Department of **Employment, Economic Development and Innovation**

Beeftalk

Taking stock of your future

Prime news and views for beef producers of south-east Queensland

in this issue

Queensland Government

editorial

The beginning of the summer was variable across much of SEQ. Some areas received very good rain while others received very little and were preparing for a very poor season.

Fortunately February and early March have produced some of the best general rain we have experienced for many years. Dams have filled, creeks have run at record heights, and the grass is growing. This augers well for a good year.

To take advantage of the good season we need to maintain a high standard of management by weaning calves in April and May to conserve cow condition and save money on supplements.

The wet conditions may also cause an increase in parasite numbers. This issue of *Beeftalk* has an article outlining how to monitor and manage internal parasites.

In many areas the good season has seen the emergence of plants that have not been seen for some time. If you would like a plant identified, take a sample to your local DEEDI (formerly DPI office).

This issue again covers a diverse range of topics from the story on urea poisoning to the value of biological crusts on the soil surface.

We often hear about 'good big' cows. An article in this issue tells us why big, when referring to cows, isn't always good.

Our research report gives us an update on investigations into the use of a fungi to control cattle ticks, and we have more on minerals in an animal's diet and soil carbon.

The changes continue. Most of the *Beeftalk* team are now in a group to be known as Agri-Science Queensland with the others in the Regional Services Group within the Department of Employment, Economic Development and Innovation. While we may have new names, we hope to continue to provide the same services to primary industries.

Happy reading!
The Ed

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Net carbon position of the Queensland beef industry

According to the international rules for reporting greenhouse gas emissions, the grazing industries in Queensland contribute significantly (about 40%) to the State's annual emissions of 181 Mega-tonne CO_2 equivalent (Mt CO_2-e) through livestock methane, woody vegetation clearing and burning emissions. However, in the agriculture sector, unlike most other sectors of the economy, both natural and induced processes of sequestration and emissions occur as part of a biological production system which is diverse and covers large areas of the country.

The sources of greenhouse gas emissions from a typical beef enterprise include enteric fermentation in cattle (methane), burning of vegetation (either intentional or accidental), energy use (including electricity and fuel), land clearing, loss of pasture, and declines in soil carbon.

Biosequestration in the beef sector occurs through vegetation growth (above and below ground) and by improving soil condition. The difference between the emissions and sequestration represents a 'net carbon' position.

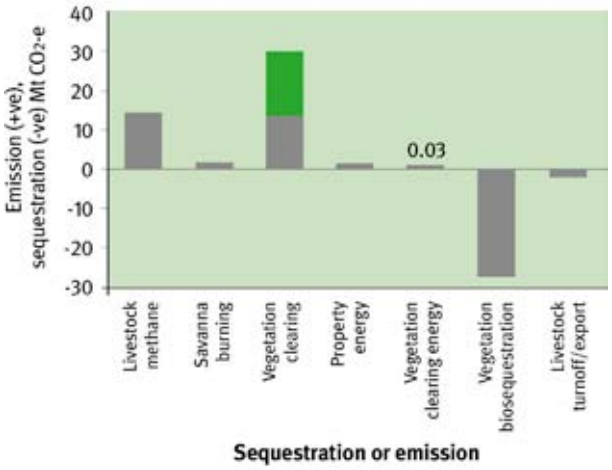

Figure 1. Magnitude of each emission or sequestration (Mt CO2-e) used to calculate the net carbon position of the Queensland beef industry. For 'vegetation clearing' the full bar (blue and maroon) indicates the estimated emissions for 2006–07; the 'blue' portion of the bar represents the emissions assuming a further 75% reduction in the clearing of remnant vegetation.

A recent study conducted by officers of the Department of Employment, Economic Development and Innovation (DEEDI) looked at the 'net carbon' position of the Queensland pastoral beef industry at the farm gate level. The analysis showed:

1. An estimated **22 720 Mt CO_2-e** of carbon stocks are being managed by graziers in Queensland. While this is not required to be reported under the current greenhouse gas accounting process, the figure provides an indication and recognition of the scale of current stocks in the land being managed by graziers (see Figure 2).
2. Total greenhouse gas emissions from the beef industry (at the farm level) in Queensland are estimated to be **45.9 Mt CO_2-e** per year. The emissions data draws on the most recent tree clearing data from 2006–07 which predates the full implementation of legislative controls on tree clearing in Queensland and includes methane and savanna burning emissions (Figure 1).
3. Total biosequestration is **28.5 Mt CO_2-e** per year (assuming no change in soil carbon). Sequestration includes growth of woody vegetation and the carbon in livestock 'exported' off the property.
4. Net emissions are **17.4 Mt CO_2-e** per year (assuming no change in soil carbon). This is before the full implementation of the legislative controls on tree clearing.
5. When the clearing controls are fully implemented and assuming the clearing rate falls 75% from 2006–07, the net carbon emissions also fall dramatically to an estimated **1.2 Mt CO_2-e** per year. This effectively means that the beef industry is **carbon neutral**.
6. Soil carbon sequestration potential is significant. While the report excludes current contribution of soil carbon to the 'net' position due to insufficient data sets, it does indicate the significant potential gains that could be achieved through improvements in land condition and soil carbon levels and their further impact on the net position of the industry.

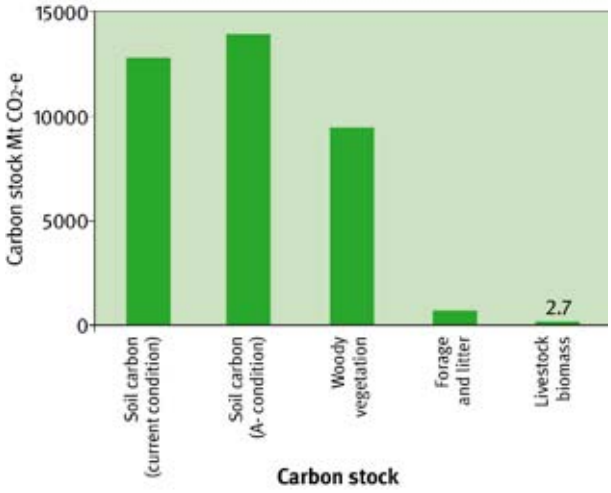

Figure 2. Magnitude of each carbon stock managed as part of the Queensland beef industry.

For example, moving half of the current C (poor) condition land in Queensland to B (reasonable) condition over a 25–year-period could sequester an additional 190 Mt CO_2-e or **7.6 Mt CO_2-e** per annum. However, further research is needed to better understand the role of soil carbon sequestration.

This article was derived from the Executive Summary of the DEEDI report Net carbon position of the Queensland beef industry by S Bray and J Willcocks (2009). This report is available at www.dpi.qld.gov.au/27_15803.htm

While the analysis used the latest available data, it did not encompass current international greenhouse accounting polices. It used a scientific approach to assess the biological processes. This assessment was not definitive but rather an attempt to better understand the issue of net carbon position in relation to agriculture. The reports' authors acknowledge that policy considerations at the national level do not occur in isolation from international developments.

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Internal parasites – a problem in a good season

The return to what many see as a 'normal' wet season is very welcome. However, livestock owners need to be aware that the wet conditions can cause an increase in internal parasite activity.

Cattle roundworm species and liver fluke can significantly downgrade animal performance. Proactively implementing management strategies before your cattle show obvious symptoms of worm infestation will save many dollars.

Younger cattle, particularly those under seven months of age, and livestock in intensively operated beef and dairy situations are at most risk of severe infection. As cattle age, they gradually develop resistance to roundworm infection and by two years of age cattle should carry very few worms if any at all.

Testing

Testing to determine the level and nature of the parasite burden will enable producers to make the best decisions for their animals. WormTest kits can be purchased from the Yeerongpilly Animal Research Institute laboratory by calling 07 3372 9534. The price of $33 includes the kit, return postage, laboratory analysis and results.

The test results report on the total *adult* worm burden and identify the species of worm present. Both types of information are needed when deciding whether to treat the animals and what chemical to use.

However, the WormTest does not identify the size of the *immature* burden, which can be large during wet weather. If your initial WormTest reported a low burden but with reinfestation rate likely to be high after rain, a follow-up WormTest in 3 to 4 weeks will identify any rise in worm levels and whether treatment is now indicated.

To determine whether local worms are developing resistance to worm drenches, carry out a worm test 7 to 10 days after treatment. If worm eggs are present at this subsequent test then professional advice should be sought for selecting alternative treatments.

Once drenched for worm or fluke, stock should be moved to less contaminated, dry paddocks that have previously been grazed by adult cattle.

Species and symptoms

Cooperia scour worm (*Cooperia spp*) and nodule worm (*Oesophagostomum radiatum*) infection symptoms are mainly scours and ill-thrift. Stock infected with barber's pole worm (Haemonchus punctata) may show symptoms of anaemia and lack of growth and be slow to muster.

To complete their life cycle, liver fluke (*Fasciola hepatica*) need an aquatic snail (*Austropeplea tomentosa*) that lives in wet, swampy areas and along water courses. Cattle of all ages are susceptible to liver fluke, which is endemic in the Mary River valley region.

Symptoms of a light liver fluke infection are jaundice, ill-thrift and anaemia, which can lead to death after several weeks of infection. Acute cases due to heavy burdens of immature fluke can manifest as sudden death with or without signs of abdominal pain, jaundice and anaemia. If liver fluke is present, the animals should be treated with the highly effective triblabendazole-based flukicide to kill both immature and adult stage flukes.

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What are biological soil crusts?

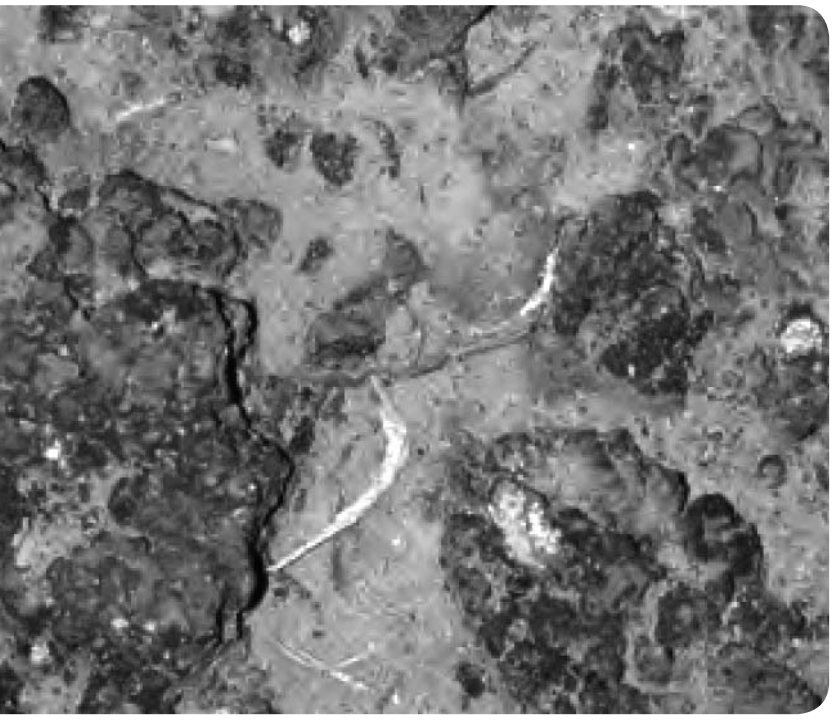
The recent debate on carbon has focused agriculture's thoughts back on the level of carbon in soil and raises questions about how soils can be better managed to store more carbon.

Most soil carbon in a soil is stored in the organic matter, so the higher the organic matter in a soil the higher the carbon. More carbon and organic matter in a soil means improved fertility and better water-holding capacity. Up until now, this has been a part of the soil carbon/fertility story that has been given little prominence.

Biological soil crusts are now being better recognised as important structures that contribute to soil fertility and protect the soil surface from erosion and evaporation. These soil crusts have been called by various names over the years, such as cryptograms or microbiotic or microphytic soil crusts. Biological soil crusts seems to be the phrase most favoured at the current time.

These biological soil crusts are seen on some soils in south-east Queensland and appear as a dark slimy substance when wet, changing to a thin cracking film when dry. The colours of soil crusts will vary depending on the dominant organism in the crust.

The biological crusts consist of lichens, bryophytes, algae, microfungi, cyanobacteria and bacteria growing on or up to 4 mm below the soil surface. These biological crusts are found globally in arid and semiarid environments and are common in Australia.



Biological crusts on soil surface. (Source: US Geological Survey)

Some functions of biological soil crusts include:

- assisting in stabilising the soil, limiting erosion, and reducing run-off during storm events
- increasing the infiltration and storage of rainwater
- fixing atmospheric nitrogen
- contributing to the nutrients available for plant growth and health
- helping in soil plant–water relations
- assisting seedlings in germinating
- providing forage for insects.

The cyanobacteria, a component of these soil crusts, are photosynthetic. Research being carried out on cyanobacteria in Queensland's gulf country is indicating how important they may be for fixing and storing soil carbon. It has been proposed that 25% of the earth's carbon may be held by cyanobacteria in soil crusts and rock biofilms. Research overseas has shown that cyanobacteria can fix between 0.02 kg/ha/yr of N to as high as 100 kg/ha/yr during optimal moisture and temperature conditions. At the higher level, the contribution of the cyanobacteria is the same as applying 10 x 20 kg bags of urea to one hectare of pasture. In addition some research is indicating that these biological organisms can secrete compounds that increase the bio-availability of phosphorus which, apart from nitrogen, can be one of our most limiting soil nutrients.

Biological soil crusts have an important and integral role to play in ensuring our soil biology is working. Research work in western NSW has shown that the crusts are susceptible to damage by continuous heavy stocking. A study at Cobar found that once the soil crust was damaged and broken up by heavy stocking rates, nutrient leaching in the sandy soils increased and soil moisture was lost. This contributed to a rundown in the productivity of the pasture.

It is worth keeping an eye out for these biological crusts on your soil surface. They might look insignificant but they could be playing a key role in keeping your soils productive and ecosystems in working order.

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Size isn't everything

Many of us look at those big heifers and comment what 'good' heifers they are. Likewise in the sale ring we tend to go for the 'good big' heifer. Often these heifers are up to 36 months old and only just in calf but they are big and beautiful cows.

Well, we may be making very expensive mistakes if we don't first consider the cow size that our country will carry, economically and productively. I learnt this the hard way.

One day I was preg-testing with our vet, who had 30 years' experience working in the Brisbane Valley. I was wailing that my best (looking) cows were being bang-tailed and drafted into the empty yard. We were also drafting out the 10 year old cows that would calve at 11 and then be fattened for slaughter.

By the end of preg-testing, the 10 year old cows were in one yard and just about all were pregnant. In the other yard there were quite a number of 'good-looking' younger cows in amongst the empties.

My old pregnant cows were all like peas in a pod with smaller frames and all had produced eight calves (nothing gets a second chance here). All the empty cows were at least a frame score taller than the old cows and were in lighter condition than the old cows. We had just weaned a calf off every cow in the yards and all had been run under identical conditions.

'Your country can't support those big cows and get a calf out of them every year,' observed our vet.

As a result we have stopped selecting so much for size. We now join the smaller-framed earlier-maturing heifers so long as they have the conformation we want. This year we averaged 92% in calf over the whole herd of 500 breeders.

We still buy big-framed muscular bulls and our bullock weights have not slipped at all. In fact, we are finding that many can be turned off a year earlier as milk or 2 tooths. Our bullocks fit that market very well and attract a price premium.

The mature cow weights have not suffered much either, although we find we are selling earlier in the season because the smaller-framed animals fatten faster than the bigger-framed cows and we don't want to incur overfat penalties at the abattoir.

Running smaller-framed cows is a bonus for our country too as we are not stocked to capacity going into winter. And by selling the cows and steers earlier in the season, we're effectively spelling the fattening paddocks while grass is still growing.

If you have improved pastures this may not apply to you. But for those of you who run your breeders on lighter native pasture country, have a good hard look at your empties next pregnancy test and see if this scenario applies to your herd. You may well be culling your best breeders at heifer selection time if you're not keeping those early maturing smaller-framed heifers and calves. They might be the ones that are going to give you the better return on your land.

Editors note:

Those 'good big cows' we comment on in a mob of breeders are generally 'good and big' because they have missed a calf or two. The real producers are likely to be the smaller cows that we don't notice so much, because they're too busy carrying and rearing a calf to look after themselves.

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THE NEW CHUM'S LAMENT ('SHEEP')

Yarding lambs with long tails, breaking,
Toiling in the teeth of fate
After old ewes bent on taking
Any opening but the gate

Blasphemy and blue lights blended
In the fiery stress of work
Hapless newchum recommended
To a hotter place than Bourke

Using four inch rails to flog and
Using words as quaint as course
Running when your horse turns dog and
Barking when your dog turns hoarse

Tearing shirts and ripping leathers
Toiling early hours and late
Keeping up ten thousand wethers
To the hungry drafting gate

Dusty men with grimy faces
Rushing crossbred weaners through
While a coughing super places
Orders underlined in blue

Straining wires with blistered fingers
Scruffing old ewes down the dip
Kicking tarboys, sacking ringers,
Cursing grass seeds in the clip.

Bending down from dawn till knockoff
Dressing stinking flyblown sheep
With a backache and a dust cough
Sore enough to make you weep

Riding round eternal fences
Dragging dead stuff out of dams
Taking Uncle Kruger chances
In a yard of angry rams

Snaggers, sixtooths and pickuppers,
Learners, wrinklies, weaners, wool,
Cull ewes, kelpies, combs and cutters,
Make the wisest man a fool.

Fancy workers, fluke and flusters,
Footrot, blowflies, crows and kites,
Mongrels, maggots, mutton, musters
Fill the days and haunt the nights

But of all this wild confusion
After meditation deep
I have come to the conclusion,
That the road to hell is sheep.

Weaning – the cheapest supplement

Weaning is probably the single most important management practice for improving the productivity of the beef industry.

Research and producer experience has confirmed that breeders will survive and produce more calves if calves are weaned before cow condition declines too much. Management and nutrition of weaners must be of a high standard to ensure that weaners survive with acceptable growth rates.

Expected pregnancy rates of cows in a range of body conditions

Cow body condition at the start of mating		Likely pregnancy rate of lactating cows*
Body condition score (1–5 scale)	Description	
1	Poor	Up to 25%
2	Backward	50%
3	Moderate	70%
4	Good	85%
5	Fat	95%

* Assumes good nutritional conditions during mating. For young cows and poor nutritional conditions, rates are likely to be lower

Fortunately most of Queensland has had good rain with the flow-on effect of good pasture and cattle in better condition. Unfortunately many producers don't capitalise on these conditions and leave weaning too late. Even a month can make all the difference. This can often lead to cows being in worse condition at weaning than in drier years.

If calves are weaned before the cows lose too much weight, there will be a likely improvement in conception rates and a reduced need for supplementary feeding for the cows. However if small calves are left on cows until later in the season, the cows will lose condition and these benefits will be lost.

Irrespective of the season, calves should be weaned at the first weaning muster regardless of their size. If fed and managed well, calves from 100 kg can maintain satisfactory growth rates. Lighter calves have been successfully reared even when weaned in extreme drought conditions.

Calves should be drafted into weight groups to reduce bullying and enable feeding to be tailored to the calves' requirements. Those in the 100 to 159 kg weight group could be drafted into smaller groups if numbers and yard space allow.

Suggested weight groups and supplements are

Weight (kg)	Supplement types	Minimum growth target (kg/hd/day)
100–159	Protein meals, fortified molasses mixes, weaner pellets or meals	0.25
160–199	Fortified molasses mixes, palatable licks or blocks[1]	0.10
>199	Fortified molasses mixes, palatable licks or blocks[1]	0.10

[1] For calves over 160 kg, urea licks and blocks should supply 75 g protein/hd/day.

Calves less than 150 kg should have free access to the suggested supplements plus good quality hay or pasture to maintain satisfactory growth rates. Calves over 150 kg can have their intake of supplements regulated to achieve desired performance.

Primary industry staff from government departments in Queensland, Northern Territory and Western Australia are currently compiling a book on weaning and weaning management. It is hoped to have this book available from MLA by the end of the year.

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Why pregnancy test?

Pregnancy testing tells a producer much more than whether individual cows are pregnant or not.

By drafting out pregnant and non-pregnant cows, the conception pattern across the breeder herd as a whole can be considered. A low pregnancy rate or late conceptions across the herd can indicate poor nutrition or health management.

By identifying productive and non-productive animals, the producer can better make decisions about culling and the need for providing supplementary feed to individual cows.

Reproductive ability is very repeatable. If a cow is able to get back in calf quickly after calving then she will most likely do so every year; if a cow takes a long time to get pregnant after calving, she will more than likely do so every year. So giving a cow a second chance will likely mean you are keeping a cow that will always calve late and possibly miss calves.

Pregnancy testing is most effective when mating is

controlled into a short period and all cows are at a similar stage in their pregnancies. A cow tested too early in her pregnancy will be diagnosed as empty and culled unnecessarily.

Pregnancy testing should be carried out from two months after the bulls have been removed. This often coincides with weaning and is before winter has set in, a good time to draft breeders according to their need for supplementation.

Producers can learn to pregnancy test cows. Pregnancy testing is taught through the Australian Agricultural Colleges Corp (AACC) as well as by many private specialists.

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Mineral supplementation — Copper and selenium

Cu and Se are essential trace elements for all mammals. Trace elements are only required in minute amounts. Daily intakes are measured in either micrograms (one millionth of a gram (ppm) or milligrams (one thousandth of a gram). Both play a role in the growth and repair of tissues and in the conversion of 'fuel' substances into energy.

Cu is essential for the incorporation of iron into haemoglobin in the blood. Without iron, the haemoglobin cannot transport oxygen from the lungs to the body tissues and so the tissue/animal dies. Likewise Se is essential in helping to remove harmful products formed within cells when 'fuel' is 'burnt'. Without Se these harmful products accumulate inside the cell, destroying it and leading to extensive tissue damage and/or organ failure and death.

Both Cu and Se are involved in the body's defence mechanisms for fighting stress and bacterial and viral infections.

Symptoms

Clinical Cu and Se deficiencies are not common under grazing conditions in south-east Queensland. However, a Cu deficiency can develop in improved pasture situations where there are high nitrogen and sulphur levels and Cu is tied up as insoluble copper sulphide which is unavailable to the animal.

In young animals deficiency signs may be no more than dull, rough coats and poor growth. Cu deficiency often produces a yellowing of the coat colour in red cattle, but so too can phosphorous deficiency. Cu deficiency has also been shown to be responsible for a greying of the hair tips. Diarrhoea may be a feature in both young and older cattle with more severe Cu deficiency. Severe Cu deficiency will cause death, particularly in calves.

Severe Se deficiency produces the 'white muscle' disease which can result in death. Usually this is restricted to young cattle (under 6 months) but there are anecdotal reports of death in older cattle. Severe deficiency seems to be associated with reduced fertility in breeders, presumably due to embryonic death soon after conception. Other anecdotal evidence suggests that deficient cattle seem more prone to infections such as metritis and mastitis.

Supplementation

Before you start on any broad trace element supplement program,

- carry out appropriate testing to confirm your herd is affected by the supposed trace element deficiency!
- examine the responses being claimed
- determine the benefits and costs in your situation.

Risks are associated with using trace element treatments when there is no deficiency. In recent years it has become fashionable to regard Se as a 'cure-all' for every production problem. There is increasing evidence to suggest that unwarranted use of Se can aggravate the very problems it is supposed to cure.

Cu and Se can be supplemented in several ways:

- Trace element mixtures are often incorporated into both 'home made' and manufactured mineral supplements; however an even intake by all animals can't be guaranteed.
- Injectable Cu and Se preparations can be use to treat animals individually. This method is time consuming and not necessarily without complications, especially with Cu. Retreatment is often required at 12 weeks.
- Intra-ruminal trace element boluses offer the advantages that each animal is treated and that the treatment will be active for an extended period – up to 8 months or longer (six months for Se).

This article was written by Gerry Murphy, formerly of DPI and now retired, and was published in *Beeftalk* No 4.

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Securing supplement supplies

The long dry period in 2009 put tremendous pressure on all supplement supplies across Queensland. Many protein meals were in short supply, cottonseed was difficult to buy and expensive, molasses storages ran out, and hay was at a premium if you could find any.

To avoid missing out, producers need to develop their supplementary feeding plan early and secure supply by entering into a contract if necessary. The days of being able to ring the carrier and have a load of molasses delivered within a week are long gone.

Producers who base their supplementary feeding on molasses need to contract their supplies early in the year and not rely on spot sales, which are rarely available during peak demand periods. Distributors and carriers also find it difficult to carry the cost of large molasses contracts that are not used in some years.

The options for securing regular molasses supplies are:

- contact mills directly and contract to take a certain tonnage each year
- contract with a local distributor or carrier for a tonnage of molasses each season, or
- use proprietary based mixes that are supplied by a number of companies throughout Queensland and are available on an as-needed basis if supply is available.

These are the main molasses supply options in southern Queensland.

Maryborough Sugar Factory

Around 30 000 tonnes of molasses are produced each year. This mill has in excess of 10 000 tonnes of molasses storage with most of its molasses sold to Bundaberg Molasses. Depending on the season about 200 to 300 tonnes are held at the mill to fill 200 litre drums.

www.marysug.com.au
Phone: 07 4121 1100

Bundaberg molasses

Bundaberg Sugar has a molasses contract system in place. A minimum of 500 tonnes is set for each contract. The contracts need to be in arranged between April and June to ensure supply. Part of the contract conditions require that 55% of the molasses is picked up during the crushing period which generally runs from July to November. Some spot sales may be available if there is a surplus but these sales cannot be assured.

Bundaberg molasses make it clear that they will fill all contracts every year. Depending on the year there may be several shiploads of molasses sent to Bundaberg from the north Queensland mills of Babinda, South Johnstone and Tableland to meet demand for molasses.

If producers cannot handle 500 tonnes of molasses they can form a group to share a contract. The other option is to secure molasses supplies through distributors and Bundaberg Molasses can supply a list of distributors.

www.bundysugar.com.au/molasses/molasses.html
Freecall: 1800 777 097

Isis Central Sugar Mill

Isis mill requires that supplies be organised between February and May and that actual requirements be confirmed by early June. Producers who require supplies can also speak to the regular contractors who source molasses from this mill. Regular customers are given priority when supplies are tight.

www.isissugar.com.au
Phone: (07) 4126 4400

Estimating your molasses needs?

Say you have 100 cows being fed for 2 months on a fortified molasses mix of 92% molasses and 8% urea at a rate of 3kg/hd/day:

3 kg x 92% x 100 cows x 60 days = 16.5 tonnes of molasses

How long can you store molasses?

Molasses can generally be stored for long periods without problems as long as no water contaminates the tank.

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Research update

Fungal biopesticide control for cattle ticks

Fungal biopesticides could provide an alternative to chemical control for external parasites on livestock. A fungal biopesticide for tick control would consist of formulated fungal spores applied to cattle in a manner similar to that used for some conventional acaricides. Fungal biopesticides offer the added benefit of avoiding problems associated with acaricide resistance and residues.

The idea of using fungi to kill pest organisms is not new. Twenty-four fungal biopesticide products are available worldwide. Four of these products are registered in Australia for controlling pasture and cane grubs as well as locusts and grasshoppers.

Staff from Agri-Science Queensland have been researching the feasibility of using local isolates of the insect-killing fungus *Metarhizium anisopliae* to control cattle ticks. A range of *Metarhizium* isolates taken from the soil or dead insects throughout Queensland have been studied.

Some isolates were found to be extremely virulent to ticks. In laboratory assays the fungus killed 100% of engorged adult female ticks within 48 hours. Pathogenesis studies revealed that the spores germinate on the exterior, then invade and destroy parts of the tick cuticle before killing the tick. Ticks are unlikely to develop resistance to this mechanism.

In 2003–2004 three outdoor pen trials were conducted to assess the effectiveness of a *Metarhizium*-based formulation in killing ticks on animals. Formulations were sprayed onto dairy heifers that had been artificially infested with tick larvae. The ambient temperature and relative humidity as well as the animals' surface temperatures were monitored.

Side counts of standard adult female ticks were conducted daily, before and after treatment, to assess the performance of the fungus against all tick stages on the animals. Egg production by engorged ticks collected in the first three days after treatment was reduced significantly. At each trial the formulation caused 100% mortality in unengorged ticks that were removed from cattle and cultured under laboratory conditions.

The trials showed that while lethal doses of the fungal biopesticide can be applied to ticks on cattle, high temperature on the skin surface during mid-summer may be a limitation. One trial in which the product appeared to be quite effective took place under cool ambient temperatures. Further research is needed in this area.

MLA is co-funding further investigations into developing the best possible *Metarhizium* formulation for ease of storage, application and rapid tick death and defining the temperature limits of this formulation against ticks. A trial will be conducted to evaluate the efficacy of the new formulation against all tick stages on cattle. If the results are positive, Agri-Science Queensland hopes to be in a position to approach a commercial partner to begin registration procedures in the subsequent year.

Further reading:

Leemon, DM and Jonsson, NN (2008) Laboratory studies on Australian isolates of *Metarhizium anisopliae* as a biopesticide for the cattle tick Boophilus microplus. *Journal of Invertebrate Pathology* 97, 40–49.

Leemon, DM, Turner, LB and Jonsson, NN (2008) Pen studies on the control of cattle tick (*Rhipicephalus (Boophilus) microplus*) with *Metarhizium anisopliae* (Sorokin). *Veterinary Parasitology 156*, 248–260.

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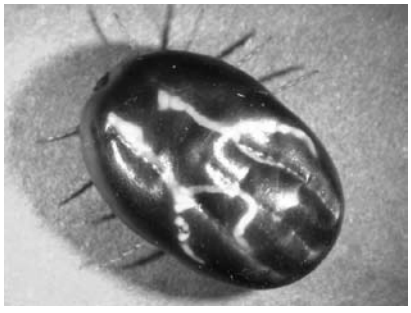
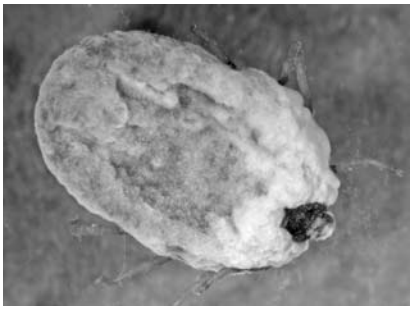
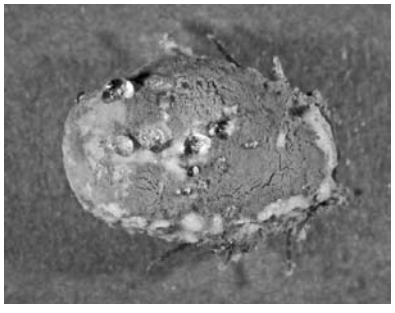


Healthy engorged tick



Tick killed by fungal infection



Fungal spores covering infected tick

Principles for using vaccines

Primers and boosters

- Killed vaccines usually require two initial injections, given at least four weeks apart, to take effect. If the second initial shot is not given, there is every chance that no protection will be provided and the first shot will have been a complete waste. If the second shot is delayed for up to four months after the first, it is likely that a fair percentage of the animals will receive some protection, though not at the same level as would have been achieved by giving the second shot at the recommended time.
- However, some killed vaccines (for example, two of the available botulism vaccines) have been formulated to enable one shot initially.
- Most live vaccines require one initial shot but there are exceptions; for example, the Bovine Ephemeral Fever (BEF) (3 day sickness) vaccine requires the same protocol as for killed vaccines.
- After the initial shots, annual booster shots are required for most live and killed vaccines to sustain protective immunity.

Vaccinate at the right time

- Vaccinate animals before likely exposure to the disease but as close as possible to the likely period of transmission. For example, give Vibrovax to bulls and heifers prior to mating, and give BEF vaccine to at-risk cattle prior to the wet season.
- It is difficult to vaccinate calves, but they do require protection. They can get this from antibodies in the colostrum immediately after birth. Maximise the levels of antibodies in the colostrum by giving breeders their annual vaccinations prior to calving. Diseases like pestivirus can spread during mating and vaccination before calving is strongly recommended in herds where this disease is a problem.
- Avoid vaccinating wet cattle. The chance of infection at the injection site is much greater in wet cattle.

Plan for giving multiple vaccines

- Some vaccines can interfere with the development of immunity from other vaccines if they are given at the same time. For example, avoid giving tick fever (blood) at the same time as any initial (priming) injections; it can be given at the same time as boosters.
- Vaccines based on gram negative bacteria (this includes most of the bacterial vaccines) can cause toxicity problems (endotoxins) in some cattle if multiple vaccines are given. Avoid giving more than two bacterial vaccines at the same time.

Live and killed vaccines

- Killed vaccines are a mix of the dead bug (minced up) and compounds called adjuvants which stimulate the development of immunity. Water-soluble adjuvants are preferred, but sometimes oily adjuvants are used to get enough stimulation; examples of these are SingVac and Vibrovax. This extra stimulation can cause prolonged site reactions if the injections are not given properly.
- Live vaccines have altered organisms to cause immunity but not disease. They do not generally have adjuvants.

Hit the right spot, gently

- Even when given properly, all vaccines cause significant reactions and pain for up to a week, to the point of lameness in some animals. A swelling will be seen on most animals at the injection site in the days after injection.
- Most vaccines for cattle should be given under the skin, especially oil-based vaccines. If the vaccine is injected into muscle severe reactions can occur. The preferred site is above the backbone in the neck area forward of the hump. Injecting into this site will minimise the potential for carcass damage.
- The needle should be sharp and clean and should be inserted as gently as possible. The best needles are capped but are only available in ¾ inch (Monoject 16G); ½ inch needles would be ideal if they were available.
- The anal fold is an UNACCEPTABLE site for vaccination; there are too many nerves, blood vessels, and opportunities for infection, and this site is adjacent to several valuable meat cuts.
- Avoid injecting more than one vaccine into the same site. Before starting to vaccinate a group of cattle, determine where each vaccine will be injected, for example either side, forward or back of neck area.

Handle vaccines for effectiveness and safety

- Vaccines should be treated a bit like milk. Vaccines exposed to freezing, heat or light can break down and become ineffective. The sterile packaging means vaccines can have a much longer shelf life than milk, but they must be kept refrigerated. Refrigeration needs to be maintained crush-side during vaccination.

Once a pack is open, its sterility is lost. Opened vaccines that are keep chilled and clean can still be used within a week.

- Use clean gear. Re-usable guns should be disassembled, cleaned, sterilised and reassembled between each use. Disposable guns should be replaced after use.
- Don't miss the animal and get yourself. A 16 gauge needle hurts. If you inject yourself with vaccine it can cause nasty prolonged reactions.

It is VERY important to ensure you do not accidentally vaccinate a person with an oil-based vaccine (e.g. SingVac) as this can cause very serious reactions requiring surgical excision and causing significant permanent damage.

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Beef supply chain costs

We often hear beef producers complaining about the price of beef in the shops compared to the price they receive on sale to the abattoir.

The costs involved in getting beef from paddock to shop counter are outlined in the following tables. These tables show how beef from a 500 kg live animal, sold to the abattoir at $3/kg for the hot carcase, will end up retailing for an average of $11.28/kg just to cover costs.

Table A shows costs in the abattoir, which include costs per kg for some processes as well as the impact that reducing kilos have on cost. Table B expands on overhead and opportunity costs involved in operating a butcher shop. Table C shows how these costs and processes affect the final average price that must be recouped just to cover costs.

Table A: Abattoir costs and processes

Process	Notes	Kg beef	Value Total	Value / kg
Dressing rate	53% dressing rate on a 500 kg live animal yields a 265 kg hot carcass	265	$795	$3.00
Slaughter charge	Costs $70	265	$865	$3.26
Shrinkage	Yields 97% after 3% shinkage from hot weight to cold weight	257	$865	$3.37
Boning out	Costs 40c/kg (before boning) Yields 68% (after boning)	175	$968	$5.53
Delivery to shop	Costs 20c/kg	175	$1003	$5.73

Table B: Butcher shop costs

Butcher hop overhead costs per week	
Wages for three staff	$3600
Rent	$600
Power	$250
Dry goods & supplies	$1500
Total weekly overheads	**$5950**
Opportunity cost/week (on $300 000 fit out at 10% per year)	$577
Total weekly overheads + opportunity costs	**$6527**
Butcher Shop throughput per week	
4 cattle	1000 kg
4 pigs	240 kg
12 lambs	240 kg
Carton of beef	200 kg
Subtotal of weekly throughput	**1680 kg**
Less trim & wastage factor of 30%	– 504 kg
Product sold	**1176 kg**
Butcher shop costs per kilo of meat sold	
Total weekly overheads + opportunity cost	$6527
Product sold	1176 kg
Cost of product sold	**$5.55/kg**

However, up to 40% of over-the-counter sales (mince, sausages etc) retail for less than the average cost of $11.28. This means the butcher must cover costs and extract the profit margin from the more expensive 'sweet cuts'.

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Table C: Retail sales price to recoup costs

Cost per kg on delivery from abattoir	$5.73
Cost per kg in butcher shop	$5.55
Retail cost (average) per kg to cover costs	**$11.28**

DNA... What is it?

What is DNA and how is it organised?

DNA, or deoxyribonucleic acid, is the building block of the genetic code. A DNA molecule is composed of two strands of nucleotides wrapped around one another and connected at the bases to form a double helix. DNA is present in all nucleated cells in animals and plants.

What is a gene?

A gene is the most basic unit of heredity. It consists of a relatively short sequence (several thousand nucleotides) of DNA at a specific location on a chromosome that determines a particular characteristic in an organism through the production of a specific protein end-product.

What is a cattle genome?

We refer to the complete DNA makeup of an animal as its genome. A genome is the full set of genetic information that an organism inherits from its parents, especially the set of chromosomes and the genes they carry. Cattle have approximately 2.7 billion nucleotides in their code, organised into 30 pairs of chromosomes.

What is a DNA marker?

A DNA marker is a variation in the DNA code, mapped to a specific location in the genome. DNA markers can be genotyped and may be associated with one or more physical characteristics.

Are all DNA markers alike?

Markers can differ in mode of inheritance, physical size (number of base pairs), functionality and how they are applied in genetic improvement. The prevailing type of marker now being used in DNA testing for traits is known as a single nucleotide polymorphism (SNP). SNP markers vary at a single base location in the genome, creating two different alleles (or forms) of the marker.

How does a DNA marker relate to a gene?

A DNA marker can actually be located directly within the gene sequence that causes a change in the trait of interest. More commonly, DNA markers are linked to (inherited with) a nearby gene that causes a change in the trait of interest.

Do we know the full code (i.e. sequence) of DNA for cattle and other livestock?

The full code set for an animal's genome is comprised of about 2.7 billion connected bases. The genome of a number of species has been sequenced including humans, cattle, chickens, horses, and platypus! Additional commercially important species such as sheep and swine are currently being sequenced.

How is an animal's makeup (i.e. genotype) for a DNA marker determined?

An individual's genotype is fixed at birth with the inheritance of one chromosomal copy from each of its parents. The animal's genotype for the marker is determined by analysing the DNA sequence variation at the marker location in the genome using high throughput DNA genotyping technologies that are routinely used for a variety of applications.

How accurate is an animal's marker genotype?

Modern genotyping technologies and applications are highly accurate. The techniques used to detect an animal's genotype are capable of identifying differences in a single base in an animal's genome at each DNA-marker location.

Will an animal's marker genotype change during its lifetime?

No, an individual's genotype is unique and fixed not long after fertilisation of an egg by a sperm, and remains fixed throughout its lifetime.

Does a DNA marker only relate to one trait?

Many traits are genetically correlated to one another due to the fact that genes can impact on multiple traits; for example, the effect of growth hormone on growth rate and carcass composition. Likewise, DNA markers that are either within these genes or linked to them are likely to have effects on multiple traits. It is also possible for a marker to have a positive effect for one trait and a negative effect for another.

What is an economically relevant trait?

A trait is an observable or measurable characteristic of an individual. An economically relevant trait is one that directly affects profitability through an association with a specific cost of production or income stream. Examples of economically relevant traits include marbling and feed efficiency.

Are all economically relevant traits heritable?

Economically relevant traits vary in level of heritability, which is measured as the percentage of the observed variation that is due to underlying gene effects that can be transmitted from one generation to another. While heritability may differ between populations, in general, traits such as fertility tend to be more lowly heritable than traits such as growth rate and tenderness, which exhibit moderate to high degrees of heritability.

If a trait is lowly heritable, does that mean that it cannot be improved genetically?

Traits with a low degree of heritability can still be improved genetically, though not as rapidly as more highly heritable traits. The rate of genetic progress is not controlled by heritability alone; the amount of observable (phenotypic) variation and the accuracy with which the variation can be identified are also key factors.

Do we know the identity of all the genes that impact on economically relevant traits in cattle?
We now know, as a result of the recently completed bovine genome sequencing project, that there are over 30 000 uniquely identifiable genes in the bovine genome. Current technologies have enabled us to identify how a few of these genes impact on economically relevant traits. An excellent example is the effect of the calpastatin gene on beef tenderness. New technologies will lead to greater knowledge about which specific genes control which traits, as well as how they interact to influence performance.

How many genes are responsible for the expression of economically relevant traits?
We do not yet know exactly how many genes impact on economically relevant traits, but quantitative genetics research in beef cattle and other livestock indicates that many genes are likely to have small – to moderate-sized effects on performance for any given trait.

Are the effects of DNA markers the same for different breed sub-populations around the world?
Often they are similar, although the more divergent or distant populations are from each other, the greater the chance that the effect of markers will vary. In beef cattle, the greatest expected differences are likely to occur between *Bos indicus* and *Bos taurus* sub-populations.

This article is printed courtesy of the Beef CRC (Cooperative Research Centre for Beef Genetic Technologies) and Pfizer Animal Genetics.

Further information:
www.beefcrc.com.au/genomicsFAQ

South-east Queensland Beef Research Committee UPDATE

The South-east Queensland Beef Research Committee met in February at the University of Queensland, Gatton. Issues discussed were reports on developing and future research at Gatton Campus, attracting students to agriculture, CSIRO's new program for agriculture, and changes in the DPI&F/DEEDI structure.

Funds for setting up producer demonstration sites were also discussed (see separate article).

Committee members inspected the Centre for Advanced Animal Science (CAAS) and were impressed by the facilities and the potential for world-leading research to be conducted at this site.

The committee's role is to

- identify problems and needs that could be addressed by research, development, education, extension and training
- assess the relative importance of these needs and the potential benefits that could be provided to the region by addressing the needs
- recommend distribution of the research portfolio across providers at a regional level as an efficient integrated strategy
- assess the resources required for research, and recommend ways in which these resources can be acquired.

You are welcome to contact any of the committee members: Cam Hughes (Chair), Jim Cross, Kylie Schooley, Richard Cox, Hazle Marland, Leigh Anderson, Liam Payne, Dennis Poppi, John Lapworth, John McIvor and Damien O'Sullivan (Secretary).

The SEQBRC is one of eleven regional Beef Research Committees across Queensland, Northern Territory and Western Australia which, in conjunction with Meat and Livestock Australia, state primary industry managers, and tertiary education and research institutions, make up the North Australia Beef Research Committee.

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SEQBRC members met with staff and researchers at the Centre for Advanced Animal Science at Gatton.

Native panics

The native panic grasses are found across most mainland states of Australia. Of the 27 or so native species, three are more common:

Native millet	*Panicum decompositum*
Yabila grass	*Panicum queenslandicum*
Hairy panic	*Panicum effusum*.

Although native panics do not grow the same bulk as green panic, they can be an important part of any pasture. Native panics grow on a wider variety of soil types of varying fertility levels than green panic or Gatton panic. There is even an aquatic species of native panic.

Native panics are summer-growing perennials which respond vigorously after rain and often go to seed very quickly. Palatability varies depending on soil type and age of the plant, with younger leafy plants being most palatable.

On flooded areas that have dried out, native millet can produce large quantities of fodder. This species is more often found on the heavier soil types in western areas and can grow to one metre high. Protein levels in native millet have been recorded at up to 10%.

Yabila grass also grows to one metre high. The large open seed heads blow away in the wind after flowering has finished and are often seen piled up against fences. Other native species also have this habit of shedding the seed heads after flowering.

Hairy panic, whilst a good feed, can cause photosensitization in sheep if it is their main source of feed. Other panic species have also been known to cause photosensitization. Hairy panic is often found on lighter soils and ridges. It is easily distinguished from other panics by its hairy leaves and stems. It is shorter than other panics, growing to 60 cm high. Protein levels in hairy panic have been measured at up to 18%.

Although the native panics may not as productive as the introduced panics, they are still a valuable and worthwhile component of any native pasture.

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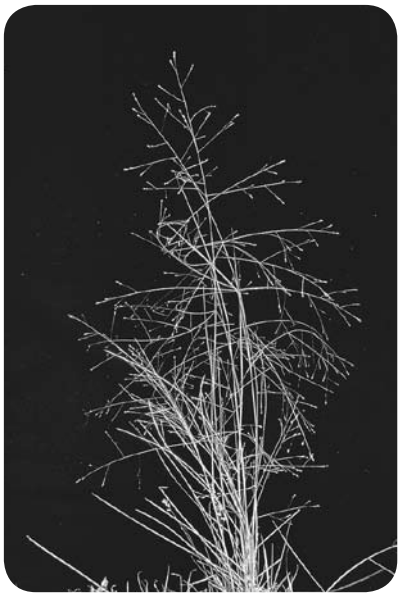

Native millet

Yabila grass

Hairy panic

NLIS humour

An old bloke recently discovered that having a hearing impairment is no obstacle to using his new NLIS reader. He approaches his animals very quietly in the yard, sticks the reader in their ear, the reader beeps – frightens the cow, he gets kicked in the shin and then he knows the read was successful... True story ☺

Hay and silage analyses – what do they mean?

A basic nutrient analysis for silage or hay provides measurements for moisture, fibre, energy and protein and estimates for the response that should be expected from cattle consuming this feed. Producers can use these figures to balance the diet and estimate intake levels relative to performance.

Moisture content, crude protein and energy (MJ ME/kg are the most important figures for a beef producer. The example analysis below indicates that the moisture is similar to pasture that is maturing and starting to seed, protein is just above what considered a minimum for maintenance (6%) but energy is above average for a pasture.

This example of a silage analysis is listed on a 'dry matter' (DM) basis. Additional tests can be made for minerals.

Parameter	Abbrev.	Sample result	Units
Moisture		68	%
Dry matter	DM%	32	%
Crude protein	CP	7.2	%
Acid detergent fibre	ADF	38	%
Neutral detergent fibre	NDF	57	%
Digestible protein		5.2	%
Digestible dry matter	DDM	61.3	%
Total digestible nutrients	TDN	61.5	%
DM intake % of body weight	DMI	2.1	%
Net energy lactation		5.7	MJ/kg
Net energy gain		3.2	MJ/kg
Net energy maintenance		6.2	MJ/kg
Relative feed value	RFV	98	
Metabolisable energy	ME	9.3	MJ/kg

As silage is a fermentation product, estimates can be made for silage fermentation quality (pH and Ammonia –N) and corrections can be made for volatile compounds lost during oven drying.

Using the figures

The nutrient analysis enables us to estimate intakes of dry matter, energy and protein.

For example, the analysis estimates ad lib intake of 2.1% of body weight in dry matter. In a 300 kg steer, this equates to an intake of 2.1% x 300 kg = 6.3 kg of dry matter.

The silage is 32% DM (or 68% water), so the wet weight of silage eaten is calculated as 6.3 kg DM divided by 32% = 19.7 kg 'as fed' silage.

The silage metabolisable energy is 9.3 MJ/kg DM and crude protein is 7.2%. Therefore 6.3 kg DM supplies 58 MJ ME and 454 grams of protein.

Nutrient requirement tables indicate that a 300 kg steer gaining 500 grams per day live weight will require 54 MJ and 425 grams of crude protein. This suggests that this silage will provide a performance of close to half a kilogram per day.

Moisture and dry matter content

It is best to compare feed nutrient values on a dry matter basis, i.e. with the water removed. A hay sample and a silage sample may both have the same energy content on a dry matter basis but because the silage is wetter it has much lower energy per kilogram on an 'as fed' basis (also known as 'wet' or 'fresh'). To determine a sample's moisture percentage, an oven is used to remove all the moisture.

To calculate energy per kg as fed from dry matter percentage:

	Energy MJ/kg DM		DM%		Energy MJ/kg as fed
Hay	8.5	x	89 (11% water)	=	7.6
Silage	8.5	x	32 (68% water)	=	2.7

In this comparison, one kilogram of the hay supplies 890 grams of dry matter and 7.6 MJ of metabolisable energy (ME), whereas one kilogram of the silage supplies 320 grams of dry matter and 2.7 MJ ME.

Working in the other direction, if you wanted to supply a beast with 8.5 MJ ME then you would need 1.12 kg of the hay or 3.13 kg of the silage.

Crude protein (CP)

Laboratories measure the nitrogen (N) content of the forage and calculate crude protein using this formula: CP = % N x 6.25. Crude protein includes both true protein and non-protein nitrogen. Crude protein values give no indication of the protein availability. For example, if the forage has been damaged by heat, which may alter protein availability, the crude protein value will not reveal this. On the other hand, the digestible protein % is an estimate of the protein available to the rumen bugs.

Producers can use the crude protein figure to balance the total protein in the diet, and view the digestible protein percentage as an indication of the protein levels available to the rumen bugs.

Metabolisable energy (ME)

Metabolisable energy (ME) is the dietary energy available to the animal for maintenance and production. High fibre feeds are less digestible and lower in ME. Low fibre diets are more digestible and higher in ME. For silages, ME (and digestibility) will be underestimated if the laboratory does not take account of the volatile compounds lost during oven drying. The error is likely to be bigger when silage

DM content is low (less than 30%), and silage protein content is high and the silage is poorly preserved (has a higher pH).

Range of ME, digestibility and fibre contents seen in Australian silages

Quality measure	High quality	Low quality
ME (MJ/kg DM)	11.3	6.7
Digestibility %	72	42
NDF%	32	72
ADF%	25	47

Acid detergent fibre (ADF) and neutral detergent fibre (NDF)

ADF refers to the cell wall portions of the forage that are made up of cellulose and lignin. The NDF value refers to the total cell wall, which is comprised of the ADF fraction plus hemicellulose.

Cellulose and hemicellulose are partially digestible in the rumen whilst lignin is indigestible. As lignin increases, both the ADF and NDF percentages increase, and digestibility, intake, and animal performance usually decrease.

NDF values reflect the amount of forage the animal can consume. As NDF percentages increase, animals will generally eat less due to the rising fibre content which takes longer to digest in the rumen.

Digestible dry matter (DDM) and total digestible nutrients (TDN)

These are estimates of forage digestibility generated from the ADF value. As ADF increases, digestibility and total digestible nutrients available to the animal decrease.

Dry matter intake (DMI) as a percentage of body weight

NDF is used to estimate ad lib dry matter intake (DMI). This can be expected to decrease as NDF increases. In the above analysis, an NDF of 57% would indicate a dry matter intake of 2.1% of body weight.

Net energy–lactation, net energy–maintenance, and net energy–gain

These net energy values are often calculated from TDN values, which in turn are generated from percent ADF. As ADF increases, net energy values will decrease. The net energy system is more commonly used in the USA whilst metabolisable energy or the estimates used to calculate ME are more commonly used in Australia.

Relative feed value (RFV)

The relative feed value indicates fibre content and its effects on intake and digestibility. RFV ranks forages on an index relative to the digestible dry matter intake of full bloom lucerne, which has an RFV of 100 (assuming an ADF of 41 and NDF of 53). The index has no units and is used to compare the potential of forages for energy intake. The higher the RFV, the higher the feed value obtained from the forage. RFV reduces with maturity and increasing fibre. RFV does not take protein content into account.

Relative feed value (RFV) of forages

RFV	Quality
151 and above	Prime
125 to 150	Premium
103 to 124	Good
87 to 102	Fair
75 to 86	Poor
74 and below	Reject

Relative feed value of some forages

Forage	RFV
Lucerne, pre-bud	164
Sorghum-Sudan grass, vegetative	112
Lucerne, mature	100
Sorghum-Sudan grass, headed	83
Wheat straw	51

Silage fermentation quality – ammonia–N and pH

The type of silage fermentation influences the losses during fermentation and the intake of silage by livestock. Poor silage fermentation produces unpalatable silage, and even if ME and crude protein content are high, intake and animal production will be low. Silage ammonia–N and pH are useful indicators of silage fermentation quality. In poorly preserved silages the protein fraction is extensively degraded, so high ammonia–N (as a percentage of total nitrogen) indicates poor fermentation. Levels of less than 10% of total nitrogen indicate good fermentation.

Silage pH measures silage acidity and hence the extent of fermentation. Lower pH is preferable. pH is considered a useful indicator of silage fermentation quality for silages with DM content less than 35%.

When silage is sent for analysis request that the analysis include ammonia and pH.

Silage ammonia–nitrogen content as a guide to silage fermentation quality

Ammonia–N (% total silage N)	Silage fermentation quality
<5	Excellent
5–10	Good
10–15	Moderate
>15	Poor

Silage pH as a guide to silage fermentation quality

Silage DM %	Probability of poor fermentation if pH exceeds:	
	Grasses	Legumes
15	4.10	4.20
20	4.20	4.30
25	4.35	4.50
30	4.50	4.70
35	4.65	4.80

Oil or fat content – ether extract

Oil or fat content is measured in some analyses and is often recorded as 'ether extract'. The aim is to have total oil in the diet less than 5%; above this level it starts to reduce fibre digestion. The level of oil in a ration is only of concern where high levels of whole cottonseed (‹ 4kg per head per day) and protein meals (› 20% of total diet) are eaten. If a feed is suspected to have a high oil content analysis for this should be requested.

Analysis of some common feeds

Feed	Moisture %	Crude protein %	Energy MJ ME/kg
Pasture - young green	70	15	10
Pasture - mature and dry	20	‹ 5	6
Cottonseed meal	10	37	10
Molasses	25	4	9
Grain	10	8 to 12	9 to 11

Sources:

Top fodder: 'Successful Silage' manual available from NSW DPI bookshop. Phone: 1880 028 374.
Top Fodder, via Dairy Australia: www.dairyaustralia.com.au/content/view/207/101/

Feeding trails at Brian Pastures Research Station help determine intake and growth responses to a range of forages and supplements.

Interpreting Forage Analysis (1994) Factsheet AS-1080 by JW Schroeder: www.ag.ndsu.edu/pubs/plantsci/hay/r1080w.htm
Australian Fodder Industry Association: www.afia.org.au

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Time frames and target weights

When breeding and managing livestock a working knowledge of breeding cycles and developmental milestones is essential.

The following table lists the frequency of cycles in mature females, duration of pregnancy, age at which the young are typically weaned, and size at which animals are ready for market or breeding for a range of agricultural animals.

Animal	Cycle	Gestation (pregnancy) or Incubation Period	Weaning age *	Estimated market/ mature weight (kg) *
Horse	21 days	340 days	3–9 months	400–500
Cow	21 days	285 days	6–10 months	450–550
Sheep	21 days	150 days	1–3 months	60–80
Pig	17 days	112 days (i.e. 3 months, 3 weeks and 3 days)	14–21 days	110 250–300
Alpaca	10–12 days	340 days	4–6 months	65–80
Dog	5–8 months	58–63 days	6 weeks	n/a
Chicken (egg)	24–26 hours	21 days	n/a	n/a
Duck (egg)	24–26 hours	28 days	n/a	n/a

*Depends on breed and growing conditions

Urea poisoning in cattle

Urea yarns

There is no question that many cattle have been poisoned by urea. Interesting yarns about urea abound, including such claims as 'urea takes oxygen out of the blood and therefore reduces the ability of females to reproduce' and 'urea makes meat tough'. Vets and advisers are frequently confronted by these stories. This article aims to help sort the truth from the fiction in such yarns.

The villains

Urea is a small molecule, and by weight is 46% nitrogen. It is normally present in blood (irrespective of any supplements) at 15–60 mg/100mL. In all mammals, urea is the end product of protein metabolism and of some nucleic acid (e.g. DNA) metabolism.

Ammonia is normally present in blood at very low levels, around 0.2 mg/100mL, as either a gas (ammonia) or dissolved (ammonium ions). Ammonia is very toxic, but is rapidly transformed to urea through the ornithine cycle.

Commercial urea

To make urea commercially, natural gas is reformed to produce hydrogen and carbon dioxide (and other chemicals). About 600 cubic metres of natural gas is required to manufacture one tonne of urea.

Under high pressure and temperature, the hydrogen from the natural gas is reacted with nitrogen extracted from the air to produce ammonia:

N_2 + $3H_2$ → $2NH_3$

nitrogen + hydrogen → ammonia

The carbon dioxide is reacted with the ammonia under high pressure and temperature to produce liquid urea:

$2NH_3$ + CO_2 → $NH2CONH2$ + H_2O

ammonia + carbon dioxide → urea + water

The liquid urea is then cooled and either prilled or granulated

Prills are smaller, softer, more translucent, more soluble, and less moisture-resistant than granules. Granules are usually more suitable in agricultural fertilisers.

For stock, prilled urea is more suitable when mixed in liquids (e.g. water dispensers and molasses), and granulated urea is more suitable in dry licks. Urea absorbs moisture when the relative humidity exceeds 75%, so this is a more significant problem with prilled urea because it forms lumps under conditions of high humidity.

Urea can be stored as a concentrated liquid but the urea will salt out of solution at low temperatures. For example, 50% urea by weight in water will salt out when the temperature falls below 15°C. To reduce the volume that salts out, urea to be stored at low temperatures should be less concentrated.

Urea in the animal

Cattle saliva normally contains urea at 2–8 mg per 100 mL. The 100–200 L of saliva produced daily by cows equates to about 5–10 grams of urea entering the rumen each day in addition to any dietary urea.

In the rumen, micro-organisms convert urea and water into ammonia and carbon dioxide using an enzyme called urease. The microbes then convert the ammonia to glutamic acid, and from this all amino acids and proteins are built. (A protein is a large molecule made of subunits called amino acids. There are 18 amino acids, all of which are relatively small molecules containing an average of 16% nitrogen.)

After the cattle have eaten urea, peak rumen ammonia levels are generally reached in 0.5 to 2 hours. A slightly alkaline pH of about 8 is ideal for urea breakdown. (pH is a measure of acidity: lower pH = more acid; a pH of 7 is neutral; higher pH = more alkaline.)

If the rumen fluid is more acidic (a lower pH):

- The rate of conversion to ammonia is lower. But urea and ammonia increase the pH (lower the acidity) of the rumen, thus enhancing urea conversion to ammonia.
- The conversion shifts more towards ammonium ions (which are dissolved in rumen fluid) than to ammonia gas; the gas form is absorbed into the blood in the rumen wall more rapidly.

The liver is the primary site for protein metabolism, and it is here that ammonia is converted into urea. Surplus body protein is converted to glutamine (an amino acid) and in turn to ammonia and then urea.

The kidneys excrete urea, which is the body's primary nitrogen-based excretion product (which is why grass grows greener where animals urinate). The excretion rate is proportional to dietary nitrogen. However ammonia is usually excreted at a fixed rate because the liver generally keeps blood levels low and constant.

Urea in supplements

Feeding urea in supplements is part of a strategy to rectify protein deficiency. When fed with sulphur (about 10 N to 1 S), urea can substantially increase the rate of microbial growth in the rumen and thus increase diet quality, due to the greater amount of microbial protein being produced. The flow-on from this dietary enhancement is improved survival and production. Feeding urea is simply a way of increasing the amount of urea in the rumen above the level that cattle recycle via their saliva each day.

In other words, urea in feed is not in any way a 'foreign chemical'.

Urea poisoning

Urea itself is NOT toxic. If fed urea is absorbed into the blood, it is rapidly excreted by the kidneys. However, some of the ammonia produced from urea by micro-organisms in the rumen is absorbed into the blood in the rumen wall, and it is this ammonia that may cause toxicity.

Ammonia toxicity

The liver rapidly converts blood ammonia to urea. Toxicity occurs when the amount of ammonia circulating in the blood is greater than the amount that the liver can convert to urea. If ruminants regularly receive urea supplements, the ability of the liver to detoxify ammonia improves – in the same way that the liver can improve its ability to detoxify alcohol. This ability builds up over several days, but can be lost over a week of no supplementation.

There is a lot of variation between individuals in their susceptibility to ammonia toxicity. Presumably this variation is related to the rate of ammonia formation, the rate of absorption of ammonia into the blood, and the capacity of the liver to detoxify the blood ammonia.

Producers often ask, 'how much urea does it take to kill an animal?' The answer is, 'it depends'. It depends on how quickly the urea was eaten, how much was eaten, and how well the individual animal's liver can convert ammonia to urea. A cow eating 3 kg per day of a molasses mix with 8% urea will consume 240 grams of urea. Few cattle die when consuming this level of urea because they consume the mix over an extended period.

Symptoms of toxicity

The main symptoms of ammonia toxicity are general depression, breathing difficulties, and muscle twitching and spasm. At post-mortem there is usually a lot of congestion (blood-soaked tissues) and fluid throughout the body, and particularly in the lungs. Any general toxicity such as that caused by ammonia disrupts body functions, and this includes pregnancy. Therefore, it is possible for a cow to abort through excess urea intake, though it is quite rare for this direct effect to be diagnosed.

Treating ammonia toxicity

In the acute phase, reducing pH (that is, increasing rumen acidity) slows the conversion of urea remaining in the rumen into ammonia and slows the rate of ammonia absorption from the rumen by shifting conversion of urea away from the ammonia gas form. Usually a weak acid such as 5% acetic acid (e.g. 2–10 litres of vinegar) is administered. Administering a significant volume of cold water (e.g. up to 40 L to a cow) reduces the rate of all chemical reactions in the rumen, including the conversion of urea to ammonia; the volume dilutes the availability of ammonia and reduces its rate of absorption into the blood.

Of interest

1. The diet of cattle is primarily the micro-organisms of the rumen, which provide all the nutrients the cattle need; rumen digestion also produces food acids that are absorbed into the blood in the rumen wall and these are transformed into glucose by the liver.
2. Plants produce ammonia from inorganic nitrogen in the soil and convert this to glutamic acid, which is the foundation for synthesis of all 18 amino acids and all plant proteins.
3. Legumes use symbiotic micro-organisms to fix nitrogen from the atmosphere, thus increasing available nitrogen.

In high-value animals with acute ammonia toxicity, surgically removing the rumen contents can save an animal's life.

Unfortunately, these measures can often be too late as a major proportion of the urea will already have been metabolised by the time clinical signs are noted. General nursing is the primary treatment. Intravenous injection of calcium and magnesium solutions may reduce muscle dysfunction. Routine bloat treatments can be used if bloat occurs. Animals with advanced toxicity might not recover, especially if there has been damage to nervous tissue, including the brain.

Urea and nitrates and nitrites?

There are stories around that implicate urea in nitrate poisoning. Urea plays no role in nitrate poisoning. None of the urea broken down by the rumen microbes is converted to nitrate or nitrite.

The main cause of nitrite poisoning is animals ingesting high levels of nitrate in pasture and crops that have been grown on ground high in nitrogen or heavily fertilised with nitrogen.

Feeding urea to horses

Horses don't have a rumen and there is no conversion of urea to ammonia in the simple stomach. But horses do have a section of the hind gut, called the caecum (between the small and large intestines), which does harbour microbes that can convert urea to ammonia. Because of this, horses can be poisoned by excess urea intake, but a typical mature horse would need to eat something like 2 kg of urea over a short period for this to occur. In other words, a horse would need to eat 25 kg of molasses with 8% urea – not likely!

Pigs and birds have no problem with urea as they do not have a gut segment where significant conversion to ammonia can occur.

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Timely tips Autumn/Winter 2010

April – May

Dry season management

- Assess pasture quantity and quality in each paddock. Match stock numbers to available feed. If pasture is limited, reduce stock numbers early.
- Assess feed quality to determine when to start protein supplementation. An NIRS test can help.
- Evaluate effectiveness and cost benefit of winter supplementation program.
- Start your dry season management plan that was developed earlier. Stick to plan.
- Ensure supply of supplements by pre-purchase or contract.
- Check feed-out equipment.

Bulls

- Remove from breeders.
- Check for defects or physical problems (e.g. sheaths, leg injuries) and cull.
- Cull bulls that are older than 7 years.
- Start dry season supplementation program.

Breeders

- Draft cows according to pregnancy and body condition for tailored management and possible supplementation.
- Start dry season supplementation program.

Calves

- Brand in the correct legal position.
- Ear tag with NLIS tag in the correct position in the OFF ear (See Beeftalk #25 page 22).
- Dehorn calves (the younger the better).
- Castrate males that are not potential bull replacements.
- Vaccinate with 5-in-1 or 7-in-1. Two vaccinations are required 4 to 6 weeks apart for long term immunity.

Weaners

- Wean and weigh. Identify mothers of poor calves.
- Draft off any small weaners (less than 150 kg) for special care.
- Feed weaners in yards to train them to eat supplements.
- Consider coccidia control measures. Outbreaks can be brought on by the stress of weaning.
- Educate weaners through yards and by tailing them out every day.
- Vaccinate with booster 5-in-1 or 7-in-1.
- In tick-infested areas, vaccinate for tick fever. Where possible, administer tick fever vaccine at least two weeks after any other vaccine.
- Put weaners into the best paddock available.

Marketing program

- Reassess your markets:
  - Is your current target market giving you the best long term return?
  - Have there been changes in specifications for the target markets?
  - Are there new legal requirements?
- Does the optimum number of sale cattle meet the target specifications?
- Can efficiencies be made in the production system?

Parasites

- Start strategic dipping for pre-winter treatments.
- If you suspect ticks are resistant to your current chemical, consider using Tick Resistant Survey Kit available from DEEDI Offices or call DEEDI Business Information Centre (phone 13 25 23).
- Check worm burdens in weaners. WormTest kits are can be obtained by calling DEEDI Business Information Centre (phone 13 25 23). Treat if necessary.
- Treat for buffalo fly to reduce numbers over-wintering.

Business Plan

- Conduct tax planning meeting with accountant.
- Assess success of previous year's business plan.
- Plan management strategies for next 12 months (budget, property maintenance and development, marketing etc).
- Are your on-farm Livestock Production Assurance (LPA) records up to date? Would they pass a random audit?

Pastures

- Start preparing land for sowing improved pastures in spring.
- Plan now to spell some paddocks in spring and summer.

Timely tips Autumn/Winter 2010

June – July

Dry season management

- Reassess pasture quantity and quality:
  - o If quantity and quality will not sustain desired animal performance, ask WHY NOT? Assess options.
  - o If quantity is below requirements, implement your selling strategy.
  - o If quality will not sustain desired animal performance, assess options.

Breeders

- Pregnancy test 6 to 8 weeks after bull removal.
- Cull breeders from main mob (on temperament, age, defects and non-pregnancy).
- Vaccinate breeders (e.g. for leptospirosis).
- Assess mating program and plan changes if necessary. Consider options for breeding programs e.g. crossbreeding.
- Maintain check on pregnant breeders, especially maiden heifers and first calf cows.
- Order NLIS tags.

August – September

Dry season management

- Re-evaluate dry season management plan.
- If season has not broken, assess breeder and weaner condition. Consider sale, agistment or drought feed.
- Draft cattle according to nutritional requirements.

Bulls

- Check bulls for soundness and determine numbers for next breeding season.
- Assess whether bulls are producing calves suited to your potential markets.
- Check young home-grown bulls as potential sires.
- Evaluate potential bull supplies.
- Vaccinate bulls for annual vibriosis and 3-day booster at least 4 weeks prior to joining.

Breeders

- Assess maiden heifers. Are they going to be heavy enough to mate?
- Assess first calf cows. Are they in good enough condition to get back in calf?
- Check early calving heifers.
- Obtain advice on breeder vaccination programs e.g. pestivirus vaccination program.

Parasites

- Plan tick control for summer. Check for resistance if control is a problem.
- Check late winter calves for scrub ticks.

Pastures

- Plan pasture management program:
- o Consider burning native pastures every 2 to 3 years in late winter or early spring after 50 mm of rain to maintain good pasture condition and control woody weed growth.
- o Try to spell each paddock in spring and summer every 3 to 4 years.
- Destock burnt paddocks until grass is 15 cm high.
- Watch SOI and other long range forecasts for suitable time to plant pasture.

Property maintenance

- Check fences and water facilities in breeding paddocks.
- Check river and creek crossings before next wet season.
- Ensure all personnel know what to do in case of fire. Do they know who to call? Review property evacuation plan with all personnel.
- Maintain fire fighting equipment, extinguishers etc and ensure fire breaks are maintained and serviceable.
- Clean around buildings and clear leaves from gutters.
- Do workplace health and safety audit of property.
- Ensure personnel have appropriate training in using and maintaining the farm equipment in a safe, correct and competent manner. Legal liability.
- Carry out annual electrical safety check on all household and farm equipment.

Personal

- It is not just the animals and property that need maintenance. You and your family are the most important assets on your property. Make sure you go for your annual health checks and ensure you have quality family time together.

Mineral supplementation — Sodium

Common salt (sodium chloride) is, as its chemical name implies, formed from the chemical elements sodium and chlorine. There is no evidence to suggest that animals ever suffer from a chlorine deficiency but there is good evidence that both cattle and sheep can be affected by sodium deficiency. In such instances significant production responses occur when salt is fed to the stock.

Several accounts have been received of sodium deficiency in grazing cattle in various parts of Queensland, including the south east. Some of these cases were initially thought to be phosphorus deficiency.

Role

Sodium (Na) is an essential macro element. In mammals it plays a vital role in maintaining the osmotic pressure of body fluids (including blood) and the correct fluid balance in tissues. It is essential for the survival and growth of rumen bacteria in cattle and sheep. Large quantities of Na are found in the rumen liquor and these can be used by the animal to make up for any short-term (70 to 100 days) deficiencies in the diet. Sodium is an essential component in milk. The mammary glands (udder) can't secrete milk unless there is sufficient Na in the milk. One of the first effects of salt deficiency in wet cattle (beef as well as dairy) is reduced milk output.

Deficiency

The signs of Na deficiency are, in many aspects, identical to those associated with phosphorous (P) deficiency, such as poor growth rates particularly in young cattle, low branding rates, rough wormy looking weaners and older cattle, and evidence of depraved appetite. This will include bone chewing and dirt and dung eating. As the deficiency gets worse, affected cattle often appear compelled to lick anything that is sweating – horses, people, other cattle, in fact anything at all that has a salty taste. This is the so-called 'salt appetite'.

Sodium deficiency results from low Na intake from both plants and water. Surface waters are usually quite low in Na, often being less than 20 mg/L (20 ppm). Similar levels can be found in shallow, pumped bores but these can easily increase up to 500 ppm or more during dry/drought periods.

Likewise plant Na levels can be extremely variable and, in fact, many pasture species can be classed as high, low or variable Na accumulators.

Queensland blue, pitted blue, kangaroo, and black and white spear grasses all belong in the low Na accumulator category. Pasture Na level is typically below 500 mg/kg on a dry matter (DM) basis. A number of the guinea grass cultivars also fit into this category, as does kikuyu.

Other pasture species, for example buffel and lucerne, appear to alter their Na level according to the Na content of the soil and can reach levels greater than 500 mg Na/kg DM.

A third group – the high Na accumulators – which includes species such as Rhodes grass cultivars and annual medics, seemingly never contain less than 5000 mg Na/kg DM and often have greater than 10 000 mg Na/kg DM (i.e. 1% Na).

Given that a lactating beef cow probably needs at least 15 g Na/day, a quick calculation based on, say, a daily intake of 12 kg dry matter and 50 L of water shows that in a low Na situation the maximum Na contribution:

- from pasture is 6 g (12 kg x 500 mg/kg = 6000 mg = 6 g)
- from water is 1 g (50 L x 20 mg/L = 1000 mg = 1 g)

This makes a total of 7 g/day, or at best about 50% of daily requirement.

These feed and water calculations are significant because in many areas of the south-east the predominant pasture types fall into the low NA category. Often these are the same areas that are traditionally regarded as low phosphorus areas. Salt is used to either limit or encourage the intake of P supplements, particularly in loose mixes and blocks. If production responses to P supplements have been recorded in the past in these low Na situations, the role of Na itself should be considered further. This is particularly important when a new product or method of P supplementation that doesn't or can't contain salt, e.g. water medication, is being considered.

Supplementation

Note that the desire to eat salt is not on its own a good indicator of a sodium deficiency. Some cattle (and some people) just like salt.

Correcting a sodium efficiency is relatively easy: simply feed salt.

Most dry licks contain high levels of salt. 'Salt hungry' cattle will often eat large quantities of such a lick, chasing the salt, and this can result in deaths from urea poisoning. To avoid this problem, feed salt on its own for at least a week before introducing the dry lick.

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Collecting plant samples for identification

It is always good practice to get a new or strange plant identified to reduce the risk of weeds becoming established on your property. Your local council weeds officer can help identify most declared weeds. Alternatively you could take a sample to your nearest Department of Environment and Resource Management (DERM) or Department of Employment Economic Development and Innovation (DEEDI) office.

How a plant is collected, preserved and presented will affect how easily, quickly and accurately it can be identified. The following points are a guide to plant collection:–

- Collect as much of the plant as possible including roots, flowers and seed pods.
- Make a note of the plant's growth habit and any particular characteristics. Was it sticky or prickly to touch, erect or prostrate.
- Make a note of the growing conditions including soil type, slope and aspect, and whether the plant occurs in native or sown pasture or in cleared country or uncleared bush.
- Putting the plant in a plastic bag will help to keep the sample fresh, but it will also promote mould. If it will be more than a couple of hours before you can get the plant identified, put the sample in the fridge to reduce the chance of mould growth.
- Dry the plant sample if it will be longer than a day or two before it will be identified. Spread out the sample and put it between sheets of newspaper, then place a weight such as some large text books on top.
- A digital photo can help with quick identification of some plants. When taking photos of plants take one of the plant where it is growing. then spread the plant out on a sheet of white paper in a well lit but not sunny area and take photos of the leaves, the seed heads, the stems, and the flowers. These can then be emailed for identification.

Plant identification publications should be available at your local council office, your nearest DERM, or DEEDI office, and your regional natural resource management group (Burnett Mary Regional Group (BMRG), South East Queensland Catchments (SEQC)). Some useful web links include: -

http://www.northwestweeds.nsw.gov.au
http://www.weeds.org.au/weedident.htm

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Inland Burnett pasture booklet

Pasture management for the inland Burnett is covered in a sixty page colour booklet that has been released by DEEDI (formerly DPI&F).

Pasture management in the inland Burnett covers:

- Pasture basics
- Enhancing native pastures
- Establishing sown pasture
- Land types in the inland Burnett
- Legumes suitable for the inland Burnett
- Grasses suitable for the inland Burnett.

The booklet will assist pasture managers in the Burnett in identifying and assessing the capabilities of their land and soil types. It also outlines options for improving native pastures and selecting appropriate sown pasture species for the various land types. The booklet includes photos of sown pasture and native grass species.

Pasture management in the inland Burnett is available free from the DEEDI office in Kingaroy (phone 07 4160 0700).

Primary industry publications – how to get them

All publications (saleable and non-saleable) produced by Queensland government departments are now available at the Queensland Government Bookshop. You can browse, search the catalogue and order online at www.bookshop.qld.gov.au

Alternatively you can contact the Bookshop directly:

Phone: 07 3883 8700 or 1800 801 123 (for calls from outside Brisbane) Fax: 07 3833 8720
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When browsing the online catalogue, the key categories for topics related to 'beef' or 'primary production' are Business and industry, Environment and resources and Law and safety.

Other publications that may be of interest, e.g. animal welfare codes, can be ordered directly from the relevant organisations, e.g. the Department of Agriculture, Forestry and Fisheries. Links to a number of these organisations are provided from the Biosecurity Queensland webpage.

Other 'bookshops' you may find useful include:

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CSIRO	www.csiro.com/resources/shop.html	1300 363 400
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