional conserved feeds such as corn silage/lucerne hay.

Bagasse

This is the fibrous residue remaining after the sugar cane stalk has been crushed and juices extracted. Bagasse is widely used as a fuel source for factory boilers and its availability is limited.

Spraying bagasse with a 30% solution of sodium hydroxide increases its digestibility from 30 to 55%. Treated bagasse fed at 10% of the total diet and supplemented with protein energy and minerals has been successfully fed in commercial feedlots, but weight gains have been lower than normal (0.7kg/day).

Trials with ensiled and pelleted bagasse rations with dairy cows have indicated that at levels of 20–22%, cost effective production largely depended on the additional supplements, e.g. grain, protein meals and minerals.

Vegetable by-products

Unless vegetable by-products are obtained and transported at low cost they are not economic feeds. Vegetable feeds need to be introduced gradually to stock and special care has to be taken to prevent underfeeding. Choking can also cause problems with some feeds, e.g. potatoes.

Chopped sweet potatoes can substitute for silage or can be fed as part of the grain ration.

Carrots contain 8-9 % CP and have a ME value of 8-9 MJ/kg DM. Fed whole or chopped, they can make up to 30% of the ration.

Pumpkins have a high moisture content (90%), and protein/energy values about half the value of sorghum silage.

Potatoes are high in moisture (80%) and have a ME content of 11.5 MJ/kg DM, about 9% CP and 2% crude fibre. Cows can eat 12-15kg daily of raw potatoes on an as fed basis.

Potatoes are best fed in combination with a fibrous feed such as hay. However, sprouted potatoes can be harmful to stock.

Fruit by-products

Pineapple and citrus pulp are useful feeds. Although low in protein (6-7% CP) and high in moisture (80%) they have a high energy value (10-13 MJ/kg DM) and are very beneficial to the rumen function and intake in high grain/low roughage diets.

Grape pulp contains mainly skins and seeds and is of no value to dairy cows due to the low protein content and high levels of indigestible fibre.

Banana pulp varies in feed quality, depending on the degree of ripeness. Low in protein (6.5% CP) green bananas are a suitable source of energy (11 MJ/kg DM). At maturity bananas rapidly ferment into simple sugars and their nutrition value decreases substantially

'Standover' crops

Various drought-affected and frosted crops may be available as stock feed – cereals, grain legume crops and canola have all been made into relatively high quality hay or silage. The quality of the hay or silage produced from failed crops depends on the growth stage of the crop and the management of the material from time of cutting to feeding. Well managed hay or silage made from failed crops can be of high quality.

Canola hay and silage. ME values range from 7.6–10.5 MJ/kg DM and 7.9–25.2% CP.

Although small, there is a risk of toxicity due to the presence of glucosinolates and nitrates. The risk appears to be greatest when hungry stock are given unlimited access to canola hay or silage fed and is reduced when fed in low roughage/high grain diets. If concerned, you should have the hay tested.

Cereal crops. As with all drought-affected crops, the decision to cut stressed cereal crops should be made before the quality of the standing crop begins to decline. Wheat, barley, oats and triticale can make reasonable quality hay or silage and are a good source of roughage for dairy stock. It is important to be aware that there can be large variations in quality. ME levels range between 4.2–9.7 MJ/kg DM for hay and 5.4–10.9 MJ/kg DM for silage, and levels of 1.2–13.4% CP and 3.2–24.0% CP, respectively. Therefore, it is advisable to buy fodder on the basis of feed analyses.

They can provide a valuable base for high grain/low roughage diets.

Further information

If you require information on unusual feeds use the following internet website
www.fao.org/ag/aga/agap/frg/afris/index_en
or contact your nearest NSW DPI Livestock Officer

Urea as a supplement

Urea is usually the cheapest form of protein substitute available but because of its toxic properties, it must be used carefully. It can be fed to stock in a number of ways, although you should not rely on urea as the sole source of protein for early and mid lactation cows.

Urea should only be fed to stock over six months old. Maximum daily intake should be less than 100g per day for adult stock, or 0.02% of bodyweight. (e.g. 400 kg x 0.02% = 80 g).

At these high feeding levels of urea, it is important to introduce urea slowly in the diet over 7–10 days and feed it in at least two batches a day. Grain-based concentrates should contain a maximum of 1.2% urea, and be aware that feeding 150g of urea once-a-day in a grain supplement will probably cause urea poisoning.

Urea toxicity

Warning:
Urea must be introduced slowly to all animals. The daily ration should be divided into a minimum of two feeds per day.

Urea supplements are often provided in the form of blocks or as loose salt mixes and sometimes with dilute molasses in roller-licker drums. Poisoning from accidental overdoses can occur regardless of how the urea is provided and often occurs when urea blocks are softened by rain, or when urea is introduced too quickly to the diet.

Stock can develop tolerance to urea if it is introduced gradually. The risk of urea toxicity will be greatly reduced if:

- Stock are given access to a dry mix of equal parts of phosphorus supplement and coarse salt for a week or so before the introduction of the urea supplement. This will satisfy the appetite of phosphorus-hungry stock, which often occurs on the coast;
- All ingredients are thoroughly mixed to prevent 'pockets' of urea; and
- Blocks and dry licks are covered or removed during wet weather.

Urea poisoning. The symptoms of urea poisoning are rapid breathing, nervous excitement, lack of coordination, bloating and salivation. Because poisoning occurs quickly, treatment is often too late and therefore ineffective.

The remedy for urea poisoning is to drench with a mixture of 0.5L water, 0.5L vinegar and 1kg sugar or molasses. Keep treated animals under observation and give a further treatment if no improvement is evident within about 10 minutes. A

relapse can occur several hours after initial response and will require further treatment.

Warning:
Urea poisoning is a potential danger whenever feeding at moderate to high levels.

Urea blocks

Proprietary blocks are a convenient but expensive method of feeding urea to cattle. Blocks containing 25% to 30% urea are of most benefit to cattle. Palatability problems are often encountered, resulting in inadequate consumption to provide the necessary 60g of urea per head each day. The major problem with urea blocks is that there is no control over intake as not all stock may consume their requirement.

Caution: Cattle have been poisoned by eating too much of a block that has been softened by rain or by drinking urea dissolved in rain water that has accumulated in hollows on the surface of the block.

Purchasing Feeds

In most cases it will be necessary to purchase feed. There are several things to consider:

- Know what you need, (e.g. energy, protein, fibre):
  - with limited paddock feed available, stock may need energy only;
  - where pasture has hayed/dried off, they will need protein as well;
  - where there is virtually nothing left in the paddock you need to buy energy, protein and fibre;
- Know the dry matter (DM) percentage (especially with silage);
- Compare prices on a dry matter basis for energy (ME) and protein; and
- Make sure pricing is on a dry matter weight basis, do not buy per bale or bag. Some examples of why it is important to buy on a weight basis are set out in Tables 12 and 13. From these examples you should be able to identify the 'best buy' for your use.

Where to buy feeds

If you have exhausted all of your local and usual contacts, try the Internet. NSW DPI provides a list of fodder suppliers via www.dpi.nsw.gov.au/reader/drought

Feed cost calculator

The *Feed Cost Calculator* is a NSW DPI Internet-based program that is also available on disc. It can be used to compare the value of feeds on an *energy* and *crude protein* basis. You can select a range of common feeds and then be provided with estimated values for energy, protein and dry matter. You can also insert your own figures using your feed test values. You are then able to enter a price per tonne for up to four different feeds. The program then calculates the value of the feed on an energy (ME) and crude protein basis. You can also examine the energy, protein and cost results of any combination of up to four selected feeds.

Table 12. Which is the better energy buy?

Feed	Cost	Energy
Barley	$300/t	89% DM, ME = 13 MJ/kg DM
Molasses	$150/t	75% DM, ME = 12.5 MJ/kg DM
Maize	$320/t	90% DM

Calculations:

1 Convert price from fresh weight to DM:

DM price ($/t DM) =	$\frac{\text{fresh weight feed price ($/t)}}{\text{DM\%}}$

2. Convert $/t to $/kg

DM price ($/kg) =	$\frac{\textit{DM price ($/t)}}{\textit{1000}}$

Divide by 1,000 to convert tonnes to kilograms

3. Calculate price per unit of energy (ME)

$ /MJ =	$\frac{\textit{DM price ($/kg)}}{\textit{ME content of feed (MJ/kg DM)}}$

4. Convert $/MJ to cents/MJ

$/MJ x 100 =	*cents/MJ*

Examples:

Barley:

$300 ÷ 0.89 = $337.08/t DM
$337.08 ÷ 1000 ÷ 13 x 100 = 2.60 c/MJ

Molasses:

$150 ÷ 75% = $200/t DM
$200 ÷ 1000 ÷ 12.5 x 100 = 1.60 c/MJ

Maize:

$320 ÷ 90% = $355.56/t DM
$355.56 ÷ 1000 ÷ 13.5 x 100 = 2.63 c/MJ

Further information

Primefact 356 *Feed cost calculator instructions*. For information on the Feed Cost Calculator version on disc, contact NSW DPI's District Livestock Officers (Dairy), listed at the back of this Primefact.

Table 13. Which is the best hay to buy?

The following example highlights the large differences in price per tonne that can be paid if fodder is purchased in bulk or on a per bale or weight basis - What is the difference between buying hay as small bales , large bales or in bulk?

Small bales @ $15.00/bale		
30-45 bales to the tonne		
30 bales	$15	*$450/tonne*
45 bales	$15	*$675/tonne*
Large bales @ $150/bale		
3-5 bales to the tonne		
3 bales	$150	*$450/tonne*
5 bales	$150	*$750/tonne*
Bulk price $350/t		

Feeding Management

Nutritional issues with high grain diets

When balancing diets for energy, protein, fibre and minerals before considering other issues associated with high levels of grain feeding. Important points to remember include:

- All grain should only be coarsely ground or hammered when feeding more than 8 kg/cow/day of any grain.
- Monitor the herd for signs of grain poisoning
    - a sign of possible grain poisoning on high grain diets is a drop to 3.4% butterfat or less, as a herd average.
    - Sore feet (laminitis), 'tucked up' appearance (abdominal pain) and smelly scours can also be indicators of grain poisoning.
- Fibre is a priority, particularly to maintain correct rumen function.
- Heifers, grain should not be fed more than 8kg/day. Due to their lower intakes the grain will make up a greater proportion of their diet and therefore affects them at lower feeding levels.
- Maize and sorghum are the safest grains to feed at high levels. Wheat is the least safe.

When feeding more than 10kg/cow/day of concentrate or grain, best results will be obtained by feeding a proportion of it away from the milking bails. Usually more than 4-5kg per feed in the bails will prolong milking.

Grain poisoning

Grain fermented in the rumen produces lactic acid, which is immediately absorbed into the bloodstream. Grain poisoning (also known as acidosis) is a lactic acid poisoning and occurs when:

- Stock are fed high grain rations without an introductory period,
- Stock gain accidental access to large amounts of grain,
- There is a quick change in the grain being fed, for example switching from oats to wheat.

Prevent grain poisoning by starting grain feeding with a small amount and gradually increase amounts each day. When changing from one grain type to another, mix the two grains together for a week or so to avoid a sudden change.

Which grain – what risk of grain poisoning?

Are your cattle more likely to get grain poisoning with any particular grains?

As a rule of thumb, the ranking from highest to lowest risk grains are:
1. Wheat
2. Triticale
3. Barley
4. Oats
5. Maize
6. Sorghum

Buffers

Buffers can be used to reduce the incidence or severity of acidosis.

Sodium bicarbonate is commonly used at the recommended rate is 150 g/day/cow.

If magnesium supplementation is required, each gram of magnesium oxide can replace 2 g of sodium bicarbonate. The use of sodium bentonite has negligible benefits.

It is also recommended that a rumen modifier be included at the recommended rates (for example Rumensin®).

Tips for feeding

The following are tips for feeding dairy cattle during feed shortages:

- Commercial dairy concentrates for early milkers should contain 16-18% crude protein, depending on the level of production and the quality of roughage fed.
- Avoid fine grinding of most grains.
- Buffers can help to prevent grain poisoning at the introduction of grain diets and during prolonged feeding at unusually high levels.
- Feed definite amounts at regular intervals.
- Avoid sudden changes in the amounts and types of feed.
- Keep feed boxes clean, and remove leftover feed, (particularly for calves).
- During periods of high temperatures, high grain diets allow greater energy intake than high roughage diets.

- Split the herd into low and high producing cows
    - feed the low producers grain in the bails and roughage in the paddock
    - feed the high producers grain in the bails and grain plus roughage in the paddock
- Feed troughs in the yards need to be about 45–50cm wide and 30–45cm deep and allow 30cm trough length per head for weaners, for yearlings, and
    - 60cm for adult stock.
- Self-feeders are also satisfactory for straight grain rations.
- Stock should be introduced to high grain diets gradually to avoid digestive upsets.
- Feed in troughs or along fence lines to avoid camping and trampling losses.
- Use a number of feeding points so all animals have equal access to feed. .

Further information

NSW DPI *Realistic Rations* manual at www.dpi.nsw.gov.au/reader/dlink-realrations

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Appendix 1 *- Approximate dry matter, metabolisable energy (ME) and crude protein contents of feeds*

ME (MJ/kg DM)			Crude protein (%)
Foodstuff	Dry Matter (%)*	Tested Average* range	Tested Average* range
Low protein, dry roughages			
Oaten hay	90	9.3 (8.5–9.5)	5.8
Wheaten hay	90	8.0	6.0
Pasture hay (mostly grass)	85–90	8.3	6.0
Oat, barley or wheat straw	90	5.0 (4.5–5.5)	3.0
Sorghum stubble	90	7.0 (6.5–8.0)	3.6
Cottonseed hulls	90	7.0	3.9–4.5
Rice hulls	90	2.4	2.0–3.1
Corn stubble	90	5.5 (4.5–6.5)	4.8 (2–7)
Soybean stubble	90	5.5 (4.0–6.5)	5.5 (4–6.5)
Peanut hulls	90	3.6	3.3
Oat hulls	90	5.3 (5.3–5.4)	3.8
Sorghum (failed crop)	90	9.0 (8.5–9.5)	7.4
Peanut hay	90	8.5 (8.0–9.0)	9.3 (7.6–10.7)
Soybean hay (mature)	90	6.0 (5.5–6.5)	8.1
Wheat stubble	90	5.1 (4.8–8.2)	–
Barley stubble	90	5.5 (5.1–6.2)	–
Rice stubble	90	5.7 (5.3–6.6)	–
Oat stubble	90	4.6	–
High protein, dry roughages			
Lucerne hay	90	8.5 (8–9.8)	15–20
Clover hay	85–90	9.0 (8.3–10.9)	13
Pasture hay (mostly clover)	85–90	8.3	11
Cowpea and field pea	90	9.5	16
Soybean hay (full pods)	90	9.5 (9–10)	13–14
Soybean hay (75% pods)	90	8.5 (8–9)	17
Low protein, wet roughages			
Maize silage	30-35	7.5-11	6.9–9.0
Sorghum silage	30-40	8.0-10	6.9–7.5
Oat, wheat, barley or rye green fodder or silage (cut at flowering stage)	30-40	8.5-10.5	6.0–8.0

High protein, wet roughages			
Lucerne green fodder	25	8.3	16
Lucerne silage	35-40	8.4-10.5	15
Pasture fodder (mixed grass & clover)	25	10.3	17.5
Pasture silage (mixed grass & clover)	30-40	8.2-11.0	16
Young grazing oats, wheat, barley, rye or millet	30-40	9.3	10
Grains			
Maize	90	13.5 (13–14)	9.5 (9.0–10)
Grain sorghum	90	13	9 (5–11)
Wheat	90	13 (12.5–13.5)	12 (11–13)
Barley	90	13 (12.5–13)	11 (10–12)
Oats	90	12.5 (11–13)	10.5 (10–11)
Lupins	-	13	32
Cereal grain by-products			
Wheat pollard	90	11	15
Wheat bran	90	12	15
Oat bran	90	9	8.0
Hominy	90	12.6	11 (10–12)
Rice bran	90	11	14
Protein-rich concentrates			
Soybean meal	90	12	50
Safflower meal	90	11	40–55
Peanut meal	90	11	42
Cottonseed meal (decorticated)	90	10.5	41
Linseed meal	90	11.5	30–35
Sunflower meal	90	10.5	40–45
Coconut meal (6% fat)	90	12.5	21
Milk powder (cow's whole)	90	17	26.5
Milk powder (cow's skimmed)	90	12.8 (12.6–13)	36
Urea (46% nitrogen)	90	–	Equal to about 280
Miscellaneous			
Brewers grains (dry)	90	9.5	20
Molasses	75	13	3.5
Sheep and cattle nuts	90	11 (9–13)	15

* This figure should be used as a guide only because of the very wide variation between samples – laboratory testing of feeds is recommended. Cattle and sheep advisers can provide a list of feed testing laboratories