Managing a beef business in the subtropics

Queensland Government

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Compiled by the *Managing a beef business in the subtropics* project team.

The Department of Primary Industries and Fisheries seeks a better quality of life for all Queenslanders – a quality of life supported by innovative world-class food and fibre industries, by responsible and ecologically sustainable use of natural resources and by capable and self-reliant rural communities.

General disclaimer

Information contained in this publication is provided as general advice only. For application to specific circumstances, professional advice should be sought.

The Department of Primary Industries and Fisheries, Queensland has taken all reasonable steps to ensure that the information contained in this publication is accurate at the time of production. Readers should ensure that they make appropriate inquiries to determine whether new information is available on the particular subject matter.

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Contents

About

Managing a beef business in the subtropics

Managing a beef business in the subtropics has been designed to assist you as

- commercial beef producers
- small area landowners
- agribusiness
- consultants
- students, and
- hobby farmers

to understand the beef business, production through to markets and selling, in the subtropics.

Managing a beef business in the subtropics covers

- the beef property
- the beef product
- markets and selling
- handling and basic husbandry
- feeding and pasture management
- growth management
- managing drought
- breeding
- health

supported by more detailed information and tools in the appendices

- summary of yearly cattle management activities
- record keeping
- quality assurance systems
- terms used to describe live animals, carcases and meat
- useful calculations and worksheets

Managing a beef business in the subtropics is about having a business focus and arranges information in an easy-read format.

Throughout the book, 'Boof', our helpful hound dog sleuth, highlights more detailed information, further reading, tools and useful contacts.

The text is also supported by tables, charts, diagrams and photographs.

A glossary and useful contacts list is also supplied.

In a nutshell

Managing a beef business in the subtropics is about understanding your clients, the beef industry supply chain and how to meet specifications, stay viable and sustainable.

1

The beef property

Beef production is a major primary industry in south east Queensland, accounting for 20 per cent of primary production. The majority of cattle are crossbred, usually between *Bos indicus* (tropical or humped breeds) and *Bos taurus* (British and European breeds).

Beef production occupies more land than any other industry in the south east Queensland region. There are approximately 26,000 properties running beef cattle. Approximately 11,000 of these properties run less than 50 head. Small properties and herds contribute significantly to beef production in the region and to the rural community in general. Many producers operate as mixed enterprises, combining cash cropping with cattle production.

Family farms predominate and are generally worked without permanent employed labour. There is a trend for larger properties to be broken up into smaller holdings. Many of these smaller properties do not generate sufficient income to sustain a family and are supported by off-farm income.

As in many primary industries, income from a beef enterprise is usually seasonal and can vary dramatically from year to year. Most cattle finished on pasture are sold at the end of the pasture growing season in March to June. Market prices are variable and are influenced by climatic conditions, international politics, and supply.

Profitability of a beef business is generally low relative to non-farm enterprises and can vary from negative returns to in excess of ten per cent return on assets.

Production systems and markets

Beef producers usually gear their properties to one or more of the following production systems and markets

- breeding and growing through to finishing (targeting the domestic or export slaughter markets)
- breeding and selling as stores (weaners to two years old)
- buying stores to grow for resale as stores or to finish (again for the domestic or export slaughter markets)
- producing seedstock (bulls and cows).

Physical and biological resources

Land types

See Table 1.1 pg 5

The fertility of the country usually determines the production system. Most properties will have a number of land types, which can be broadly identified by the dominant vegetation and the soil type. Breeders and growing cattle are usually run on lower fertility country. Finishing is carried out on more fertile country. Most cattle are finished on pasture; some are finished in feedlots.

The carrying capacity of the land varies from 1 beast per hectare on high fertility improved country, decreasing to 1 beast per 8 hectares on the low fertility native pastures.

See Mineral deficiency pp 111 – 113

Some land and soil types in south east Queensland are deficient in phosphorus. Uncorrected, this will result in poor growth rates and low branding percentages.

Large areas of land are needed to run a viable beef enterprise. A property big enough to run a 300 cow breeding herd turning off 3-year-old finished steers requires a substantial investment in money and time if it is your sole income.

Table 1.1 *Major landtypes and production systems in south east Queensland*

Landtype	Carrying capacity (ha/AE[1])	Annual liveweight gain (kg/hd)	Production systems
Brigalow/ softwood scrub	2 – 4*	160 – 220*	forage cropping/grain cropping sown pasture breeding, growing, finishing
Vine scrub	1.5 – 3*	160 – 220*	cane production/horticulture sown pasture breeding, growing, finishing
Blue gum flats	3 – 5	130 – 180	native pasture sown pasture cropping breeding, growing, finishing
Silver-leafed ironbark slopes	4 – 5	120 – 160	native pasture some sown pasture some cropping breeding, growing, finishing
Narrow-leaved ironbark slopes	5 – 7	100 – 140	native pasture some sown pasture (mostly legume addition) timber breeding, growing
Spotted gum ridges	10 – 12	80 – 110	native pasture timber breeding
Box flats	4 – 6	120 – 160	native pasture some sown pasture some cropping breeding, growing, finishing
Gum-topped box slopes	6 – 15	80 – 120	native pasture breeding, growing
Wallum/coastal lowlands	2 – 4*	150 – 200*	cane production/horticulture sown pasture plus fertiliser breeding, growing, finishing

[1] AE = adult equivalent (see Glossary)

* Developed with sown pasture after clearing

Leasing can be a viable alternative to purchasing land. The advantages of leasing land include

- less capital is required to get started
- risks of under-capitalisation are reduced
- more capital is available for livestock purchase
- surplus capital can be invested off-farm.

Climate

Rainfall, amount and distribution, is the primary determinant of pasture growth. Droughts are a common feature of the climate in the region. They usually begin with the failure of or very limited spring rain. This is often followed by below average summer rain, inevitably limiting pasture growth.

In south east Queensland, average annual rainfall varies from 1,000 to 1,250 mm/yr in coastal areas to 700 mm/yr in sub-coastal areas. About 70 per cent of rain falls during October to March. Variation from year to year can be 50 per cent.

Animal growth is also seasonal, mimicking the rainfall pattern. Cattle tend to gain weight from the break in the season (September/October) in spring and into summer. Weight gain decreases as pasture matures through autumn, and most cattle maintain or lose weight during winter.

December to February is the hottest period of the year with a mean daily temperature of 29°C. Heat wave conditions, where daily maxima exceed 40°C, are not uncommon and can have a serious impact on pasture growth and cattle performance. During winter, mean daily temperatures are 15°C. Frosts occur from early May to late September. Low temperatures limit production from tropical pastures. Coastal and elevated areas are less prone to frosts.

The Southern Oscillation Index (SOI) provides an indication of the probability of rain falling in south east Queensland in the coming 3 to 6 months. The SOI is the difference in air pressure between Darwin and Tahiti

- When the SOI is consistently negative, an El Nino situation exists and the probability of many regions of eastern Australia receiving above average rainfall is low.
- When the SOI is consistently positive or rapidly rising, the probability of many areas receiving above average rainfall is high.

The effect of the SOI on rainfall varies from district to district. The computer program Rainman assesses SOI levels with reference to local long-term rainfall patterns, allowing predictions to be made for specific districts.

Pastures

See Table 5.2
pg 55

Pasture forage (in particular native pasture) is the cheapest source of nutrients for grazing livestock. The productivity of a given pasture (native or sown) is predominantly determined by rainfall and soil fertility. Generally, the fertility of different classes of country will not change; infertile country will always be that way.

Land condition influences pasture productivity by determining how efficiently rainfall is converted into grass and ultimately beef production. An indicator of land condition is the presence and productivity of preferred pasture species relative to undesirable species. Species composition is also significantly influenced by grazing management.

Cattle

See Breeds and breed societies in Useful contacts
pg 170

The two basic breed types used in the beef industry are *Bos taurus* and *Bos indicus*. *Bos taurus* can be further divided into breeds that originate from Great Britain, such as Hereford, Angus and Shorthorn, and breeds that originate from Europe, such as Charolais, Limousin and Simmental. *Bos indicus* or 'humped' cattle, such as Zebu, Sahiwal and Red Sindi, originate from the Indian sub-continent. (The Brahman is a breed developed in the United States of America by crossing several *Bos indicus* breeds. It is not an original *Bos indicus* breed.)

Breeds from Great Britain are early maturing (reach mature weight at a younger and generally lighter age than other breeds). European breeds are later maturing, achieving a heavier mature weight. All *Bos taurus* breeds are susceptible to cattle tick but perform better than *Bos indicus* breeds in milder climates on high quality feed.

Bos indicus breeds are resistant to parasites, can tolerate higher temperatures and have lower maintenance requirements than *Bos taurus* breeds. With these characteristics they are better suited to the hot, tick-infested climate of much of Queensland.

There are many crossbreeds that are now recognised as breeds in their own right. These are generally crosses between *Bos indicus* and *Bos taurus* cattle. Breeds such as Droughtmaster, Santa Gertrudis, Braford, Brangus and Charbray fall into this category.

See Breeding objectives pg 94

Selecting a breed is often a compromise between personal preference, market requirements and the breed most suited to the environment on the property. Be careful of breed 'fads' in the industry. Often a new breed or cross is seen as better than all existing breeds. This is generally not the case. Any new breed or cross should be critically evaluated against the current breed, market requirements and environmental conditions. A new business that needs to minimise risk would be best advised to breed a versatile herd that complies with a range of markets rather than an exclusive herd for niche markets that offer higher returns but are more vulnerable to market fluctuations.

When buying

- check for physical defects; this is usually done by observing the cattle in a yard or paddock
- where possible, buy from a reputable breeder; this is particularly important when buying breeding cattle
- avoid animals with bad temperament.

Cattle are bought for the following reasons

- bulls for breeding
- cows and heifers for breeding and to build up the breeding herd
- steers and females to grow on for slaughter or to resell for finishing for a slaughter market (referred to as 'stores').

Infrastructure

To manage cattle, you will require fences to contain and guide the cattle, good quality water that cattle can access daily, and well-designed and strategically placed yards for carrying out husbandry procedures, drafting and transport.

A poorly developed block with rundown infrastructure will generally be cheaper to buy than a well-developed block with well-maintained infrastructure. However it will take a lot of money and time to bring an underdeveloped property up to an acceptable state of development, and income may be low for some years.

Fences

Fences are used to direct cattle movement for best management of pastures and soil. By fencing according to land types, areas can be managed separately to prevent stock from overgrazing some areas and undergrazing others.

See Table 5.1
pg 47

Water

A reliable and adequate supply of good quality water is essential. Cattle prefer to drink once and possibly twice a day. Reducing the distance cattle need to walk to water will encourage cattle to evenly graze a paddock. Watering points should be no more than 1.5 km apart.

Yards

See Cattle yards: design, materials and construction in Recommended reading
pg 175

Yards are an integral part of any beef operation. Because of the cost involved in their construction and their long life span, considerable thought should go into planning. Take the time to look at other people's yards and note any good ideas. Carefully planned and well-constructed yards result in safe and efficient cattle work.

Yard design is important in reducing stress and bruising. Well-designed yards take advantage of the natural herding instincts of cattle, cater for their limitations in sight, and allow animals with different-sized flight zones some degree of security. There are no protrusions to cause bruising and few areas for cattle to jam.

A centrally located set of yards supported by strategically-placed smaller yards designed according to the herd size and property layout will be functional. If yards are to be used for holding cattle for more than a couple of days then the site should be 1 to 2 per cent slope, have gravely soil, shade and a reliable water supply. Take care not to over-capitalise and only build infrastructure that will provide a return on its investment.

Yards can be constructed of a range of materials including 'sawn' timber, 'split' timber, steel, concrete and polythene. Timber is especially popular where it can be supplied on the property. Timber is strong, durable and relatively easy to work. It may require treatment to prevent termite attack. Steel is long-lasting and durable but it can be noisy. Portable panels are cost-effective and provide some flexibility for altering yard design. Cast concrete and polythene panels are available but are not commonly used because of cost or handling problems.

There are many effective designs for livestock handling facilities. Even though two designs may look completely different, they will have similar features. In general, facilities will contain several yards, starting with a receiving yard followed by subsequent yards that gradually reduce in size.

Receiving yards should have a wide, double gate entrance (4 to 6 m wide), and be situated on, or near, a fence or wing. The size of the yard should provide between 2.2 and 2.4 m^2 per animal for the largest mob likely to be worked through the yards. A 'deep' yard will tend to draw the mob in. The exit from the receiving yard into the holding yards should be situated on, or near, a fence and should preferably taper. As only moderate pressure will be applied to stock in the receiving yard, it can be constructed of relatively light material.

Holding yards should be of slightly heavier construction than receiving yards. The holding yards are used to hold cattle pre- or post-drafting and should be positioned close to the receiving and drafting yards. These yards should provide between 2.0 and 2.2 m^2 per head. In smaller facilities the receiving yard often doubles as the holding yard.

Forcing yards are used to move cattle into the drafting race and loading facilities and should be of solid construction. Corners should be 90^0 minimum (preferably 135^0) to prevent stock bunching in the corners. Curved yards and yards that

taper toward a clearly defined exit work most efficiently. Forcing yards should be no wider than 6 m.

Cattle can be drafted in a *drafting yard*, *pound* or *drafting race*. A set of yards that incorporates several types of drafting facilities provides the operator with a wide range of drafting options.

A *drafting yard* is similar in shape to a forcing yard, but is generally smaller. A drafting yard should be no more than 6 m wide and should be between 9 and 12 m long.

A drafting yard works well in conjunction with a *pound*, especially when two or more operators are working. Cattle can be drafted into the pound and then released through the appropriate gate, or alternatively, a small mob can be put into the pound and then drafted out. Drafting into a pound decreases the chances of a miss-draft.

A *pound* should have a minimum of 6 sides and preferably 8 or more, so it is more or less circular. The size of the pound depends on personal preference, but should be small enough to encourage cattle to look for a way out. A diameter of 5.5 m is adequate where cattle are drafted into the pound. Gates should be between 1.5 m and 2.2 m wide and provide some sort of visual barrier. The drafting gate into the pound should open outwards, back into the drafting yard and pound gates should open inwards and be swung in the same direction, i.e. all clockwise or all anti-clockwise.

An alternative to drafting in a pound is to use a *drafting race*. Cattle are drafted out of the race through a series of side gates that open into the race. Cattle flow can be maintained if the lead-up race is longer than 8 m. Gates can be operated from overhead or from the side of the race. The use of a second operator or remote control gate opening increases drafting speed.

Races are used for 'bulk' husbandry operations (drenching, cross-branding, vaccinating, etc.) and provide a lead up to a vet crush, scales, or plunge dip. The internal width of the race should be between 650 mm and 730 mm with a top rail height of 1.5 to 2.0 m. Most races range from 6 to 12 m in length. Cattle tend to flow better in a curved race. The inside radius of the race should be greater than 4.5 m. Cattle flow into a curved race is improved where the first panel or two of the race is straight.

Cattle yards should have a *vet crush* where individual animals can be restrained for husbandry and veterinary procedures. There are many commercially available vet crushes that can easily be incorporated into existing or new yards.

Management

Managing a cattle business is a continuous process of planning, implementing, monitoring and reviewing to achieve the goals for each component of the farm business.

Operating sustainably

Managing a beef business is often a matter of reaching a compromise between short term gain and long term sustainability.

A farm is viable in the short term if it services its borrowings and meets the living costs of the farm family. However to be viable in the long term, it needs to achieve this plus

- generate sufficient funds to maintain the farm's productive assets
- provide funds for investment which increases long term productivity, and
- demonstrate ecological sustainability.

If the enterprise has a lot of debt, the pressure is to push the production of the property to its maximum to pay off the debt. This could be at the expense of pasture, thus jeopardising long-term sustainability and profitability.

The natural resource base is the hub of the farm and it needs to be preserved and enhanced. Sustainable resource use must be considered in the short term (1 to 2 years), medium term (5 to 10 years) and long term (10 to 50 years). Addressing the 'triple bottom line' means minimising negative environmental, economic and social impacts, both on-farm and in the wider environment off-farm.

Consumer awareness of environmental issues is reflected in the increasing demand for land to be managed to produce food sustainably. This awareness affects beef producers as the market place changes, as demand for unsustainably produced food decreases and niche markets, such as for organically produced beef, develop. In time, consumer awareness often translates into legislation, providing for sustainable land management.

Self and staff management

The success of a business is often significantly affected by the ability of managers to manage themselves and their staff. Self-management includes time management, stress management, negotiation, plus succession and retirement planning. Staff management includes staff selection, staff training, communication, staff motivation, leadership and conflict management.

The goals, attitudes, management skills and experience of managers and staff (both family and employees) operating the business are the most critical factors determining the success of a beef enterprise. High-performing managers are generally resilient, positive, proactive, open to new ideas, independent, and exercise control.

Skills required in a beef enterprise take time to develop and include technical skills, business skills and people management skills. Where skills are lacking in certain areas, staff training or contractors or consultants can be employed to fill the gaps.

Information management – record keeping

Information, essential for all aspects of the business, is particularly vital to managing the production and sale of cattle. Effective decision-making requires obtaining both internal information (e.g. pregnancy rates, gross margins, grazing pressure) and external information (e.g. market intelligence, climate forecasts).

See Record keeping
pp 127 – 134

The decisions you want or need to make about managing your beef business will determine the type and depth of information you need to record. After deciding on your goals, cattle type and determining your property's production capacity, you will have selected one or more markets to target. Keeping appropriate records will help you monitor and evaluate your progress towards your goals and target markets.

There are many systems and approaches to keeping and analysing records, both manual (paper-based) and electronic. Electronic options include developing your own spreadsheets or using packaged software programs. Advantages of electronic recording and analysis systems include automation and easy access to records for decision-making and taxation.

Business planning and financial control

A well-defined farm mission statement and business goals provide clear targets toward which planning can be directed. The farm's financial performance is affected by all aspects of the property's operations, including the enterprise combination, target markets, technology adopted, labour management, natural resource management and risk management. However business goals are not the only goals. Providing a safe and happy work environment, minimising risk, providing employment for family members, educating children, establishing a base for retirement, and estate and succession planning are non-profit goals common to many farm businesses.

Farm planning and control should

- satisfy the need of the bank manager to manage lent funds
- provide records for the accountant to analyse, in order to prepare satisfactory tax returns
- provide the business manager with sufficient records to monitor the ongoing financial performance of the enterprise.

Cashflow management is critical in cattle businesses as income is usually spread unevenly throughout the year and with large swings in income and expenses from month to month. However a business assessed on cashflow alone might produce a cash surplus but run down assets, degrading long-term profitability. Calculating a management profit and loss (which differs from taxation profit and loss) will enable historic gross margins to be calculated and limited resources allocated to the most appropriate enterprises.

Enterprise management

See The beef product pp 13 – 24, Yards pp 6 – 7, Handling and basic husbandry pp 38 – 42, Feeding and pasture management pp 44 – 66, Seasonal deficiencies and supplementary feeding pp 73 – 82

This relates to the management of the various farm enterprises (e.g. breeding, growing, fattening and trading cattle) and the actions that can be taken to improve farm profitability and productivity. The technical skills required include

- animal handling and husbandry
- vehicle and machinery operation and maintenance
- infrastructure construction and maintenance
- supplementary feeding techniques.

Marketing

This refers to strategies for identifying market demand and ensuring that production is consistent with what the market requires. The manager must be attuned to market trends, and be able to compare the potential premiums for new beef products versus the costs of meeting those markets.

You can choose to increase the sophistication of your cattle enterprise and seek markets that reward features of your product or production system. A critical volume of supply may be needed to secure some value-based premiums. Examples of production systems where value based marketing is working include niche markets such as organic beef, Meat Standards Australia (MSA), hide payment, and payment for saleable meat yield. Steps to succeeding in niche markets include conducting research, building relationships and supply chains, ensuring integrity of inputs throughout the supply chain, considering distribution strategies, ensuring food safety and quality assurance systems, and addressing product differentiation and branding.

See MSA pp 127 – 134

See Meat and Livestock Australia in Useful contacts pg 172

Alliances are a means of bringing producers together to harness their skills and knowledge and work together to improve supply, quality and consistency of their beef production businesses. A supply chain alliance can be between producers at the same point in the supply chain (horizontal alliances) or between producers and service providers along the supply chain (vertical alliances), or a combination of both.

Specialist marketing services are emerging, whereby consultants offer advice or can be employed for the following tasks: live cattle assessment, sale by description, developing market contracts, group marketing, matching consignments to processor requirements to minimise discounting, and developing strategic marketing plans.

Risk management

Most farm plans are made in an environment of considerable uncertainty. Risk management involves identifying and managing risks for all aspects of the business. This may extend from personal threats such as death and divorce to property issues such as drought, markets and public liability. Your attitude toward risk and change will determine how you manage internal and external threats to the business. It will also determine how you view, recognise and exploit opportunities. Below is a list of risks that farmers often face.

Natural resource risks	Salinity Soil erosion Loss of vegetation and shelter Loss of wildlife resulting from predators and loss of habitat Invasion of vermin and weeds Loss of water quality in farm water storages
Financial risks	Interest rate rises Exchange rate increases causing drop in export prices Equity drops Profitability drops Taxation increases Price crashes Loss of equity if natural resources are not managed well
Production risks	Production falls, due to drought, flood, fire, disease, parasites and management Production cost increases Production quality falls
Marketing risks	Price falls, due to oversupply, change in world market access, rise in A$ or drop in demand Consumer preferences change Loss of market share, either domestically or internationally
Self and staff risks	Ill health Accident Loss of key personnel Marriage breakdown Staff conflict/lack of motivation Insufficient funds for retirement Conflict and resentment due to poor succession planning Inability to make appropriate decisions during a time of stress

Source: Blackburn and Ashby (1995)

Insurance is an important strategy for managing risk. Categories of insurance include

- formal insurance covering production, equipment, health of key staff, salary continuation, and public liability risks purchased through insurance companies
- price insurance by locking-in prices using futures markets, options, and fixed price contracts
- production strategies such as establishing fodder reserves, irrigation and selecting stocking rates that account for drought
- diversification, such as having a variety of enterprises, a variety of sites, off-farm sources of income, and flexibility.

The beef product

2

See Safe Food Queensland and SAFEMEAT in Useful contacts pg 173

Food quality and safety are of utmost importance to our domestic and international beef customers. Many safeguards are in place to protect public health and build consumer confidence in our food products in both domestic and export markets.

Animal identification is useful for establishing ownership of stock, but it is also essential for establishing traceback to the property of origin in the event that disease or chemical residue is detected at sale or slaughter. Other requirements affecting beef producers' activities both on- and off-property are designed to protect the producers themselves, other producers, and long-term market access. In particular, the use of agricultural and veterinary chemicals must be closely managed, and many products specify periods of time which must elapse between using the chemical and presenting the animal for slaughter.

See Minimising chemical residues pp 17– 21

As well, your approach to managing your beef business and handling your cattle can have a considerable impact on the returns you receive for your product. A number of quality assurance systems are available to beef producers; some are voluntary, and others are required for access to certain markets. Quality assurance means deciding on and committing to best practice procedures. For example, well-handled, unstressed cattle in the best possible condition produce the best possible meat product. You can also affect the post-slaughter management of your product by choosing meat works that offer best practice post-slaughter management.

See Quality assurance pp 16 – 17, Quality assurance systems pp 135 – 140

Registrations and regulations

See your local stock inspector or DPI&F Call Centre 13 25 23

All owners of livestock should be aware of the obligations of owning livestock under the *Stock Act (1915)* and *Brands Act (1915)*. These requirements have been put in place to help establish ownership of cattle and to manage diseases and chemical residues that may pose a problem to human health and meat sales.

See Identifying cattle pp 127 – 128

Cattle are identified using brands, earmarks, tattoos, tail tags, ear tags, and electronic identification devices for the following purposes:

- establishing ownership
- identifying individual cattle for legal, management or breeding purposes
- tracing cattle and beef products from paddock to plate.

Registering a property

Stockowners who have 11 or more head of cattle are required to register their property with the DPI&F. Having properties registered means movements can be traced in the event of a chemical residue or disease being found on the property or in an animal after it has left the property.

The property registration number is put on all property tail and ear tags and is quoted on the National Vendor Declaration (Cattle) form when cattle from the property are sold and waybills when cattle are moved.

Property numbers have eight components, identifying the number of the property within its state and region. For example: QEFR0123

Q	E	FR	0123
Queensland	Check Digit	Fitzroy Shire	Actual Number

Establishing ownership and identifying individual cattle

A registered Horse and Cattle brand applied to an animal establishes ownership of cattle and horses in Queensland. Branding cattle is not compulsory, but it is advisable to avoid disputes over ownership of straying animals. Branding is compulsory for animals 100 kg liveweight and over before they can be sold.

See your local Stock Inspector or DPI&F Call Centre 13 25 23

Brands must be registered with the Department of Primary Industries Registrar of Brands. The basis of the branding system is a three-piece brand (e.g. 2AB). A symbol brand (e.g. Y.) may also be used but must be registered in conjunction with a three-piece brand.

Earmarks are not compulsory and they do not legally denote ownership. However if earmarks are to be used, they must be registered in conjunction with a three-piece brand. Earmarks are used mainly as a convenient way to recognise stock, mostly on larger holdings.

Owners of registered brands and registered earmarks must submit an annual Brands Return form. Brands may be cancelled if these forms are not submitted for three years in a row.

Registered stud cattle in various breed societies may be legally identified by ear tattoos.

Moving cattle

Cattle about to be moved to an abattoir or saleyard must be tagged before they are moved unless they qualify for an exemption, and must be accompanied by the appropriate waybill and/or stock travel permit.

Tail tags

Cattle from holdings without a property registration number (i.e. running ten or less head) may acquire District Tail Tags from their local DPI&F Stock Office.

Cattle being moved are exempt from tagging only when

- store cattle are being moved directly from property to property
- stock are being moved directly to a special stud stock sale
- cattle purchased, travelled and resold within 40 days have the original tags still in place
- a line of 20 head or more are consigned direct to slaughter (e.g. 22 bullocks in the one truck are exempt but a mixed load of 12 cows and 10 bullocks is not exempt).

There are five types of tail tags

See Hormone growth promotants pp 79 – 80

See AUS-MEAT in Useful contacts pg 169, See Quality assurance systems pp 137 – 138

Contact your local stock inspector or DPI&F Call Centre 13 25 23

- white tail tags are for general use and must be used for cattle treated with hormone growth promotants (HGPs) or when the HGP status of the cattle is unknown
- pink tail tags may be used for cattle that have NOT been treated with HGPs, and whose owners wish to sell them as HGP-free
- red district tail tags are issued to owners of less than 11 head of cattle for movement to sale or slaughter (owners of cattle bearing district tail tags consigned to export abattoirs may be required to pay a residue testing fee)
- purple tail tags are used to identify grain-fed cattle from AUS-MEAT registered feedlots
- lime green tail tags are used to identify cattle that are eligible for the EU market.

Tail tag order forms are available from DPI&F offices.

See LPA and NLIS on pp ??

See Health pp 122, 124

Waybills and travel permits

The requirements for waybills and permits varies depending on the origin and destination of the cattle. These requirements change from time to time. Check with your local stock inspector for the most up-to-date requirements.

Suspect cattle

Animals with health problems or injuries, such as lumpy jaw, cancer eye, conditions of lameness, fever and wounds, are considered 'suspect' and are ineligible for sale through saleyards. These cattle must be consigned for sale direct to an abattoir for slaughter, and the appropriate travel permit must be obtained from a Stock Inspector.

Selling cattle

There are some legal requirements and some recommended voluntary practices for selling cattle in Queensland

- all cattle 100 kg liveweight or more must be branded before they can be sold
- all cattle being sent to market must be identified by a tail tag bearing the registered property number, unless exempt (see above)
- all cattle for the EU market must be identified with devices approved by the National Livestock Identification System (NLIS)
- all cattle sold in Australia should be accompanied by a National Vendor Declaration (NVD) form
- Livestock Transaction Levies must be paid on the sale of livestock (cattle, sheep and goats) and also the transfer of livestock between the production and processing stages.

National Vendor Declarations

This is a voluntary scheme, but most processors and feedlots will not purchase cattle without a National Vendor Declaration (Cattle) form (NVD). The information recorded on an NVD is underpinned by State legislation, which means vendors completing an NVD become accountable under law for false or misleading statements. It is advisable to keep a cattle management diary to be able to complete NVDs accurately.

NVDs describe the history of the cattle being sold, providing a practical means of identifying

- animals with exposure to residues
- HGP-treated livestock and untreated livestock
- management history, including length of ownership, health treatments, supplementary feeding and grazing history
- vendor's correct trading name and registered property number (property identification code or PIC).

The NVD format is constantly updated as new industry issues emerge. Always ensure you have the current version and explanatory notes, available from local stock and station agents.

Livestock Transaction Levy

The Commonwealth Government, through Meat and Livestock Australia, administers the collection and allocation of the Livestock Transaction Levy and contributes matching funds. The monies raised are put back into the industry to assist research and development, disease control and monitoring, and promotional activities.

The cattle transaction levy is currently $3.50 per head, except for bobby calves which are $0.90 per head.

When you sell livestock through an **agent** or **processor**, the agent or processor is responsible for deducting the transaction levy from the sale and then passing the transaction levy on to the Levies and Revenue Service on a monthly basis. The levy deduction is usually marked on the sale receipt producers receive from your agent or processor after the sale. This also applies to producers whose business is buying and finishing or dealing in cattle.

When you sell livestock to **another producer** whose main business is breeding rather than buying or to a hobby farmer, you (the person selling the livestock) are responsible for deducting the transaction levy from the sale. In such a case, the seller must lodge a return to the Levies and Revenue Service for the financial year on an annual basis. Lodgement forms and the necessary recording requirements can be obtained from the Levies and Revenue Service. This includes livestock sold with a property on a producer-to-producer basis where a solicitor or settlement agent, but not a buying or selling agent, is party to the sale. If you are selling or buying a property with livestock, consult your nearest Levies and Revenue Service office of Meat and Livestock Australia.

See Livestock Transaction Levy in Useful contacts pg 178

When the transaction levy is paid late, a penalty accrues on outstanding amounts at a compounding rate of two per cent per month, calculated from the due date to the actual date of payment. Other penalties may be imposed by a court for failure to submit a return, submitting a return that is false or misleading in a material particular, failure to maintain proper records, or obstructing an authorised person undertaking investigations.

Quality assurance

Some beef markets specify a recognised quality assurance (QA) system must be in place, while other markets offer a premium for cattle that have been managed under an audited QA system.

QA means planning, documenting and carrying out the systematic actions necessary to be adequately confident that the resulting product or service will satisfy quality requirements. An effective QA system has clearly defined and documented auditable plans, procedures, responsibilities and records.

Advantages of QA include

- meeting customer demand for assurance of food safety and meat quality
- increased customer confidence
- increased markets, marketability and competitive advantage
- improved business and on-property management
- ability to trade under nationally and internationally recognised standards
- having records in case litigation arises.

Disadvantages of QA are the time and cost of implementing a program and keeping the necessary records.

See Quality assurance systems pp 135 – 140

The most common QA system in the Australian beef industry is CATTLECARE. Other systems exist that offer more stringent or flexible programs

- Livestock Production Assurance (LPA)
- CATTLECARE
- Meat Standards Australia (MSA)

- National Feedlot Accreditation Scheme (NFAS)
- National Saleyards Quality Assurance program (NSQA)
- Livestock Export Accreditation Programme (LEAP)
- EU accreditation
- Organic
- Environmental Management Systems (EMS)
- Hazard Analysis Critical Control Point (HACCP).

Beef producers also growing grain and/or running sheep may also be involved in

- Graincare
- Flockcare
- Livestock Production Accreditation Scheme (LPAS).

Minimising chemical residues

Chemical residues are small amounts of elements or chemicals, such as heavy metals, organochlorines, and veterinary or agricultural chemicals or their breakdown products, which are present in or on produce either through natural circumstances or as a consequence of agricultural or industrial activities. Minimising chemical residues is important for

- food safety (human health)
- animal health and welfare (cattle)
- environmental protection
- domestic and international market access, maintenance and expansion.

Withholding periods and Export Slaughter Intervals

All agricultural and veterinary chemicals are registered through the Australian Pesticides and Veterinary Medicines Authority (APVMA) for use in Australia, and have specific withholding periods (WHPs). They may also have specific Export Slaughter Intervals (ESIs). WHPs are the minimum time that must elapse between the last chemical treatment and the slaughter of the treated animal for human consumption or harvest for use. ESIs are the minimum intervals required from the last chemical treatment to slaughter for meat being exported overseas. ESIs are necessary for chemicals where the Australian and overseas Maximum Residue Limits (MRLs) differ.

Maximum residue limits

Maximum residue limits (MRLs) are the maximum concentrations of a residue of an agricultural or veterinary chemical recognised as acceptable or legally permissible in or on food, animal feed, or an agricultural commodity.

Residues above the MRL indicate that good agricultural practice has not been observed, for example, that chemicals were applied at the wrong rate or that there was an insufficient withholding period before marketing. Residues above MRLs in a food usually do not represent any immediate risk to a consumer. MRLs are usually at well below the Acceptable Daily Intake (ADI), so a residue would need to be many times greater than the MRL before the ADI is approached. However, a residue above the MRL could mean failure to meet stringent market specifications and consequent loss of access to export markets.

Minimising chemical residues on-property

Residues above acceptable levels are caused by

- failure to observe withholding periods (WHPs) or Export Slaughter Intervals (ESIs)
- off-label or improper use of chemicals
- contaminated feed
- injection site residues
- treated grain
- crop by-products
- contaminated storage facilities
- short interval dipping
- using market cattle as dip-stirrers
- contaminated sites
- off-site contamination, e.g. spray drift, water, orchards, etc.

To minimise chemical residues on your property

- Only use those chemical products that are registered for the crop or stock you are treating and use them only for their registered purpose.
- Carefully follow the instructions on the label.
- Adhere to the approved withholding periods so that any residues will be down to acceptable levels before your produce reaches the consumer.
- Avoid spray drift onto other crops, pastures and areas where livestock are likely to feed, environmental areas and residential areas.
- Clean spraying equipment thoroughly before and after use to prevent it from harbouring unacceptable chemical residues.
- Keep agricultural chemicals thoroughly mixed while applying. Inadequate mixing will mean some parts of the crop or grain may receive too much active ingredient for safety or too little for adequate pest control.
- Have separate storage areas for fodder, planting seed and agricultural chemicals to reduce the chance of fodder being accidentally contaminated.
- Never feed any seed that has been treated with fungicide to any livestock, including poultry. Seed treatment chemicals are coloured by law to make it easier to distinguish treated seed or grain that has been contaminated with such seed.
- Do not use second-hand packs (which may have held treated seed) to store livestock feed.
- Before grazing land that has previously grown sugar cane, cotton, bananas, apples, pears and cut flowers, test for persistent organochlorines. Prevent soil movement from such areas onto your grazing lands.
- Do not use organochlorine insecticides for the control of insects or rodents in feed stores, haystacks, piggeries, poultry sheds, calf pens or dairies.
- Keep records of agricultural and veterinary chemical use on your property.

To minimise the risks of buying feed that is contaminated with pesticide or other chemical residues

- When negotiating the purchase of stock feed direct from the grower, request a commodity vendor declaration as a condition of purchase. Inspect the vendor declaration before you finalise the deal and make sure the details are complete.

- Make sure you inform the seller of how you intend to use the feed and the type of animal it will be fed to. Stress the importance of your knowing the chemical history of the stock feeds you buy.
- Check the label or invoice to ensure you are purchasing an appropriate product. Stock feed bought from manufacturers must have a label or invoice that clearly states the intended purpose of the stock feed.
- Keep clear records of the above.
- Store a sample of the stock feed on farm so if problems do occur further testing can be done.
- Keep a record that includes details of stock feed, feeding dates, manner of feeding, amount fed and the paddocks in which the stock were fed.
- DO NOT buy or use unusual feeds unless you are satisfied they do not present a residue risk.

Minimising chemical residues in the Australian beef industry

In the Australian beef industry, state and federal governments are working to minimise chemical residues in beef by

See ChemCert Training Queensland Inc in Useful contacts pg 177

- promoting safe, effective chemical use on-farm, e.g. through courses and training such as ChemCert Training Queensland Inc.
- National Vendor Declarations (NVDs) and Fodder Vendor Declarations
- promoting the use of quality assurance programs, e.g. LPA, CATTLECARE
- the National Organochlorine Residue Management (NORM) Program
- strict, reliable chemical registration (APVMA)

See ChemClear® in Useful contacts pg 177

- providing chemical (material and container) disposal options, such as ChemClear®
- monitoring and testing beef products, developing quality management systems to reduce risk, and regulating e.g. Australian Quarantine and Inspection Service (AQIS), DPI&F's Animal and Plant Health Service (APHS), Safe Food Queensland, National Residue Survey (NRS), and SAFEMEAT.

Organochlorine pesticides (OCP) and the NORM program

The objective of the NORM program is to minimise the risk of cattle with organochlorine residues above the Australian Maximum Residue Limit (MRL) being slaughtered for human consumption.

The term *organochlorine* refers to a wide range of organic chemicals which contain chlorine and sometimes other elements. Since organochlorine pesticides (OCPs) were introduced into Australia in the mid-1940s, they have been used in many commercial products to protect crops, livestock, buildings and households from the damaging effects of insects. Most of these chemicals are no longer in use. However long after their original use OCPs persist in the environment, where they degrade slowly and accumulate in the food chain.

In the past, OCP residues in primary produce have resulted in Australian beef exports being rejected. Grain, fruit products and fibres are also vulnerable.

Under the NORM Program, all cattle properties are allocated an organochlorine chemical (OC) status according to their residue history (Table 2.1). Slaughtered cattle are tested for organochlorines either randomly or according to the property of origin's OC status.

Table 2.1 *NORM Program property status abattoir criteria*

	Status	Criteria
C	Clear Property/Minimal or Nil Risk	NO TARGETED RESIDUE TESTING REQUIRED. Only subject to random testing under the National Residue Survey (NRS).
R	Resolved Property	NO TARGETED RESIDUE TESTING REQUIRED. Test as for Clear properties above.
T1	Low Risk Property	1:10 LOT TESTING AND RELEASE ALL. Test one animal/carcase from every tenth lot and immediately release the whole lot on testing including the test carcase and carcase parts.
T2	Medium Risk Property	1:5 LOT TESTING, HOLD SENTINEL ANIMAL AND RELEASE COMPANIONS. Test one animal from every fifth lot. Hold the test animal/carcase and associated carcase parts, and release the companion animals/carcases.
T3	No known history or High Risk Property	100% LOT TEST AND HOLD ALL. Test one sentinel animal from every lot, holding the test carcase and carcase parts and hold the companion animals of the lot pending results. If result of lot test is >0.75 MRL – each companion animal in the lot will be tested on a test-and-hold basis at the vendor's expense, or may be returned to the property or origin subject to the issue of a Travel Permit by a Meat and Livestock Inspector.
T4	High Risk Property	100% LOT TEST AND HOLD ALL. Test and hold as for T3 'high risk', but all testing and holding will be at the vendor's expense including sentinel testing, and companion animal testing as per T3 'high risk', i.e. if the result of the lot test is >0.75 MRL
A (T4)	Quarantined Property	As per T4 above
M	Monitor (refer to as 'M' Monitor List and not 'M' status)	100% LOT TESTING AND RELEASE ALL. Test one animal/carcase from every lot and immediately release the whole lot on testing including the test carcase and carcase parts.
F	Feedlot: High Risk	100% LOT TEST AND HOLD ALL FEEDLOT CATTLE ONLY. Test and hold as for T3 'high risk' but only applies to feedlot cattle from listed properties. Grass-fed cattle are not to be tested. Companion animal or carcase testing as per T3 'high risk'.

For further information and updates on the NORM program, phone the DPI Call Centre on 13 25 23

Properties with a 'T' organochlorine status are identified on the Australian Quarantine and Inspection Service (AQIS) Targeted Testing List (TTL). This database is accessed by meatworks and selling agents and indicates the tests that must be carried out when cattle are consigned to slaughter. To find out the status of your property, contact your local Stock Inspector or Veterinary Officer.

Australian Pesticides and Veterinarian Medicines Authority (APVMA)

See APVMA in Useful contacts pg 176

The Australian Pesticides and Veterinary Medicines Authority (APVMA) evaluates, registers and regulates agricultural and veterinary (agvet) chemicals in Australia. Before an agricultural or veterinary chemical product can enter the Australian market, it must go through the APVMA's rigorous assessment process to ensure it meets high standards of safety and effectiveness. Any changes to a product that is already on the market must be referred to the APVMA. The APVMA also reviews products that have been on the market for many years to ensure they meet contemporary standards.

Agricultural chemical products include any substances or organisms used to

- destroy, stupefy, repel, inhibit or prevent pests
- destroy a plant or modify its physiology
- modify the effect of another agricultural chemical product
- attract a pest for the purpose of destroying it.

This encompasses most herbicides, insecticides and fungicides used in agriculture. Dairy cleansers for on-farm use, crop markers, insect repellents for use on humans, swimming pool disinfectants and algaecides, and household and home garden products for pest and weed control have been deemed to be agricultural chemical products. Some pest traps and barriers using chemical attractants also require registration. Fertilisers are not considered agricultural chemical products unless they modify the physiology of a plant.

Veterinary chemical products include any substances administered or applied to animals for

- preventing, diagnosing, curing or alleviating a disease, condition or pest infestation
- curing or alleviating an injury
- modifying the animal's physiology
- modifying the effect of another veterinary chemical product.

Veterinary chemical products also include vitamins, minerals and additives if they are used for any of the purposes mentioned above, medicated blocks and licks, enzymes for animals, stock food non-active constituents, direct-fed microbial products, and sheep branding substances. Non-medicated licks and blocks, stock foods and stock food additives must be registered if they carry claims about therapeutic effect, performance or productivity enhancement.

Minimising losses due to handling and transport

Good handling and transport of cattle will maximise your returns. Well-handled cattle are quieter than poorly handled cattle. Wild or 'stirry' cattle increase production costs by

- increasing mustering costs
- increasing the risk of injury to handlers
- damaging yards and fences.

Animals under stress often perform poorly, with reduced liveweight gains and poor reproductive performance.

Livestock death

Accidental deaths will often occur, but the incident rate can be reduced through good handling and transport. Examples of accidental death attributed in some part to poor handling include trampling and plunge dip drowning. Metabolic disorders such as transit tetany can be avoided with careful management before transport and good handling during transport. Animals that are exhausted to the point of collapse can die from overheating, especially in hot weather.

Reduced livestock value

Reduced livestock value can occur either at the saleyards or at the meatworks

Saleyard losses	Meatworks losses
liveweight loss	carcase weight loss
bidding prejudice (mostly against wild cattle)	reduced meat quality
	bruising
	presence of scarring and cysts

Weight loss

Cattle loose weight both before and after slaughter. Carcase weight is affected more by the length of time that cattle are without feed or water than by the distance travelled or method of sale (saleyard versus direct to abattoir).

Gut fill can account for 10 to 20 per cent of liveweight (Table 2.2). Fluctuation in gut fill is the major influence on weight loss. Gut fill depends on diet and when the cattle last ate or drank.

Table 2.2 *Estimated liveweight losses over 72 hours from cattle of various initial*

Hours without feed and water	Estimated liveweight loss (kg, %)		
	200	400	600
12	8 (4%)	16 (4%)	24 (4%)
24	12 (6%)	25 (6.2%)	38 (6.3%)
48	19 (9.5%)	40 (10%)	60 (10%)
72	24 (12%)	48 (12%)	72 (12%)

Bruising of the carcase is the direct result of poor handling and transport injuries.

Fasted animals can lose carcase weight due to dehydration and tissue breakdown (mostly to supply energy). The longer cattle are without water, the more their tissues dehydrate. Cattle re-hydrate quickly when offered water. There is little carcase weight loss due to tissue breakdown in the first few days that cattle are off feed.

Cattle off grass lose weight at a faster rate than cattle off grain (feedlot).

Bruising, injuries and scarring

At the meatworks, bruised meat will be trimmed from the carcase, reducing the carcase weight and value. Bruising may cause a carcase to be downgraded from a high value market (such as EU) to a lower value market (such as US manufacturing).

Bruising results from

- poor handling in yards (too many cattle in a yard or race)
- excessive use of goads
- poor yard or crate design
- poor transport (cattle too tight or trampled)
- horned cattle.

Scarring, abscesses and cysts can reduce carcase value in the same way as bruising. In extreme cases, the entire carcase may be rejected. Scarring can occur as a result of injuries, dog bites or husbandry procedures such as spaying. Abscesses are localised chronic infections at the site of old wounds; they can also be caused by needle injections. Cysts are similar to abscesses, but are generally enclosed in fibrous connective tissue; intramuscular and subcutaneous injections occasionally induce cysts to form.

See Australian model codes of practice for the welfare of animals - contacts in Recommended reading pg 179

Reduced meat quality

See Describing meat pp 150 – 152

Pre-slaughter stress directly affects carcase quality attributes such as tenderness, colour and keeping quality. Pre-slaughter stress reduces muscle glycogen. Glycogen is the stored form of glucose in muscle and is a readily available source of energy. Following death, anaerobic metabolism of glycogen produces lactic acid, which lowers the pH of the meat. Optimal pH for meat is

about 5.6 and at this pH it should be a bright cherry red, tender and have good flavour and keeping qualities.

When glycogen is reduced due to stress, the pH of the meat fails to fall to the desired levels. As a result the meat will be tough and dark cutting. Dark cutting meat is not suitable for ageing and is susceptible to spoilage.

The most common financial impact of reduced meat quality is carcase downgrading (e.g. from EU to US manufacturing).

Optimising post-slaughter quality

Producers can affect the post-slaughter management of their product by choosing meat works that offer best practice post-slaughter management such as tender-stretching, electrical stimulation, aging and vacuum packaging.

Cold shortening occurs when the temperature of the carcase is lowered too quickly before the rigor mortis process has completed. When the temperature drops to below 10°C before the pH is below 6.0, the muscles are still physiologically active and shiver in an attempt to maintain local temperature. This results in tougher meat.

Cold shortening can be prevented by processors by

- maintaining the rate of cooling in line with the rate at which rigor mortis is occurring
- physically restraining the carcase as it goes into rigor mortis, such as by tender-stretching
- accelerating glycogen use to complete rigor mortis before the muscle is subjected to rapid chilling, such as by using electrical stimulation.

Cold shortening is usually only a problem in domestic market carcases, which tend to be leaner. The lack of subcutaneous fat means these carcases cool to the required temperature at a faster rate than the heavier more mature export carcases, which normally have a higher amount of subcutaneous fat.

Tender-stretching

Tender-stretched carcases are hung from the pelvis, whereas traditionally carcases are hung by the Achilles tendon (Figure 2.1). Tender-stretching causes the hind leg to hang at 90 degrees to the body so a greater number of muscles are stretched and enter rigor mortis in an extended state.

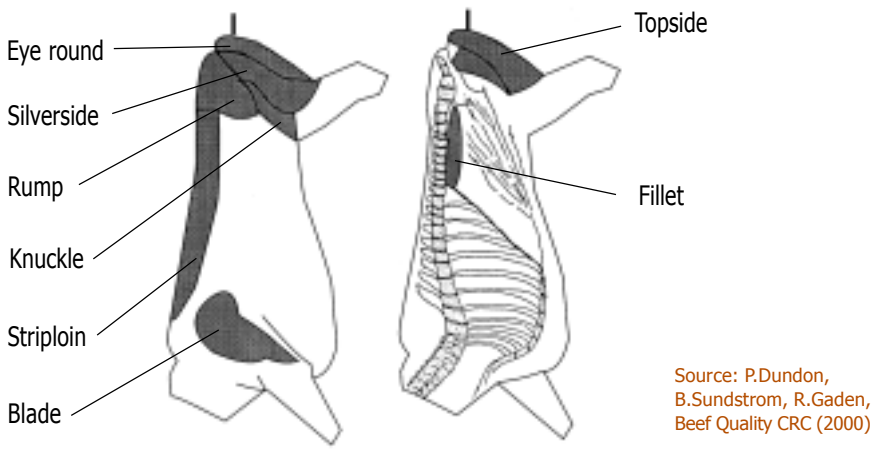


Figure 2.1 *Muscles affected by Tenderstretch hanging*

Tender-stretching improves the tenderness of the following cuts: rump, thick flank, topside, silverside, striploin and cube roll. Tender-stretching has a slightly negative affect on the tenderloin tenderness.

Electrical stimulation

Correctly applied, electrical stimulation prevents cold shortening by increasing the rate of rigor mortis so that the final pH is reached before the carcase temperature drops to 10°C. An electrical shock is applied to the carcase, causing the muscles to contract and accelerating glycolysis so that lactic acid accumulates in 3 hours rather than 20 hours, which is the normal rate of pH decline.

Electrical stimulation can be applied as a low voltage (100v) within 10 minutes of stunning or as a high voltage (500–1,000v) within one hour of stunning.

Vacuum packaging

This refers to the cuts of meat being enclosed in a special type of plastic film. The process provides an airtight, moisture-proof package that protects the meat from oxidation, dehydration and evaporation during storage. The oxygen-free environment prevents bacterial growth and provides better yields by preventing weight loss from shrinkage and losses to trimming from freezer-burn. Vacuum packaged meat can be stored between 0 and – 1.5°C and at 85 per cent humidity for up to 12 weeks.

Ageing

Ageing is the process where meat is kept in a chilled condition for a period of time. Storage temperature affects the rate at which muscles age. Higher temperatures will age meat faster but they will also allow bacterial spoilage to occur. Meat is normally aged at temperatures between 0 to 4°C. At these temperatures most of the benefits from aging will be achieved within 14 days.

Markets and selling

3

Producers can select markets and selling systems with varying degrees of sophistication to suit their personal preference and business structure. The difference between the cost of production per kilogram and price received per kilogram determines the net price received, so a more sophisticated selling system or niche market, which offers premiums but requires more time or financial resources, may not be more profitable than a simple selling system or lower priced markets.

This chapter is intended as a guide to markets and selling. Table 3.1 (page 31) gives an indication of the liveweight, carcase weight and fat depths for a range of slaughter markets. Detailed specifications should be sought from prospective buyers as these may vary from one buyer to another.

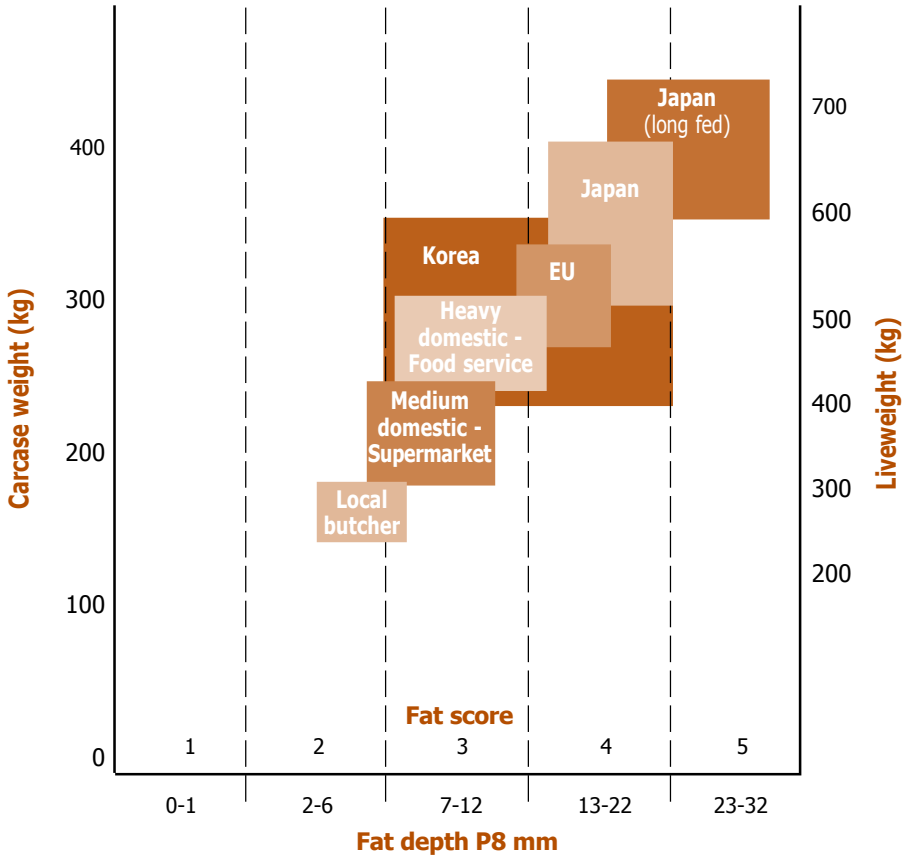


Figure 3.1 *Target market specifications for slaughter cattle*
Note: US manufacturing markets accept all lean carcases

See AUS-MEAT in Useful contacts pg 169

Specifications and price grids

Within all markets there are different restrictions and degrees of flexibility in any given set of specifications. Table 3.3 (page 32–33) outlines some of Australia's major markets and their respective specifications.

See Terms used to describe live animals, carcases and meat pp 141 – 152

For example, the main specifications for slaughter cattle are dentition, sex, P8 fat and carcase weight (Table 3.1 page 31). Carcase weight (hot standard carcase weight and dressing percentage) is the main price determinant. Additional slaughter market specifications can include bruising, residue status, previous use of hormone growth promotants and quality assurance systems.

Table 3.1 *Examples of basic market specifications*

Market	Dentition (no. of permanent incisors)	Carcase weight (kg)	P8 fat (mm)
Light domestic	0	140 – 180	4 – 8
Medium domestic	0 – 2	180 – 240	6 – 10
Heavy domestic	0 – 2	240 – 300	8 – 13
European Union (EU)	0 – 4	260 – 327	7 – 17
Japan grass-fed	0 – 4	290 – 400	7 – 22

Source: Bob Gaden, NSW Department of Agriculture (2001)

Individual processors set prices for carcase specifications that meet the requirements of the markets they target, which means each processor's price grid may differ. Penalties apply for cattle that do not meet specifications, which can considerably reduce the benefit of good prices if compliance with specifications is low (Table 3.2). Prices may vary from week to week, but specifications of the ideal animal for a particular market do not change often. A range of markets should be considered for the best overall results.

To match your livestock to specifications and assess which price grid will offer the highest return, you need to accurately assess your cattle for liveweight, expected dressed weight, age, and P8 fat depth. You can upgrade your skills in assessing live animals by

- estimating carcase characters on animals before they are sold and comparing this with feedback from the processor
- employing experienced marketers
- attending training workshops.

Table 3.2 *Example of a domestic price grid*

Carcase weight (kg)	Fat (mm)				
	0 to 4	5 to 16	17 to 18	19 to 24	24+
Less than 210	-40	-20	-25	-35	-55
210 to 270	-20	0	-5	-15	-35
270 to 280	-30	-3	-8	-18	-38
280 to 300	-50	-15	-20	-30	-50
Greater than 300	-110	-30	-35	-45	-65
Dentition					
0 to 2 teeth	0				
More than 2 teeth	-20				

Base price 233c/kg HSCW. The grid figures are penalties on the base price for non-compliance.

Table 3.3 *Major markets and their specifications*

Major market	Product	Feeder specifications	Production system	Target live specification	Carcase
Japan	Chilled grass-fed	Liveweight: 250-350 kg Sex: steers/heifers Muscling: minimum C Genetics: N/A	Pasture or crop finishing	Liveweight: 550 kg Fat score: 4 Sex: steers/heifers Age: maximum 42 months Muscle score: minimum C	HSCW: minimum 280 kg P8 fat depth: 12-22 mm Dentition: maximum 7 teeth Butt shape: A, B, C Fat colour: N/A Meat colour: N/A EMA: N/A Marbling score: N/A
Japan	Chilled short-fed	Liveweight: 250-400 kg Sex: steers/heifers Muscling: minimum C Genetics: N/A	Minimum 100 days on approved grain rations	Liveweight: 550 kg Fat score: 4+ Sex: steers/heifers Age: maximum 42 months Muscle score: minimum C	HSCW: 300-400 kg P8 fat depth: 10-22 mm Dentition: 4-7 teeth Butt shape: A, B, C Fat colour: N/A Meat colour: N/A EMA: N/A Marbling score: N/A
US	Hamburgers		Pasture, crop or grain finished	Liveweight: heavy cattle preferred Fat score: lean cattle preferred Age: all ages	HSCW: All weights, heavy carcases preferred P8 fat depth: Lean carcases preferred
Korea	Frozen grass-fed	Liveweight: 250-350 kg Sex: steers/heifers Muscling: minimum C Genetics: N/A	Pasture or crop finishing	Liveweight: 550 kg Fat score: 3-4 Sex: steers/heifers Age: maximum 36 months Muscle score: minimum C	Cold weight: 250-320 kg P8 fat depth: 12-22 mm Dentition: 0-6 teeth Butt shape: A, B, C Fat colour: 0-9 Meat colour: 1A-6 EMA: N/A Marbling score: N/A

Domestic	Yearling carcase	Liveweight: minimum 230 kg Sex: steers/heifers Muscling: N/A Genetics: preference for British and European crosses	Pasture or crop finishing	Liveweight: 240-300 kg Fat score: 2 Sex: steers/heifers Age: maximum 18 months Muscle score: N/A	HSCW: 160-220 kg P8 fat depth: 4-15 mm Dentition: 0 teeth Butt shape: A, B, C Fat colour: 0-4 Meat colour: 1A-4 EMA: N/A Marbling score: N/A
Domestic	Grain-fed yearling	Liveweight: minimum 250 kg Sex: steers/heifers Muscling: A, B, C Genetics: N/A	Minimum 70 days on approved grain ration	Liveweight: minimum 300 kg Fat score: 2-3 Sex: steers/heifers Age: maximum 18 months Muscle score: A, B, C	HSCW: 180-240 kg P8 fat depth: 8-12 mm Dentition: 0 teeth Butt shape: A, B, C Fat colour: 0-3 Meat colour: 1A-3 EMA: 58 cm^2 Marbling score: N/A
Domestic	Supermarket yearling	Liveweight: minimum 200 kg Sex: steers Muscling: A, B, C Genetics: Beef breeds only	Finished on pasture, crop, grain supplement, or total grain ration	Liveweight: 300 kg Fat score: 2-3 Sex: steers Age: maximum 24 months Muscle score: A, B, C	HSCW: 160-220 kg P8 fat depth: 4-15 mm Dentition: 0 teeth Butt shape: A, B, C Fat colour: 0-4 Meat colour: 1A-4 EMA: N/A Marbling score: N/A

N/A Not applicable

Markets for slaughter cattle

Cattle are sold for slaughter to either domestic or export markets.

Domestic slaughter

About 35 per cent of Australian beef goes to domestic slaughter, making this the largest single beef market. Cattle are slaughtered for the domestic market through some 215 meat processing companies licensed by the Australian Quarantine Inspection Service (AQIS), and reach domestic consumers through some 7,600 butchers, supermarkets and food service outlets.

Features of the domestic market

- The domestic market ranges from calves below 30 kg HSCW to a top end at the specialised hotel and restaurant trade around 260 kg HSCW.
- In contrast to most export markets, the Australian domestic market demands young, light cattle. Over the last few years, grain-fed beef has begun to gain significant domestic market share.
- In the lighter trade divisions (mainly vealers), breed specifications are uncommon. As carcases become heavier, the breed requirements become more specific. Higher *Bos taurus* content (British and European breeds) is preferred.
- Generally cattle that have been administered with hormonal growth promotants (HGPs) will be accepted, but not always.
- Both steers and heifers are accepted, but heifers may be discounted slightly.

Export slaughter

Australia exports about 69 per cent of its annual beef production, making it the world's largest exporter of beef despite being a relatively small beef producer in global terms. Australia produces only 4 per cent of the total global beef production but it accounts for 23 per cent of the global export trade. Annual beef shipments total approximately 900,000 tonnes shipped weight (1.5 million tonnes carcase weight), reaching over 100 countries.

The Australian cattle industry continues to be heavily reliant on the Japanese and United States (US) markets, which account for over 65 per cent of Australia's exports. Since the Japanese market was fully liberalised in the early 1990s, it has overtaken the US as the largest destination for Australian beef and veal. Other major markets include Korea, Canada, South Asia and Europe (EU).

See AQIS in Useful contacts pp 169– 170

Strict guidelines exist to cater for the many, and often constantly changing, requirements of importing countries. Beef for export must be processed by an accredited export processor and exported by a licensed meat exporter. AQIS regulates imports and exports, issuing permits and regulating inspections. AQIS is also involved in the policy aspect of exports such as veterinary protocols and other aspects of animal health and welfare. AUS-MEAT is the national organisation and accreditation authority responsible for quality standards and the accurate description of meat and livestock. There are 40 AUS-MEAT-accredited processors licensed by AQIS to process beef for export, and a further 300 companies licensed to export this beef from Australia.

See AUS-MEAT in Useful contacts pg 169

Japan

Japan is Australia's foremost high quality beef market, taking around 320,000 tonne shipped weight annually. This market remains the highest value market for Australian beef, comprising around 37 per cent of the total value of Australia's

beef and veal exports. The financial importance of the Japanese market ensures that Japanese demand is a crucial factor in determining the value of Australian cattle, especially those that are specifically targeted at that market.

Australian beef is channelled through the retail, food service and auxiliary processing segments of the Japanese market according to the quality attributes of each product. Approximately 70 per cent of Australian beef exported to Japan enters the food service sector. Most chilled grain-fed cuts are sold through the retail or high-end food service segment. Chilled grass-fed and frozen grain-fed product is sold to medium level food service; frozen grass-fed cuts are sold to medium- to low-end food service; and frozen manufacturing product is sold to hamburger manufacturers for use in the fast food sector.

In recent years, growth in the Japanese food service sector and falls in retail trade have seen an increase in the proportion of grain-fed beef exports in relation to grass-fed exports.

United States of America

The United States of America (US) is currently the second largest export market for Australian beef, accounting for approximately 32 per cent of Australia's export product. The US market primarily takes manufacturing grade beef, which is imported to correct an imbalance in the US production system. US cattle are almost always finished in the feedlot, so the US beef industry has an excess of fat trim and a deficit of lean trim. Imported Australian grinding (manufacturing) beef is blended with local fatty trimmings to produce ground beef for the production of hamburger patties and 'deli' type items.

Product for the US market is sourced from cattle of all ages and weight classes.

The price of Australian manufacturing beef in the US is principally determined by three factors: the exchange rate; demand in the US market, particularly at the food service level; and the level of US domestic lean beef production.

US market conditions are a crucial factor in determining the value of Australian cull cows. Cull or export cows are leaner than steers or bullocks, and although they attract lower prices, they fulfil the US manufacturing beef demand. In addition this market is a valuable outlet for the meat trim off prime steers and bullocks. The US market therefore provides a valuable outlet for Australian producers, delivering returns in addition to those provided by primal cuts from steers and bullocks targeted for markets such the local retail and food service trades and quality beef to Japan and Korea.

Korea

South Korea is currently Australia's third largest export market for beef and veal, taking around 105,000 tonnes annually at a value of A$387 million. It also takes smaller, but still significant, quantities of Australia's edible offal. Australia has traditionally sent frozen grass-fed quarter beef and limited quantities of grain-fed quarter beef to this market. This product is drawn from steers or heifers of 400 to 500 kg liveweight (220 to 280 kg dressed weight). This weight falls between the heavier carcases for Japan and the lighter domestic supermarket carcases, thus providing a particularly valuable outlet for middle-weight cattle.

With the liberalisation of the Korean beef market in 2001, Australia has significantly increased the quantity of chilled beef that it exports to Korea.

Canada

Canada is Australia's fourth largest beef export market. During 2002–03, Australia exported 72,000 tonnes shipped weight of beef and veal to Canada, with a total value of nearly A$100 million.

South Asia

Frozen beef represents the majority of Australia's beef exports to this region in terms of volume. Chilled beef exports to South Asia, while of a relatively low volume, have grown considerably over the past ten years.

European Union

The European Union (EU) is an important export market for Australian beef. Australia has restricted access to the EU market of 7,000 tonnes of high quality beef annually. The quota is filled with high value cuts, which are sold into the food service sector where the highest returns are achieved.

See Quality assurance systems pp 137– 138

See Meat and Livestock Australia in Useful contacts pg 172

Cattle supplying the EU market must come from accredited properties. Details of the accreditation requirements are available from Meat and Livestock Australia.

Markets for store cattle

The store cattle industry involves a large range of production options. Store cattle can be described as cattle that are not in prime condition and are not intended for immediate slaughter. The alternative destinations for store cattle are shown in Figure 3.2.

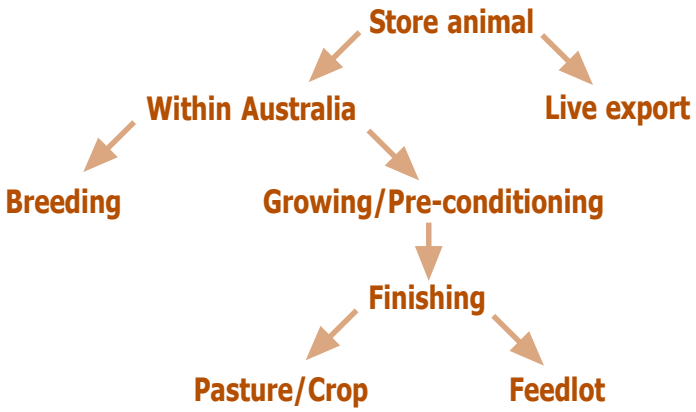


Figure 3.2 *Pathways for store cattle*

Specifications for store cattle will vary depending on the end market, so you need to know the live animal requirements of the finisher and also the final carcase specifications of their customer, the processor.

Demand for store cattle is affected by temperament, condition, pre- and post-weaning management, potential daily weight gains, genetics, horn status, brand size and placement, identification system, disease status, structural soundness, price and frame size.

Pre-conditioning

Pre-conditioning, also known as backgrounding, involves growing cattle to a desired entry weight at a specified age for finishing on grain or pasture. Producers involved in this enterprise are commonly referred to as backgrounders. The backgrounder can affect the feedlot's profitability by changing the tendency

of cattle to start on a ration, grow and deposit fat. Backgrounders should ensure cattle are in good condition, of good health, and protected from diseases and parasites, which may impact on their performance once in the finishing system. Other specifications may also apply.

Pasture and crop finishing

Growing cattle on pasture and crop is the most common form of finishing cattle in Australia. Trading cattle and growing them out to heavier or finished weights is the sole enterprise of many beef businesses.

Buyers within this market generally require quiet cattle, without horns and of a reasonable frame size that demonstrates a propensity to put on weight. Other factors include the reputation of the vendor's cattle, quality assurance programs, use of hormone growth promotants, and previous handling and history.

Feedlot

See Quality assurance systems pp 136– 137

More than 850 Australian feedlots are accredited by the National Feedlot Accreditation Scheme (NFAS). The NFAS is a beef cattle feedlot management program, covering product integrity, animal welfare and environmental management. The scheme is independently audited by AUS-MEAT who will not grant or renew accreditation if a feedlot does not meet key criteria.

The major grain-fed beef markets are

- domestic supermarket/butcher market – young cattle, 70 days on feed
- Japanese short-fed full set market – Japanese steers, 120 days on feed
- Japanese medium-fed full set market – Japanese steers, 180 days on feed
- Japanese lot-fed full set market – Japanese steers, over 360 days on feed.

Profitability in the Australian feedlot industry is determined by export prices to Japan, Australian domestic grain-fed beef demand and prices, prices of grain and other feed components, and cost of purchasing feeder cattle.

Live export

Australia has exported low numbers of live cattle for breeding, lot-feeding and slaughter to countries around the world for many years. Cattle for slaughter and to stock local feedlots have only been exported in significant numbers since the early 1990s, particularly to Indonesia and the Philippines. The growth in Australian live cattle exports has been the result of a combination of the following trends in South East Asia

- high rates of economic growth
- increased beef consumption levels
- stagnant local beef production
- availability of cheap feeds from agricultural by-products
- poor infrastructure for handling chilled and frozen beef
- religious and social preferences for freshly slaughtered beef
- high tariffs on beef imports relative to cattle imports
- low processing costs compared to Australia.

The live cattle trade provides a particularly important outlet for cattle producers in northern Australia. Distances and travel times to South East Asia are minor, and the predominant northern Australian *Bos indicus*-derived cattle breeds cope

well with the tropical conditions encountered both on the voyages and in Asia. The recent growth in North African and Middle Eastern markets that prefer higher *Bos taurus* content has resulted in more cattle producers in the southern Australian states having the option of turning off cattle to live export.

The Livestock Export Accreditation Program (LEAP) is an industry-based quality assurance scheme. Exporters must be LEAP-accredited before they are able to obtain a licence from Department of Agriculture, Fisheries and Forestry (DAFF) and they are audited regularly by an independent party (currently AUS-MEAT). They must adhere to their individualised quality assurance programs, and observe the relevant animal welfare and product quality codes and guidelines.

See Quality assurance systems pp 137

Markets for seedstock

Seedstock cattle are bulls and replacement heifers that are bred and sold specifically for breeding. Seedstock producers breed cattle that will produce steers and heifers suitable for an intended purpose, whether that be for domestic or export slaughter markets or for retention for breeding.

Seedstock production is designed to improve the commercial producer's profitability. A seedstock breeding program should address selection strategies that improve turn-off weight, increase market compliance, increase the value of animals turned off, and reduce costs. For further information on establishing breeding objectives and breeder herd management.

See Breeding pp 94 – 109

Markets for beef co-products

Cattle hides are the most valuable beef co-product, accounting for 10 to 15 per cent of an animal's value. Although the Australian tanning industry is expanding, most hides are still exported prior to tanning. The chief markets for Australian beef hides are Japan, China and Italy. The leather from hides is used in clothing, shoes, saddlery, sporting goods and furniture. Vertical alliances are being developed which encourage producers to minimise hide damage. Hide quality can be improved through appropriate branding and dehorning practices, parasite control, yard design and maintenance, and handling.

Selling systems

The main selling systems in Australia are saleyards, over the hooks, paddock sales, forward contracts and computer-based auctions. Commonwealth Livestock Transaction Levies are payable on all transactions on a head basis. Cattle are usually sold as dollars per head or cents per kilogram liveweight or carcase weight.

A selling system that provides clear signals from the purchaser/retailer/consumer back to the producer for store or slaughter stock and has a pricing system supporting those signals is referred to as a value-based marketing system. The advantages and disadvantages of the various selling systems described in this section are summarised in Table 3.4 on page 40.

Saleyards

The most common method of selling beef cattle in Australia is through the auction system at saleyards, which accounts for 40 per cent of cattle sales. The traditional strengths of this system are that buyers can see the animals they are paying for and pricing is competitive.

The cost of selling at saleyards depends on the centre. Local governments or agents usually own saleyards and charge yard fees per head sold. Cattle in saleyards must be sold through an agent, so commission is also incurred.

Over the hooks

Over the hooks (OTH) is the other major method of selling cattle in Australia, accounting for 32 per cent of sales. Under this system the price is negotiated directly between the producer and the processors and is usually based on a set grid.

Over the hooks selling provides producers with feedback from processors, enabling them to improve management practices, and reduces the risk of carcase damage that can occur at saleyards.

Cattle are always sold OTH according to their specifications using AUS-MEAT descriptions detailing sex, weight, dentition, fat and muscle score.

Paddock sales

A paddock sale of slaughter or store cattle is negotiated, with or without an agent, directly between a producer and a buyer. The stock are usually yarded and drafted for inspection by the buyer. The basis of the sale is dollars per head or cents per kilogram liveweight. The point of change of ownership is negotiated between the buyer and vendor. For example, change of ownership may occur when the stock are loaded for delivery (dollars per head sales) or when they are weighed (liveweight sales). Costs of freight and weighing need to be negotiated, although usually the vendor pays for weighing costs and the buyer pays for freight.

Forward contract

A standard forward contract is essentially a contractual agreement between a producer and a customer to supply a given product at a given time for a given price. The contract includes details of the number and description of cattle to be delivered, time of delivery, and price arrangements.

Computer-based auctions

Cattle are sold by description through computer-based auctions. An accredited assessor, who may be an agent or independent, weighs and describes each animal in the lot, then posts this information on the website for any buyer to review. The vendor sets an undisclosed reserve price. At the appointed sale time, buyers bid by computer.

Cattle passed in may be resubmitted at the next sale without reassessment or further cost.

Successful buyers contact the vendor and arrange a date for transport of stock, usually during the following week. Stock are transported direct to the buyer's abattoir or property. Slaughter cattle must be processed within 48 hours. The agent sends sale proceeds accompanied by a carcase feedback sheet (if relevant) to the vendor.

For more information contact your preferred selling agent.

Video auctions

Video auctions have been successful in the marketing of larger lines of sought-after breeding stock or steers from well-known breeding herds.

The selling agent describes the stock for a written catalogue, and a video is taken according to guidelines. A video sale can be held in conjunction with a live

saleyard auction. The auctioneer controls the sale, which follows a lot-by-lot format, and bids can be taken from the live auction or by electronic hook-up from any of the bidding centres in the network.

Futures contracts

Futures contracts are traded on the Sydney Futures Exchange, providing Australian beef and cattle producers with an effective hedging mechanism for managing price uncertainty and risk. A futures contract is an obligation to buy or sell a commodity at a future point in time. A futures contract differs from a forward contract in that it is a standardised contract with market prices available to all users. In addition, there is no counterparty risk because the contracts are traded directly with the Sydney Futures Exchange.

Table 3.4 *Advantages and disadvantages of various selling systems*

Selling system	Advantages	Disadvantages
Saleyards	Good for small drafts All stock can be sold Convenient Agent handles stock, paperwork and risk of buyer default No expert market knowledge required Suitable for store cattle Proximity to property Competition Advertising for your stock	No feedback on market suitability Extra steps in handling and selling Buyers assume average dressing and meat quality Price is unknown until point of sale Risk of not getting your reserve price Extra selling costs
Over the hooks	Direct transport to works Reduced bruising and stress Payment on actual carcase weight Opportunity to gain premiums Choice of flat rate or grid (if used at works) Fairer price for quality Good for larger drafts Feedback supplied Ability to compare live animal assessment with grid	Lack of competition Difficult to compare works because of varying grids May get penalties Price per head is unknown until point of sale
Paddock sale	Reduced handling Reduced stress Reduced selling costs Suitable for large lines Know a price before animals leave the property	Lack of competition No benefit if carcases surpass expectations Not paid on stock performance Possibly a lower price Hard to negotiate with professional buyer Feedback only on request
Computer-based auctions	Potential widespread competition Wide circulation of catalogue No prior inspection by buyer necessary Direct movement of stock to buyer Less bruising and stress in process Producer paid for carcase weight Professional assessment Reserve can be set Transit and *del credere* insurance included	Two musters: assessment and delivery Time lag for payment from decision to sell to receiving money Extra fees (listing and inspection) Requires more planning Not suitable for small drafts due to assessment costs and sourcing buyers
Forward contracts	Guaranteed price Able to plan ahead Continuity of quality of supply for processors Feedback	High degree of control needed over production system Specified timeframes for delivery and numbers

Handling and basic husbandry

4

Good handling produces quiet, well-behaved cattle. Quiet cattle suffer less stress and bruising than excited cattle. The amount of stress animals suffer varies between individual animals and is largely determined by temperament. To a certain degree, temperament is genetic; wild cattle breed wild cattle. However, the way animals are handled can either exacerbate behavioural problems or correct them.

Good handling and husbandry practices should be employed in

- weaner education
- mustering
- yard work
- standard husbandry procedures
- transport.

Handling and training cattle

Livestock behaviour

Good handling is based upon, and takes advantage of, livestock behaviour.

Cattle have evolved as prey animals; they perceive humans (and dogs) as potential predators and have an innate fear of them. They have strong herding instincts, and individual animals

- tend to follow a leader
- prefer to maintain visual contact with the mob
- usually move around an operator in a circular motion
- become agitated when left in a yard by themselves or when they are cut out of a mob.

Cattle have panoramic vision of almost 360^0, with a small blind spot directly behind them. However because they have binocular vision in a relatively small area directly in front of them, they have poor depth perception. Cattle can easily detect movement and this, in combination with the poor depth perception, causes cattle to baulk at contrasting shadows and uneven ground surfaces. A handler should avoid approaching an animal from its blind spot, as the sudden 'appearance' of the handler close to the animal can cause the animal to take fright.

Cattle will maintain a certain distance from potential predators, which is the so-called flight distance or 'flight zone'. Nervous or 'flighty' animals have a much larger flight zone than quiet animals.

Livestock handling is based on applying pressure to the flight zone to initiate a positive response (such as the animal moving away quietly or stopping) and then releasing that pressure as a reward for the correct response. Cattle have long memories and are creatures of habit. Good handling encourages cattle to respond positively to pressure, and aims to re-enforce these responses every time they are worked.

Weaner education

Weaning is the best time to teach cattle to be worked with horses, bikes, dogs and vehicles, and to load and travel. Weaner education provides a sound foundation that can be built on with continued good handling throughout the animal's life. Properly trained weaners are quieter, suffer less from stress, and probably bruise less than untrained weaners.

See Seasonal deficiencies and supplementary feeding pp 73 – 78

Calves are normally weaned at 6 to 8 months of age, or earlier if in drought. Feed and water weaners in the yards for 7 to 14 days. During this period, teach them to work through the yards and respond quietly to handlers. The types of

supplementary feeding they will encounter during their life on the property should also be introduced at this stage.

Towards the end of the weaning period weaners should be 'tailed' or grazed out away from the yards and returned to the yards in the evening. From this they will learn the basics of being mustered. They should

- quietly move together and form a mob when a handler approaches
- block up when required
- walk out at a steady pace
- willingly enter the yards
- respond positively to working dogs.

Mustering

Never startle cattle by riding onto them without letting them know you are there. Talk to them and quietly attract their attention. Avoid shouting or making other loud noises.

Develop a set mustering pattern for each paddock and stick to it. Cattle will become used to this pattern and will usually conform. Muster toward a common end point in the paddock, such as a trough or a holding paddock. When all the cattle are together, and before moving on, hold them until they settle. When the mob moves off, make them walk; do not let cattle run.

Talking to the cattle as you walk them along will help keep them settled. Watch for signs that cattle are becoming agitated or overheated. Agitated or overheated cattle are difficult to work and should be allowed to settle.

Bos indicus cattle like to follow and it is a good practice to have a person in the lead. This also helps to steady the mob.

When working cattle through a gate, start the lead then move back to allow the leaders to draw the mob through the gate. It is an advantage to have a handler near the gate to steady the flow through the gate (to stop them from rushing and jamming) or to keep the mob moving if some animals baulk.

Yard work

See Yards pp 8 – 9

As with mustering, talk to the cattle so they know where you are, and work them quietly. Give the herd a chance to cool down after they have been yarded and before commencing yard work.

A set routine is important as cattle become used to working through yards in the same way each time. Cattle should never be worked tightly, particularly in the smaller forcing yards. Allowing room for cattle to move freely when being handled helps prevent them jamming in gateways.

When working cattle in confined areas such as a forcing yard, work them through the gate from the front. This will allow the lead to enter the forcing yard or race and the others can then follow in single file. Do not push cattle from the back of the yard.

Situations will arise when it becomes necessary to be firm with animals to get them to do what you want. Individual animals that are persistently bad tempered or rogues should be culled.

Standard husbandry procedures

See The Stockman's handbook and the Australian model code of practice for the welfare of animal-cattle in Recommended reading pg 175

All husbandry procedures are potentially stressful as they require the animal's flight zone to be entered, usually when the animal is restrained and unable to escape. It is best to work quietly and efficiently. Finish the procedure as quickly as possible and then release the animal and allow it to re-enter the mob and settle down.

'Branding' time

'Branding' is commonly used in the beef industry to refer to a occasion when a number of operations, including branding, are carried out on calves between 3 and 6 months of age. Operations normally carried out at this time are

- branding
- dehorning
- earmarking
- vaccinating
- castrating.

Branding time is a stressful time for calves. Ensure all equipment is in good working order; needles, knives, scalpels, earmarking pliers and dehorners are sharp and clean: and brands are at the required temperature.

Work calves quietly and be patient; avoid using dogs and goads. When the operations are finished, allow calves to mother-up and remove them from the yards as soon as possible.

Branding

See Establishing ownership and identifying individual cattle pp 13 – 14

Branding can be done with either a hot iron (fire branding) or a very cold iron (freeze branding). When using a hot iron, make sure the iron is red hot and only apply it until there is a mark on the skin; 2–3 seconds is usually adequate. An iron that is not hot enough and which is applied for too long will cause the brand to 'blotch' and be unreadable.

Freeze branding requires special irons. These are chilled to extremely low temperatures with either dry ice or liquid nitrogen and applied for up to 30 seconds. Freeze branding requires more skill than fire branding. Freezing kills the pigment in the skin causing the new hair that grows to be white.

Dehorning

Horns are a major cause of bruising. To reduce bruising, horns must be completely removed; tipping does not reduce bruising. Dehorned cattle are safer to handle, cheaper to transport (more can be loaded into a given area), and require less trough space when being fed supplements or in feedlots.

Dehorning is probably *the* most stressful husbandry procedure. However dehorning is far less stressful for calves than for mature animals, and is best done at branding when the young horn is still in the 'bud' stage. A number of tools are available for dehorning.

Earmarking

See Establishing ownership and identifying individual cattle pp 13 – 14

Earmarking involves using earmarking pliers to remove a small piece of ear in a specific (and registered) design and place. Ear marks are used for easily identifying cattle ownership.

Vaccinating

See Health pp 121 – 123, 126 NB enterotoxaemia and malignant oedema aren't in Health

At branding time, calves are usually given the first of their vaccinations for clostridial diseases. A vaccine for these diseases is combined into a vaccine known as 5-in-1 (i.e. blackleg, tetanus, botulism, enterotoxaemia and malignant oedema). If leptospirosis is a problem, 7-in-1 vaccine may be used. This vaccine is 5-in-1 vaccine plus two strains of leptospirosis. Irrespective of which vaccine is used a second vaccination is required 4 to 6 weeks later.

Cattle of all classes require vaccinations as per the annual cycle. Vaccines are available from vets, produce agents, and stock and station agents. Vaccines are administered by needle and syringe either under the skin (subcutaneously) or into the muscle (intramuscularly) as per the manufacturer's recommendations.

Castrating

Male cattle are castrated primarily to make them easier to manage. Castration also changes carcase composition by encouraging greater fat deposition, which makes it easier to meet certain market specifications.

Castration without local or general anaesthetics should be confined to calves at their first muster and preferably under the age of 6 months. Only under exceptional circumstances (e.g. range management of older, previously unmustered bulls) should older bulls be castrated, and then preferably by a veterinarian.

The three methods commonly used for castrating calves are open castration, elastration, and bloodless castration with Burdizzo pinchers.

Open castration

This is the oldest and most commonly used method of castration. A sharp blade is used to remove the testes from the scrotum. Open castration has the advantage that castration is completed at the time of the operation and, if properly performed, is 100 per cent effective.

Elastration

Castration with rubber rings is only recommended for calves up to 2 weeks of age. A small rubber ring is placed around the neck of the scrotal purse close to the calf's body. This cuts off the blood supply to the scrotum and testes inside, causing them to die and drop off.

Elastration can be performed quickly and simply, and does not require the same degree of skill and experience as open castration. The main disadvantage is that it takes some weeks for the scrotum and testes to drop off.

Bloodless castration

Castration by Burdizzo without local or general anaesthetics should be confined to calves at their first muster and preferably under the age of 6 months. This method of castration, or more correctly emasculation, relies on cutting off the blood supply to the testes by means of a pair of sturdy clamps called Burdizzo pinchers which sever the testicular cord without injury to the scrotum. The testes die within the scrotum, which is unaffected. The advantage of Burdizzo castration is that there is no cut, eliminating infection and fly strike. If properly performed it is fully effective, but if adequate care is not taken failures will occur.

Weighing

Weighing is important in backgrounding and finishing operations. Many animals will feel uncomfortable in the confines of the weighing crate. Where possible, stay out of the animal's flight zone to allow it to stand quietly. Don't overcrowd the race, and avoid leaving animals on their own for any length of time.

Dipping

Don't overcrowd the lead-up race. Encourage animals to enter the dip by applying appropriate pressure to their flight zone and by taking advantage of their inclination to follow the leader. Ensure they enter one at a time. Keep an eye on animals in the dip and promptly turn any animals that flip over, turn in the dip or re-enter from the draining pen. Ensure that the draining pen does not become tightly packed. Control the rate at which animals leave the draining pen; rushing cattle are liable to slip on the wet floor and injure themselves.

Transporting cattle

Good communication and cooperation between the producer and the driver are essential for maximising animal welfare and meat quality. Producers set the handling standards which will influence their staff and the transport drivers.

Transport drivers are responsible for the welfare of the animals from loading until delivery, so they decide on an appropriate loading density. Loading rates are determined according to the size, shape and horn status of the cattle, as well as weather conditions and distance to be transported (Table 4.1). Overloading cattle, especially cattle with horns, increases the risk of an animal going down and being unable to get up again, and increased carcase bruising.

Table 4.1 *Suggested loading rates for adult cattle on road transport**

Mean liveweight of cattle (kg)	Floor area (m^2/hd)	No. of head per bottom or single deck
250	0.77	38
300	0.86	34
350	0.98	30
400	1.05	28
450	1.13	26
500	1.23	24
550	1.34	22
600	1.47	20
650	1.63	18

*Top deck rates may vary, depending on the design of the crate.

Prior to loading, select and sort cattle according to type, sex, horns and size. Allow enough time for fasting and resting before transporting.

Cattle require time to settle down after mustering. After handling in the yard, they should be rested for 6 to 12 hours before being transported. How long they will need to rest will depend on the time taken to muster and handle the cattle, distance to be travelled, and current weather conditions.

When cattle are fasted before transport, the floors of trucks are drier, the animals travel better, and they are cleaner and easier to unload on arrival. To fast cattle, keep them off water for 6 to 8 hours and feed for 6 to 12 hours prior to loading. The exact time off water will depend on weather conditions. The resting and off-water periods can be concurrent.

The Model Codes of Practice for the Welfare of Animals sets out guidelines for transporting cattle, emphasising the responsibilities of cattle owners and agents, livestock transporters, drivers, attendants and railway officials before, during and after transport. The code covers

- selecting and preparing cattle for transport
- minimising stress
- loading density, loading and unloading methods
- travel and spelling periods
- emergency euthanasia.

Feeding and pasture management

5

Cattle need adequate supplies of energy, protein, minerals, vitamins and water to grow and reproduce. When the supply of these nutrients from pasture is insufficient to meet an animal's requirements, it may be necessary to provide supplements. The type of supplement and how much to feed depends on the nutrients needed and whether the aim is to maintain weight, minimise weight loss or produce weight gain.

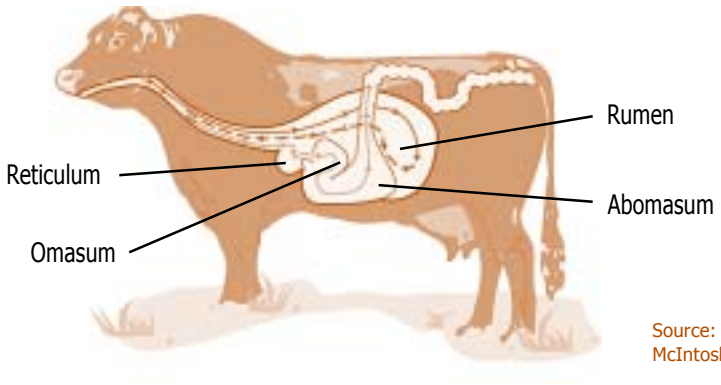
Ruminant nutrition

A basic understanding of the physiology of the digestive system and nutrient requirements will help to ensure the correct nutrients are fed to overcome any deficiencies.

The ruminant digestive system

Feeding cattle is largely a matter of attending to the needs of the microorganisms in the rumen, the first stomach, where nutrients are extracted from the cow's fibrous diet by fermentation. Dietary changes must be gradual; sudden changes in diet can result in death.

Ruminants have four stomachs: the rumen, the reticulum, the omasum and the abomasum (Figure 5.1). The abomasum is similar to the single stomach in monogastric animals (e.g. horses, pigs, humans). From this point onwards, the digestive tract in cattle is very similar to that in monogastric animals.



Source: Jeffery and McIntosh (2000)

Figure 5.1 *The ruminant digestive system*

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

At birth the rumen is smaller than the abomasum because the calf is only digesting milk. Milk passes directly into the abomasum via the oesophageal groove. As the calf begins to eat dry food, the rumen and reticulum grow in volume and acquire a mixed population of microorganisms from adult cattle. A calf cannot survive satisfactorily on a high fibre diet before about three months of age.

The rumen–reticulum contracts about two to three times per minute. These contractions keep the contents well mixed and keep the microorganisms in

contact with the food. When cows 'chew their cud', they regurgitate and re-chew the contents of the rumen. This further assists the mixing and breakdown process.

After the rumen, unfermented food, excess microorganisms and the products of rumen fermentation pass through the omasum, where moisture is extracted, into the abomasum.

Diet determines the proportions of the various species of microorganisms present in the rumen. Grazing cattle will mainly have microorganisms adapted to breaking down plant fibre. Cattle on grain diets will mainly have microorganisms that break down and use starch.

See Health pg 115

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

Nutrient requirements

Grazing cattle derive a range of nutrients, particularly energy, protein, minerals and vitamins, from the plant material they eat. Figure 5.2 indicates the relative importance of the various nutrients in the ruminant diet. Digestion releases the nutrients and converts them into forms that can be used by the animal. An animal's nutritional requirements will vary according to age, sex, level of production, pregnancy and lactation status.

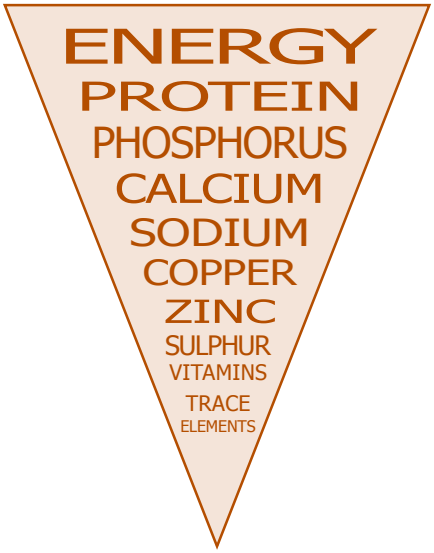


Figure 5.2 *Essential nutrients for cattle, from most to least important*

Energy

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

The most important VFAs are acetic acid, propionic acid and butyric acid

- When fibrous feedstuffs are fermented, acetic acid is mostly produced, with methane as a by-product. The methane is lost by belching and represents lost energy.
- Grain feeding increases the production of propionic acid relative to acetic acid. Fermentation that produces propionic acid is more efficient in terms of utilising the energy in a feed to produce energy that is used by the animal.
- The proportion of butyric acid produced is similar on both feed types.

See Monensin pg 78 and Rumen modifiers pg 80

Rumen modifiers can be used to increase production of propionic acid relative to acetic acid. Rumen modifiers alter the microbial population of the rumen to encourage the development of microorganisms that produce propionic acid and reduce the population of those that produce methane.

Protein

See Protein supplements pg 74 and Urea pp 74 – 78

Ruminants derive protein from plant sources (plants, grains, protein meals derived from plants) and non-protein nitrogen (NPN) sources such as urea.

The rumen microorganisms break down nitrogen from these sources into ammonia, which they use to form microbial protein for their own growth and reproduction. Then the microbes pass out of the rumen into the abomasum and

Pasture in this condition has little value

small intestines where they are broken down into the amino acids that are absorbed into the ruminant's body (Figure 5.3).

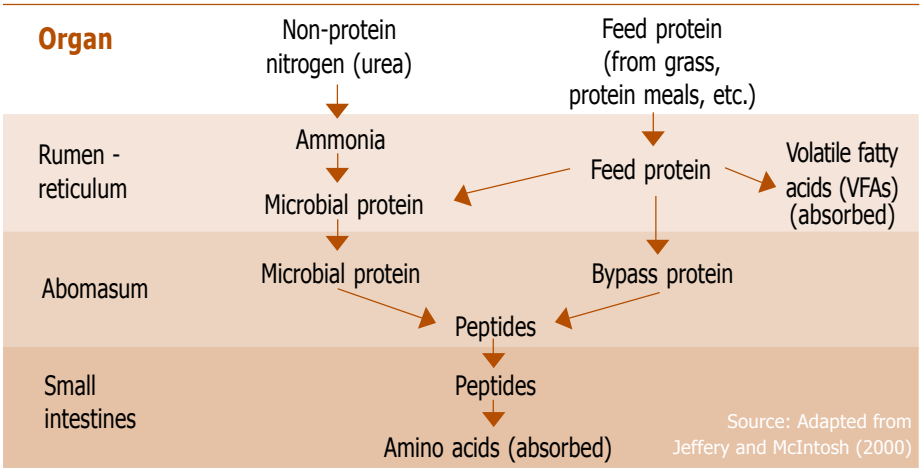


Figure 5.3 *The digestion of protein (nitrogen) in ruminants*

It is the breakdown of these microorganisms that is the major source of protein for the cattle.

Not all protein is broken down in the rumen. Protein broken down in the rumen is called rumen degraded protein (RDP); protein that escapes breakdown in the rumen is called bypass, undegraded or protected protein (UDP). Most UDP is broken down in the abomasum and small intestines into amino acids that are then absorbed into the body.

Rumen degraded protein is the most important source of nitrogen to the animal because it is vital to the proper functioning of the rumen. However there is a limit to the amount of microbial protein that the rumen can produce. When this limit is reached, any additional protein required by the animal must be supplied from bypass protein. (This is the case for young animals growing at greater than 0.25 kg per day and high milk producing cows.)

Provided sufficient energy is available, non-protein nitrogen (NPN) such as urea can be fed to cattle as a source of ammonia for the microorganisms and so, ultimately, protein (amino acids) for the animal. The degradability of proteins in the rumen varies with different feeds and with how quickly the feed passes through the rumen.

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

Macro minerals

Calcium
Phosphorus
Magnesium
Sulphur
Potassium
Sodium
Chlorine

Micro minerals

Iron
Selenium
Cobalt
Copper
Iodine
Zinc
Manganese
Molybdenum

Minerals

Minerals are essential for building bones, chemical reactions, and other functions of life and growth. Macro minerals are required in grams per day and micro minerals in milligrams per day.

All minerals must be in balance with each other. An excess or deficiency of one mineral can affect the uptake and use of other minerals.

Other than in areas known to be mineral deficient, grazing cattle usually have little problem with mineral deficiencies. The most common mineral deficiency of

See Mineral deficiency pp 111– 113

grazing cattle is phosphorus. Copper and cobalt are also deficient in some areas of south east Queensland.

Vitamins

Most vitamins required by ruminants are made by the rumen microorganisms, so vitamins are usually available in sufficient quantities.

Water

All animals, even as young as one week old, need an adequate supply of good, clean drinking water at all times. Inadequate water intake will reduce animal production. Cattle will not readily drink water that is highly mineralised or contaminated with microorganisms or chemicals.

Water consumption will vary widely, depending on climate and the water content of feed (Table 5.1).

Table 5.1 *Water consumption ranges for various sizes of cattle*

Body weight (kg)	Average water consumption (L/day)
50	6 – 7
70	7 – 9
90	10 – 11
120	14 – 16
150	18 – 20
190	20 – 25
350	25 – 35
450	35 – 45
540 to 730 (dry cows)	20 – 40
540 to 730 (lactating cows)	45 – 110

Source: Australian Model Code of Practice for the Welfare of Animals – Cattle, Standing Committee on Agriculture, Animal Health Committee (1992)

Feed intake

The main factors affecting intake of feed are

- **palatability** – the more palatable the feed, the greater the intake
- **digestibility** – the more digestible the feed, the greater the intake
- **nutrient balance** – an insufficiency or an excess of a particular nutrient can reduce intake, for example, where protein is deficient in mature dry pasture
- **availability** – a pasture may be very high quality but if the supply is limited, animals may not be able to eat enough to satisfy their appetite (this is often the case at the end of a drought when a short green pick is the only feed available).

Intake will vary considerably, being as high as 3 per cent of body weight (on a dry matter basis) on a high quality feed, such as a feedlot ration, and as low as 1.2 per cent on poor quality pasture.

Pasture ecology

Pasture is the most cost-effective source of nutrients for cattle and the major natural resource in any beef production system.

Nutritive value of pasture plants

The nutritional value of pasture plants is determined by their stage of growth, species, and the fertility of the soil.

Plant growth

The age of a pasture plant is the greatest determinant of its nutritional value. Young fresh growth is high in soluble carbohydrates, is easily broken down by rumen microbes, and is generally high in protein. However the *relative nutritive* value (quality in combination with quantity) of young pasture can still be low if total pasture yields are low.

As pasture plants mature, the relative proportion of soluble carbohydrates (sugars and starch) falls and the proportion of structural carbohydrates (cellulose and lignin) increases. Grasses and legumes become less 'leafy' and more 'stemmy'. It is more difficult for rumen microbes to digest the woody structural carbohydrates, so the nutritive value of the forage falls.

Pasture protein levels also fall as plants mature and go to seed. The rumen microbes require a source of nitrogen (such as the protein in the grasses and legumes) for their own growth. When nitrogen is limited, the rumen microbes work less efficiently and the breakdown of forage in the rumen slows.

After the season breaks in spring, the nutritive value of pasture will be highest and cattle will gain weight from this time into early summer. As pastures mature in late summer and into autumn, the rate of gain will decrease. Weight change during winter and early spring will vary depending on the severity of conditions: in mild, wet winters, cattle may make slight weight gains, but in cold, dry winters they may lose weight.

Plant type

At the same stage of maturity, legumes are more digestible than grasses, and temperate grasses are more digestible than tropical grasses. Most of the plants in native and sown pastures are tropical grasses or legumes. Temperate species are limited to special purpose winter forage crops such as oats, rye grass or clovers.

As the nutritive value of leaf is higher than that of stem, leafy grasses are able to supply more nutrients per kilogram of dry matter than stemmy grasses. A mix of grasses and legumes allows the grazing animal to select a diet of highest nutritive value.

Fertile landtype (e.g. blue gum flats)

Poor country (e.g. spotted gum ridges)

Soil fertility

The inherent fertility of the land type affects the nutritive value of the forage. Black speargrass, for example, is more nutritious on black soil forest country than on poor forest country.

Pasture growth

Pasture generally has four stages of growth during the year, during which growth rate, forage quality, and sensitivity to grazing pressure will vary. Pasture growth depends on soil moisture, temperature and soil fertility.

Phase	Plant growth rate	Forage quality	Sensitivity to grazing pressure
short, leafy growth phase	moderate	high	high
well-developed leafy tussock phase	high	good	low to moderate
Reproductive phase	low	moderate to low	low to moderate
Dormant phase	little or none	low to very low	very low


Phase 1 growth


Phase 2 growth


Phase 3 growth


Phase 4 growth

Soil moisture

Soil moisture is the most important factor regulating the amount of forage grown during the warmer months. Soil moisture is largely determined by rainfall (how much, how often, and when). In south east Queensland, rainfall is summer-dominant; about 70 per cent falls between October and March and as a result most pasture growth occurs during this period. Average annual rainfall varies from 1,250 mm in some coastal areas to about 700 mm inland.

However annual rainfall can vary by greater than 50 per cent between years, and the break to the winter dry season is unreliable. This means the amount of forage grown and how this growth is spread throughout the year can vary considerably from year to year.

The amount of rainfall that enters the soil is determined by the intensity of the rainfall and by the soil type, soil condition and ground cover. Hard-setting or surface-sealing soils have lower water infiltration rates than sandy-surfaced soils or self-mulching soils. Heavy stocking rates can lead to a breakdown in the soil structure and, as a consequence, reduced infiltration. At least 50 per cent ground cover as either grass or mulch maximises infiltration and reduces run-off. Run-off reduces moisture availability and causes soil erosion. Run-off may be beneficial for filling surface water storages but is lost as far as pasture growth is concerned.

Temperature

Low temperatures limit pasture growth during winter. Frosts, which can occur from early May to late September, halt the growth of tropical grasses and legumes. Tropical grasses are dormant during winter so winter rainfall will not benefit growth of these pasture plants. However winter rain may encourage the growth of winter-active herbage, improving diet quality, and is important where temperate forage crops (such as oats) are grown.

Heat wave conditions, where daily maxima exceed 40^0C, increase evapo-transpiration and can cause a check in pasture growth. Heat waves can kill establishing pasture seedlings and should be considered when sowing pastures.

Soil fertility

When there is sufficient soil moisture, low soil fertility will limit production.

Nitrogen is the most important nutrient for pasture yield (particularly for grasses). Soil fertility can be improved directly by applying fertiliser or indirectly by including legumes in the pasture mix. Legumes form a symbiotic relationship with nitrogen-fixing bacteria in their roots, making nitrogen more available to these plants and in the soil.

Applying fertiliser to improve or maintain soil fertility is an expensive approach (especially if using nitrogen-based fertiliser) and is only likely to be cost-effective in some high-input sown pasture systems.

Using legumes to improve soil fertility will generally provide no more than modest improvements. The ability of legumes to lift soil nitrogen levels depends on the relative proportion of legumes in the pasture and how efficiently they fix nitrogen (which in turn is determined by the availability of other nutrients such as phosphorus and sulphur).

Pasture composition

Pastures contain a complex mix of grasses and broadleaf plants that grow on a wide range of soil and land types. Individual plants differ in their ability to supply

At least 50 per cent ground cover as either grass or mulch maximises infiltration and reduces run-off.

Heavy stocking rates can lead to a breakdown in the soil structure. Not only is rainfall efficiency reduced but erosion can develop.

Spelling early in the growing season enables the desirable 3P grasses to replenish their root reserves.

nutrients and provide ground cover. Pastures balanced with a mix of species will provide a more consistent nutrient supply throughout the year than pastures dominated by one or two species.

Characteristics of a good pasture plant

The most desirable grasses to have in a pasture are *productive*, *palatable* and *perennial* (3P grasses). *Productive* grasses produce a high quantity of plant material per millimetre of rainfall. *Palatable* grasses contain a high proportion of leaf and are preferentially (selectively) grazed by stock. *Perennial* grasses live for more than one or two years, providing a reliable source of feed and persistent ground cover.

Edible, non-toxic broadleaf plants, including legumes, can complement grasses by supplying nutrients at times of the year when these nutrients are limiting in grasses. When grasses are maturing during late summer and early winter, pasture legumes supply protein. Legumes such as Seca stylo, Wynn cassia and lotononis, when well established in a pasture, can lift individual animal performance by 30 to 50 kg in a year.

Effect of grazing

Grazing affects pasture productivity and pasture composition both positively and negatively. The effect of grazing depends on

- the type of plant and its growth stage
- how severely and how often the plant is grazed
- the season
- how selective the stock are and their preference for a particular type of plant.

Most desirable pasture plants benefit from appropriate grazing, because grazing

- stimulates tillering in grasses and branching in forbs and edible shrubs
- can slow seed set and keep pasture plants in a more palatable growth stage
- opens up the sward to allow light to reach low growing species such as trailing legumes
- allows seeds to germinate and pasture seedlings to establish.

Excessive grazing when pasture is growing can significantly change pasture composition. If leaves are removed faster than they are being replaced, grasses weaken as their stored nutrient reserves are depleted, and they eventually die. Continued overgrazing will effectively remove the desirable 3P (productive, palatable, perennial) plants from a pasture, leading to a long-term decline in pasture productivity and livestock production.

Rest from grazing allows pasture composition to improve. Early in the growing season grasses rely on stored energy reserves in their roots for growth. Once the new growth has produced sufficient leaf area, the plant's energy needs are met by photosynthesis and eventually the root reserves are replenished. Spelling early in the growing season enables the desirable 3P grasses to replenish their root reserves and allows new plants to establish. Spelling late in the growing season will allow grasses and legumes to set seed and ensures sufficient fuel for a burn in the following spring.

Grazing animals will select the most nutritious components of the pasture. Generally, the lighter the stocking rate the better individual animals will perform. Increasing the stocking rate, while reducing individual animal production, will

Heavy stocking has caused blue couch and wiregrass to replace speargrass.

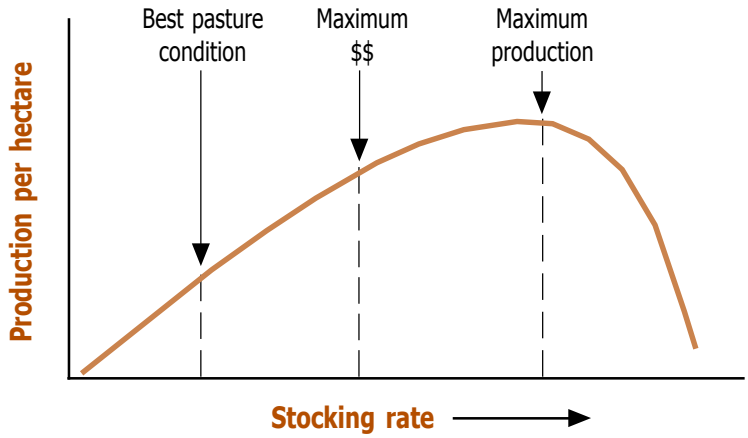


Figure 5.4 *Effect of stocking rate on pasture production per hectare*

increase production per hectare *up to a point*, beyond which production per hectare will decline because of the cumulative impact of reduced individual performance (Figure 5.4).

Pasture management

Consider doing a Grazing Land Management Workshop, phone DPI&F Call Centre 13 25 23

The primary goal of pasture management is to maintain the supply of nutrients from pasture to cattle over a prolonged period. This goal can be achieved by managing pasture composition and maintaining the soil, water and pasture resources. Pasture management principles are similar for native and sown pastures.

Sustainable pasture management is based on appropriate forage utilisation. Utilisation describes how much of the total herbage grown in a given season is actually grazed by stock. Utilisation rates of 20 to 30 per cent for native pastures and 40 to 50 per cent for sown pastures are considered to be sustainable.

Appropriate utilisation leaves sufficient pasture to

- provide ground cover and protect the soil from erosion
- form litter and maintain soil organic matter
- preserve the crown and root systems of 3P grasses, enabling them to remain vigorous and set seed
- provide fuel for an effective fire
- allow for other grazing (e.g. kangaroos, insects, microfauna).

Tools for controlling forage utilisation and managing changes in pasture composition include

- adjusting stocking rates to feed availability (forage budgeting) and strategic spelling
- fire
- fencing to separate widely different land classes
- distributing watering and supplementary feeding points across large paddocks to encourage more even grazing
- strategic spelling and grazing
- monitoring.

Grazing systems

Grazing systems vary from low-input conservative set stocking to high-input rotational grazing systems.

Set stocking

Set stocking is commonly used for native pastures and for breeder operations. Stocking rates are based on the long-term carrying capacity of a given paddock, which is determined from past experience or calculated using long-term rainfall records and rainfall use efficiency indices for a given land type and land condition. Overgrazing during dry years is a risk.

Variable stocking

Variable stocking is suited to production systems where stock numbers are relatively easy to adjust (e.g. growing and finishing). Pastures are usually assessed at the end of the growing season (in May) and stocking rates adjusted so that there is an appropriate amount of standing feed at the break of season in spring. Variable stocking reduces the risk of overgrazing in dry years, and provides potentially better forage utilisation in wet years.

Strategic spelling

Strategic spelling is planning to spell individual paddocks every 4 to 5 years. Spelling is most effective in the growing season, when stock numbers are adjusted by distributing animals over the remaining paddocks. By completely removing grazing during the growing season, new seedlings can establish and 3P grasses and desirable forbs can replenish root reserves and set seed. This method also ensures a build-up of fuel.

Rotational grazing systems

Rotational grazing systems are intensive systems requiring improved management skills and an increased workload. Large paddocks are fenced into a number of smaller paddocks and livestock are shifted around the paddocks according to available feed and pasture growth. Some systems use high density stocking rates for short grazing periods followed by long rest periods. Initial set up costs (fencing and water) can be high. Benefits include more even distribution of grazing (resulting in improved per hectare productivity) and reduced selective overgrazing. The downside to reducing selective grazing is lower individual animal performance.

Forage budgeting

See Forage budgeting pp 154–156 and Feed plans pp 128–129, 134

Winter/dry season forage budgets are a useful tool for balancing stocking rates and pasture utilisation. The aim of a dry season forage budget is to manage the stocking rate to aim for a certain level of standing dry matter remaining in the paddock at the end of the dry season/start of the spring break.

In intensively managed systems, forage budgets may allow for stocking rates and production targets to change with seasonal conditions. Forage budgeting during the growing season is more complex and involves more guesswork than dry season forage budgeting.

When setting stocking rates by forage budgeting, you will need to

- set a goal for the amount of dry matter at end of the dry season (i.e. ground cover, fuel for a fire)
- estimate the feed available at the beginning of the period, taking into account the pasture quality and a sustainable utilisation rate

- calculate the stock's feed requirements per animal during the period, taking into account starting weight, expected weight gain, expected daily intake, and the number of days until good rain is expected
- determine the appropriate stocking rate to achieve the end-of-season goal in terms of hectares per animal and in terms of the total number of animals the pasture in a particular paddock will support.

Calculating a forage budget is worked through in the *Useful calculations and worksheets* (pages 154–156). Table 1.1 (page 5) and Table 5.2 (page 59) show the ranges of stocking rates applicable to various land and pasture types.

Most beef producers don't vary their breeder numbers much between years so their stocking rates remain fairly static. Past experience and local knowledge are good guides to the correct stocking rate for particular land types and individual paddocks. To develop your understanding of sustainable pasture utilisation and stocking rates on your property through the dry season, record your estimates and calculations and monitor both animals and pasture as the seasons progress.

Fire

See Savanna burning: Understanding and using fire in northern Australia in Recommended reading pg 176

Fire can be used to

- reduce undesirable grasses
- control woody weeds and regrowth
- reduce wildfire hazards
- limit patch grazing.

Burn no more frequently than every 3 to 4 years

Many desirable native pasture species (especially black speargrass) are adapted to fire, so fire can be used effectively to change pasture composition in native pastures. For example, fire in combination with pasture spelling is particularly useful in changing wiregrass-dominant pastures back to pasture dominated by desirable 3P species such as black speargrass and forest bluegrass.

Many of the sown pasture species are not particularly adapted to fire, so fire is seldom used to manage sown pastures. If legumes such as Seca stylo are over-sown into a native pasture, fire can be used prior to seed broadcasting to remove competition. As the legumes are susceptible to fire, fire should not be used again until the legumes are well established and are capable of regenerating from seed.

Burning controls woody regrowth up to 1 m high

Burns in spring and early summer, following rainfall of at least 25 mm, will be most effective.

Fencing and water distribution

Fencing and water distribution control cattle movement and grazing pressure throughout the pasture.

Different land types requiring different management should be fenced separately, where feasible. This allows stocking rates or grazing systems to be altered according to the special requirements of each land type.

Locating watering points centrally in smaller paddocks or distributed throughout large paddocks encourages animals to graze paddocks evenly.

See GRASS Check - A Graziers Rangeland Assessment in Recommended reading pg 175

Pasture monitoring

The key to effective pasture monitoring is to have a system in place for recording objective information about species present, ground cover and stocking rates. The recording procedure needs to be uniform for different paddocks and different years. Photographs taken from the same point provide a good objective record.

Photo standards enable you to monitor pastures and assess the effect of stocking rate

The monitoring system GRASSCheck identifies key indicator grasses that, by their presence or absence, indicate changes in pasture composition.

A *decreaser* is a grass that will decrease when exposed to heavy or prolonged grazing, e.g. kangaroo grass. The decrease may be because the grass is very palatable (and thus subject to selective overgrazing) or because the grass lacks a competitive advantage. Many 3P grasses are decreasers.

An *increaser* is a grass which increases with prolonged or heavy grazing. The increase can be due to some competitive advantage (e.g. blue couch) or to low palatability (e.g. wiregrass).

Sown pastures

See Grazing the North: creating wealth and sustaining the land in Recommended reading pg 175

The most easily recognised type of sown pasture is the fully sown pasture or 'improved' pasture, often referred to as a 'high input' pasture development. This usually involves removing the existing vegetation, preparing a seedbed, and sowing exotic grasses and legumes. In most situations it will not be economical to replace a productive native pasture with a fully sown pasture.

The other major form of sown pasture development, referred to as 'low input' pasture development, involves oversowing perennial legumes into an existing native pasture. Table 5.2 shows likely cattle growth response to legume-improved pasture on a number of landtypes.

Ley pastures and browse legume forage systems are other forms of sown pasture development. Ley pastures (pasture/crop rotations) are used in cropping systems to help restore soil fertility and structure and to break disease cycles. Ley pastures are relative short-term (2 to 5 years) and are restricted to cropping lands.

Table 5.2 *Average performance of cattle grazing coastal and sub coastal pastures*

Pasture type	Pasture condition					
	Good			Poor		
	Annual gain (kg/hd)	Stocking rate (ha/AE)	Response to legumes (kg/hd/yr)	Annual gain (kg/hd)	Stocking rate (ha/AE)	Response to legumes (kg/hd/yr)
Native pasture low fertility soils	110 (100-120)	5 (4 – 6)	30 (20 – 40)	90 (70 – 110)	6 (5 – 8)	40 (30 – 50)
Native pasture low/med fertility soils	150 (110 – 190)	4 (3 – 6)	30 (20 – 40)	125 (100 – 150)	5 (4 – 7)	40 (25 – 50)
Native pasture med density soils	170 (140 – 210)	3 (2.5 – 4)	20 (10 – 30)	150 (120 – 180)	4 (53 – 5)	40 (25 – 50)
Sown grass pasture med fertility soils	180 (150 – 220)	2* (1.5 – 3)	10 (0 – 25)	150 (120 – 180)	3 (2 – 4)	40 (25 – 50)
Sown grass pasture high fertility soils	190 (160 – 240)	2* (1.5 – 3)	10 (0 – 25)	160 (140 – 190)	3 (2 – 4)	40 (25 – 50)

* These stocking rates are achievable only in the first few years after sowing.
( ) range, AE = adult equivalent (see *Glossary pg 181*)

Source: Cheffins (1996)

Sown pastures offer high productivity on fertile landtypes

Sown pastures can play several roles in a beef production enterprise. The benefits of sown pastures include

- faster cattle growth rates
- higher turnover rate of stock
- ability to take advantage of favourable soil fertility and moisture conditions (e.g. brigalow, alluvial flats, irrigation)
- improvement of soil fertility and breaking of pest cycles in cropping systems (ley pastures)
- improved productivity from degraded areas
- suppression of weeds.

Sown pastures can improve the supply of nutrients to cattle. This means higher weight gain per unit area as

- higher weight gain per head, or
- higher carrying capacity, or
- both.

Many sown pasture species have a longer growing season than native species, so cattle can gain weight for longer in the year.

Limitations or problems with sown pastures include

- high establishment costs (land preparation, seed, destocking, farming and sowing equipment)
- risk of failed establishment
- poor choice of pasture species
- pasture longevity ('run-down')
- pasture maintenance costs
- unreal expectations regarding productivity and animal production.

Planning to develop pasture

The following discussion refers mainly to the high input development option of a fully sown 'improved' pasture.

Pasture development can be expensive and risky. A planned approach to development includes the following steps

- Decide why you need sown pastures (e.g. for finishing sale cattle).
- Assess the economics (gross margins and cash flow).
- Choose suitable land (develop your best country first).
- Select suitable pasture species (i.e. 'best bet' species and mixtures for a given land type).
- Evaluate land preparation options that will give the best establishment with least soil loss.
- Investigate the technology – consider seed treatment, seeding rate, time of year, sowing depth and techniques.
- Plan for the establishment phase – decide when to graze so as to minimise damage to the pasture.
- Budget for pasture maintenance (e.g. spelling, renovation or fertiliser).

Tables 5.3, 5.4 and 5.5 (pages 58–60) suggest 'best bet' species for the Moreton region and the coastal, central and north Burnett regions. Further information on individual species is available from the DPI&F Beef Notes and Farm Notes series, CSIRO publications and produce agents. Seek local advice for your situation.

Managing sown pastures

The way in which a pasture is grazed affects how productively it will supply nutrients to grazing animals. Best grazing strategies are those which

- maintain desirable species
- keep feed young and nutritious
- maintain adequate leaf area for plant regrowth
- retain ground cover for soil protection.

On sown pastures these outcomes can be achieved when utilisation rates are 40 to 50 per cent and should result in sustainable liveweight gains. To make informed stocking decisions, monitor animal performance, pasture composition and ground cover.

Nitrogen is often the most limiting nutrient for pasture production. After a number of years, the amount of available nitrogen declines in a process known as pasture 'run-down'. Run-down is the major cause for sown pastures failing to be cost-effective over the long term (Figure 5.5).

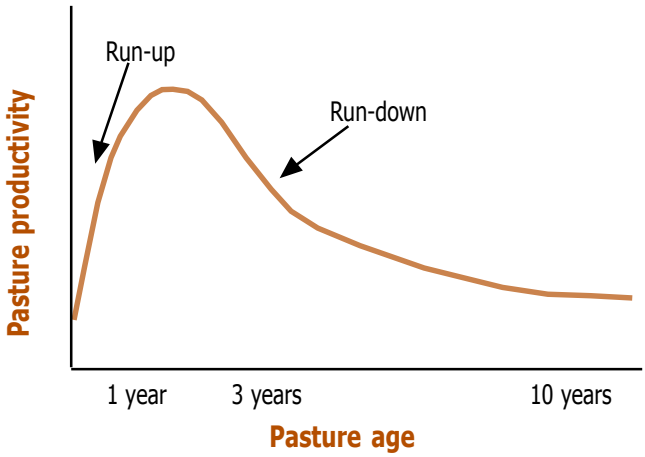


Figure 5.5 *Sown pasture productivity runs down over time*

In uncultivated land, a lot of nitrogen is present in the soil in a form unavailable for plant up take. When land is first cultivated, this previously unavailable nitrogen is released. As a result the sown pasture receives a boost known a pasture 'run-up'. However in time much of the available nitrogen again becomes locked up in an unavailable form and pasture productivity declines.

Nitrogen availability can be managed by

- mobilising existing soil nitrogen (e.g. ploughing, renovating, mechanically controlling regrowth)
- using well-adapted legumes for nitrogen-fixation
- applying nitrogen fertiliser (only feasible for high input production systems)
- fertilising to overcome deficiencies of nutrients limiting nitrogen fixation (especially phosphorus, molybdenum, sulphur).

Generally, the higher the inherent fertility of the soil, the slower the run-down. In sown pastures on fertile brigalow soil, run-down can take up to 20 to 30 years. On an infertile sandy soil, this process may take just 2 years. Under run-down conditions, most exotic grasses are less competitive than natives and often disappear.

Landtype	Best bet grasses	Best bet legumes	Other options	Methods	Comments
Brigalow softwood scrub	Rhodes (Katambora, Callide) green panic (Petrie) panic (Gatton) buffel (Biloela, Gayndah) creeping bluegrass (Hatch, Bisset)	leucaena (Peru) Tarramba (Cunningham) cassia (Wynn) desmanthus (Jaribu)	bluegrass (Floren) purple pigeon grass (Inverell) barrel medic siratro (Siratro, Aztec)	full cultivation blade ploughing renovation	Creeping bluegrass, cassia and shrubby stylo are best in lighter scrub soils.
Brigalow (clay)	Rhodes buffel creeping bluegrass bluegrass (Floren)	desmanthus leucaena butterfly pea (Milgarra) caatinga stylo (Primar, Unica)	purple pigeon grass makarikari grass (Bambatsi) barrel medic	blade ploughing renovation cultivation	Paspalum, Loren and makaridari grass in melonhole country. Leucaena where drainage is good. Establishment of grasses and legumes is difficult.
Blue gum flats (mostly cracking clays)	Rhodes bluegrass (Floren) creeping bluegrass	siratro barrel medic lucerne leucaena caatinga stylo	purple pigeon grass desmanthus shrubby stylo American jointvetch (Lee, Glenn) butterfly pea	full cultivation renovation	Shrubby stylo should not be sown on heavy clays or where drainage is restricted.
Silver-leafed ironbark (clay)	Rhodes (Katambora, Pioneer) creeping bluegrass	shrubby stylo caatinga stylo	green panic purple pigeon grass siratro butterfly pea leucaena	full cultivation renovation	Rhodes and green panic will decline without nitrogen. Leucaena on deeper soils.
Box (clay)	Rhodes (Katambora, Pioneer) buffel (Biloela, Gayndah, American) creeping bluegrass	shrubby stylo	desmanthus cassia	full cultivation renovation	Leave country with sufficient cover for soil protection.
Silver-leafed ironbark (granite) and **narrow-leafed ironbark**	Rhodes (Katambora, Pioneer) creeping bluegrass	finestem stylo (Oxley) shrubby stylo cassia lotononis (Miles)	sabi grass (Nixon) jointvetch (Bargoo)*	light cultivation renovation bandseeder strip cultivation	Leave country with sufficient cover for soil protection.
Box (erosive)	Rhodes (Katambora, Pioneer) creeping bluegrass Indian bluegrass (Keppel, Medway)	shrubby stylo	pangola grass cassia	light cultivation	Grasses suitable for land reclamation are required.
Gum-topped box, spotted gum, narrow-leafed ironbark with wattle understorey	Not suitable for most sown grasses, but can grow Indian bluegrass	finestem stylo shrubby stylo cassia lotononis		bandseeder aerially seeded strip cultivation	

*seed rarely available. () names in (parentheses) are cultivar names.

Source: *Sown pasture management workshop. Futureprofit.* Department of Primary Industries and Fisheries, Queensland.

Table 5.4 *Dryland sown pastures for coastal Burnett*

Landtype	Best bet grasses	Best bet legumes	Other options	Comments
Aluvial flats	Rhodes (Callide) creeping bluegrass pangola signal (Basilisk)	siratro scrubby stylo lotononis cassia	Caribbean stylo (Verano, Amiga) American jointvetch pinto peanut (Amarillo) paspalum	
Basalt soils	Rhodes (Callide, Katambora) bluegrass (Floren) creeping bluegrass green panic	siratro glycine (Tinaroo, Cooper) shrubby stylo (Seca) Caribbean stylo (Verano) cassia jointvetch (Lee)	guinea grass (Hamil)	Caribbean stylo as a pioneer only.
Coastal lowlands	Rhodes pangola	lotononis lotus (Maku) American jointvetch	koronivia grass (Tully)	Pinto peanut and lotus for moist situations only.
Hills and mountains (granite sands)	Rhodes (Katambora) signal Indian bluegrass (Keppel)	finestem stylo Caribbean stylo shrubby stylo lotononis cassia		Caribbean stylo as a pioneer only.
Foxtail flats (wet)	paspalum pangola	lotus American jointvetch	koronivia grass setaria (Narok, Solander)	

() names in (parentheses) are cultivar names.
Seeding rates: Small seeded legumes, for example lotononis, 500 g/ha. Medium size, for example siratro, 2 – 3 kg/ha. Large seeded legumes, for example pinto peanut, 10 – 15 kg/ha. Grasses, 1 kg/ha pure live seed.

Source: *Sown pasture management workshop. Futureprofit.* Department of Primary Industries and Fisheries, Queensland.

Landtype	Best bet grasses	Best bet legumes	Other options	Comments
Aluvial and black soils	kikuyu Rhodes (Callide) green panic panic setaria (Narok, Solander)	white clover (Haifa, Ladino) red clover lucerne lotus pinto peanut	digitgrass (Premier) medics kenya white clover (Safari)	Kikuyu only on high fertillity soils. Lotus in wet areas only.
Shallow stony soils	Rhodes (Callide)	siratro lotononis desmondium (Greenleaf) axillaris (Archer)		Use desmodium and axillaris only in areas with rainfall above 900 mm.
Red soils	kikuyu	creeping vigna (Shaw) white clover (Haifa, Ladino)	green panic glycine	
Brown soils	Rhodes (Callide) green panic panic kikuyu setaria	siratro glycine white clover lucerne	digitgrass medics jointvetch	Jointvetch only in areas with rainfall above 900 mm. Setaria in moist areas.
Duplex soils	Rhodes (Callide, Katambora) Indian bluegrass	siratro lotononis pinto peanut	cassia shrubby stylo	
Granite sandy soils	Rhodes (Callide, Katambora) setaria	finestem stylo siratro lotononis pinto peanut	cassia	Finestem stylo is the preferred species. Setaria in moist areas.
Coastal sands	pangola paspalum setaria	siratro lotononis lotus white clover	jointvetch	

() names in (parentheses) are cultivar names.
Seeding rates: Small seeded legumes, for example lotononis, 500 g/ha. Medium size, for example siratro, 2 – 3 kg/ha.
Large seeded legumes, for example pinto peanut, 10 – 15 kg/ha. Grasses, 1 kg/ha pure live seed.

Source: *Sown pasture management workshop. Futureprofit.* Department of Primary Industries and Fisheries, Queensland.

Good grass production on open country

Reduced grass production but potential benefits in terms of timber and wildlife habitat

Woodland management

Interactions between pastures and trees

Carrying capacity can be increased by clearing trees. However, this does not mean that all trees should be removed. Some areas should never be cleared in the interest of providing shade for cattle, stabilising waterways, reducing salt problems in adjacent lowland or avoiding creating salt problems, or for conservation or aesthetic purposes.

Trees compete with grass for water, light and nutrients, and markedly reduce pasture productivity. Competition for moisture is more pronounced in drier inland areas. The graph below demonstrates that clearing results in increased pasture production. In wetter areas there is good pasture response to moderate clearing, whereas in drier areas, clearing has to be more severe to achieve a proportional pasture response.

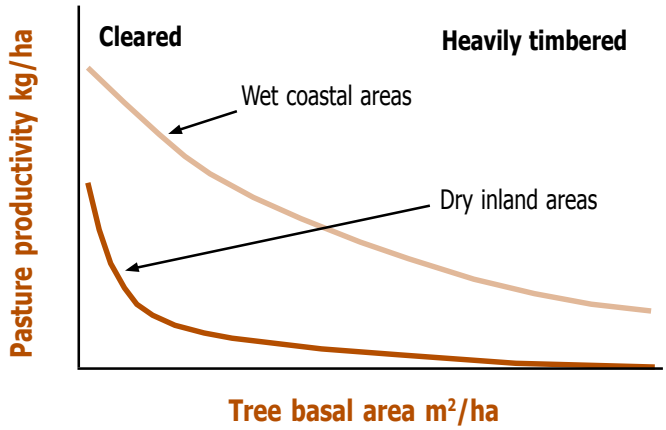


Figure 5.6 *As trees increase, pasture productivity decreases*

Eucalypt woodlands have the ability to rejuvenate following clearing. Managing regrowth is an important aspect of land management in south east Queensland. Regrowth can be back to pre-clearing tree basal area levels within twenty to thirty years.

Tree clearing legislation

See Department of Natural Resouces, Mines and Energy pg xxx in Useful contacts

Tree clearing on all freehold land is covered by the *Vegetation Management Act (1999)* and on leasehold or crown land by the *Land Act (1994)*. Consult the Department of Natural Resources, Mines and Energy (NRM&E) for more information.

Declared plants

Weeds are a **problem** in that they reduce the productivity of agricultural land or have adverse impacts on biodiversity. Weeds are also a **symptom** of the larger scale problem of changed and/or poor land use. Successful weed management relies on a holistic approach and is based on an understanding of the ecology of the weed.

Declared plants are plants recognised by state or local government as having, or having the potential to have, significant impacts on agricultural production or the environment. Most declared plants are weeds that have the potential to significantly reduce the productivity of agricultural land. Some are poisonous

plants. Some can form thickets and reduce access for management procedures such as mustering; others can choke waterways or adversely affect riverine environments.

See Department of Natural Resouces, Mines and Energy in Useful contacts pg 171

Landholders have certain responsibilities under the *Land Protection (Pest and Stock Route Management) Act (2003)* to manage declared plants. The enforcement of these responsibilities is chiefly the responsibility of local government. The specific responsibilities depend on the classification of the plant. There are provisions for local government to develop Pest Management Plans on a shire basis. Weed problems on properties can be tackled most effectively with individual landholders developing property-based pest management plans.

Pest plants can be declared under three simplified categories that are common to both weeds and pest animals i.e. Class 1 pests, Class 2 pests and Class 3 pests. (This replaces the former more complex 5 plant and eight animal categories.)

Class 1 pests	Pests not generally present in Queensland, but which have a recognised pest potential elsewhere. If infestations of the pest are found in Queensland, the goal is to eradicate them.
Class 2 pests	Pests present in Queensland which have a major adverse impact on the economy, environment and society. Usually the target of active pest control programs at State, regional or local levels.
Class 3 pests	Pests present in Queensland which have an adverse impact mainly on the environment or society. They may require management or control in some areas especially in environmentally significant areas or areas relatively free of the pest.

Plant species declared as pests in Queensland are listed in Table 5.6 pages 68–69.

Landholder responsibilities and legal requirements

For pests declared as Class 1 pests and Class 2 pests, landholders must take reasonable steps to keep their land free of the pests and can be issued with a pest control notice if they do not do so.

Class 3 pests are seen chiefly as having adverse impacts in non-agricultural situations. Pests in this category cannot be supplied or sold (as for the other categories) and can be included in a pest control notice for private land that is in or adjacent to environmentally significant areas if the declared pest is a threat to the survival of the area.

There is no requirement to control Class 3 pests on other private lands. The pest may be tolerated in a situation (e.g. private gardens, schoolyards or street plantings) where it presents little threat because there is continual management and control.

Produce, livestock, sand and soil and machinery have the potential to move weed seed. Under the *Land Protection Act*, it is an offence to sell a product contaminated with the reproductive material of a Class 1 pest or of a Class 2 pest that has been listed by regulation to be a notifiable pest. If the product for sale contains the reproductive material of these declared pests, a declaration must be made to the purchaser.

Quarantine powers exist to restrict the spread of Class 1 and Class 2 pests. These powers are available to local government as well as the Department of Natural Resources, Mines and Energy. A quarantine notice can be effective for up to 3 months.

Developing a plan

Planning to manage pest plants involves the following steps

See Poisonous plants pp 130–133

- **Identifying declared plants** – As with poisonous plants, the first step in managing declared plants is the ability to identify them. It is a good idea to be suspicious of any plant you haven't seen before and have it identified. People who can identify weeds are located at local councils, NRM&E and DPI&F offices and Landcare groups.
- **Categorising and mapping the infestation –** Assess the infestation across the property. Map weed locations and property infrastructure necessary for management, such as fencing, roads and watering points. Rank the level of infestation according to each plant population (e.g. isolated 'scout', scattered plants and isolated clumps, moderate infestation, heavy infestation). Many control methods have thresholds for plant density beyond which they may become impractical or excessively expensive.
- **Determining the land use capability and accessibility** – Generally, the more fertile the land type, the more options there are for management and control. There is a higher cost-benefit in controlling a weed infestation on good country compared with controlling an infestation on poor country. The accessibility of an infestation will also affect management decisions. Country that can't be accessed with machinery has few control options.
- **Ensuring sufficient resources are available** – Weed management can be very expensive and time consuming. You need to be certain that you have sufficient resources (machinery, equipment, labour and finances) to implement the management plan.
- **Choosing effective control strategies** – Investigate control options best suited to your situation. The easiest or cheapest in the short term may not be effective in the long term. Discuss your ideas for managing weeds with people who have had some experience in similar situations.
- **Retaining flexibility in a 5 to 10 year planning cycle** – There is no such thing as a silver bullet when it comes to weed management; it takes time and effort. Break the management effort up into smaller chunks and concentrate on specific areas before moving on to larger areas. There is usually a requirement for ongoing follow-up so a plan needs to run over 5 to 10 years.

Control strategies

Healthy pasture will limit the establishment of weeds. Paddocks that are subject to over-grazing are more susceptible to weed invasion than well-managed paddocks. It makes poor economic sense to invest considerable funds and effort into managing declared plants, and then to jeopardise that effort through poor grazing management. On-going pasture management is critical.

The most effective control strategy for a particular weed situation depends on

- the plant population (average number of plants/ha)
- the class of country (arable versus non-arable)
- how accessible the country is for machinery.

A typical life cycle of a weed involves the establishment of pioneer or 'scout' plants in a new area. These plants grow and produce seed, which can be the start of soil seed banks and are a source of further contamination. The life cycle continues and plant populations build up (Figure 5.7).

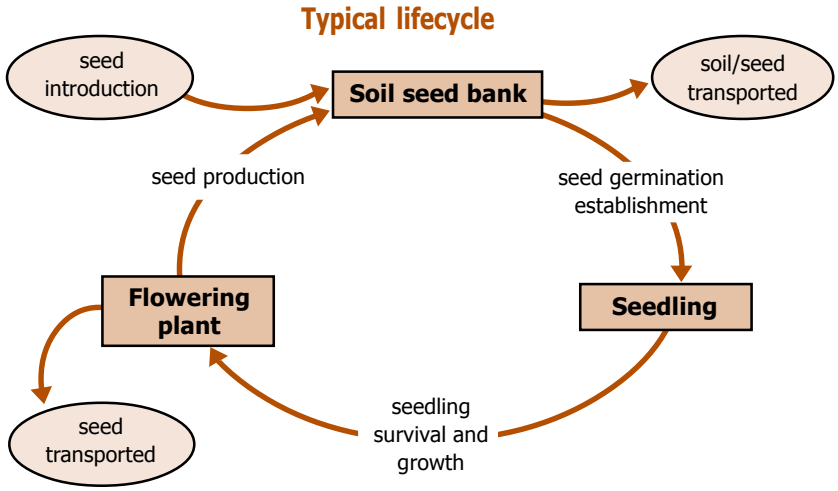


Figure 5.7 *Typical weed life cycle*

Generally it is best to work from scattered plants toward heavier infestations. With woody weeds such as prickly acacia and mesquite, the seeding trees must be eliminated first to stop seed production. High priority areas include yards, holding paddocks and access tracks.

Common vectors for seed transport include

- livestock
- vehicles and machinery
- fodder and pasture seed
- other factors such as wind, water and native and feral animals.

Cattle will transport seed either through their gut or attached to their hair. Cattle suspected of carrying seed should be quarantined for at least 5 days. The quarantine area can be a set of yards or a well-grassed holding paddock or laneway. Never shift cattle directly from a contaminated paddock to a clean one and always determine the property of origin of purchased livestock.

Machinery and vehicles suspected of carrying seed should be cleaned down before entering a clean area. It may be necessary to restrict the access of off-farm vehicles.

Determine the origin of hay. Only feed hay in specific feed-out stations and monitor for weeds. Only purchase pasture seed from a reputable merchant and ask to see the analysis report (which is your right as the purchaser).

Wind, water and feral and native animals can move seed. Management options are limited but include developing buffer strips and patrolling for scout plants.

When weeds become established, several control methods may need to be used within a single paddock. For example, where a forage pre-cropping option is used to manage giant rats tail grass, it is necessary to spot-spray the headlands, fence lines and any gullies. Also, it is important that cattle are not reintroduced to the paddock from an infested area.

For details on management options for specific weeds, contact your shire weeds officer, local NRM&E Land Protection Officer or contact the DPI&F Call Centre on 13 25 23.

Table 5.6 *List of declared plants*

Common name	Pest category			Botanical name
	1	2	3	
acacias (non-indigenous)	X			*Acacia* spp. other than *A. nilotica* and *A. farnesiana*
African boxthorn		X		*Lycium ferocissimum*
African fountain grass			X	*Pennisetum setaceum*
alligator weed	X			*Alternathera philoxeroides*
American rat's tail grass		X		*Sporobolus jacquemontii*
anchored water hyacinth	X			*Eichhornia azurea*
annual ragweed		X		*Ambrosia artemisiifolia*
asparagus fern			X	*Asparagus acthiopicus 'sprengeri', A. africanus* and *A. plumosus*
athel pine			X	*Tamarix aphylla*
badhara bush	X			*Gmelina elliptica*
balloon vine			X	*Cardiospermum grandiflorum*
belly-ache bush		X		*Jatropha gossypiifolia*
bitou bush	X			*Chrysanthemoides monilifera subsp. rotundata*
blackberry			X	*Rubus angiocandicans, Rubus fruiticosus* agg.
bridal creeper	X			*Asparagus asparagoides*
broad-leaved pepper tree			X	*Schinus terebinthifolius*
cabomba		X		*Cabomba spp.*
camphor laurel			X	*Cinnamomum camphora*
cat's claw vine			X	*Macfadyena unguis-cati*
Chilean needle grass	X			*Nassella neessiana*
chinee apple		X		*Ziziphus mauritiana*
Chinese celtis			X	*Celtis sinensis*
Christ's thorn	X			*Ziziphus spina-christi*
lantana (all species)			X	*Lantana spp.*
Dutchman's pipe			X	*Aristolochia spp.* other than natives
fireweed		X		*Senecio madagascariensis*
floating water chestnuts	X			*Trapa spp.*
giant Parramatta grass		X		*Sporobolus fertilis*
giant rat's tail grass		X		*Sporobolus pyramidalis* and S. *natalensis*
giant sensitive plant		X		*Mimosa invisa*
gorse	X			*Ulex europaeus*
groundsel bush		X		*Baccharis halimifolia*
harrisia cactus		X		*Eriocereus spp.*
harungana			X	*Harungana madagascariensis*
honey locust	X			*Gledistia spp.* including cultivars and varieties
horsetails	X			*Equisetum spp.*
hymenachne		X		*Hymenachne amplexicaulis*
kochia	X			*Kochia scoparia*

Common name	Pest category			Botanical name
	1	2	3	
Koster's curse	X			*Clidemia hirta*
lagarosiphon	X			*Lagarosiphon major*
lantana			X	*Lantana camara*
limnocharis	X			*Limnocharis flava*
Madeira vine			X	*Anredera cordifolia*
Madras thorn	X			*Pithecellobium dulce*
mesquites	X			*Prosopis spp.* other than *P. glandulosa, P. pallida, P. velutina*
mesquites		X		*Prosopis glandulosa, P. pallida and P. velutina*
miconia tree	X			*Miconia spp.*
mikania vine	X			*Mikania spp.*
mimosa pigra	X			*Mimosa pigra*
mother of millions		X		*Bryophyllum spp.*
myrica	X			*Myrica faya*
parkinsonia		X		*Parkinsonia aculeata*
parthenium		X		*Parthenium hysterophorus*
piper	X			*Piper aduncum*
pond apple		X		*Annona glabra*
prickly acacia		X		*Acacia nilotica*
prickly pear		X		*Opuntia spp.* other than *O. ficus-indica*
privets			X	*Ligustrum lucidim* and *L. sinense*
red sesbania	X			*Sesbania punicea*
rubber vine		X		*Cryptostegia grandiflora*
salvinia		X		*Salvinia molesta*
salvinias	X			*Salvinia spp.* other than *S. molesta*
Senegal tea	X			*Gymnocoronis spilanthoides*
serrated tussock	X			*Nasella trichotoma*
Siam weed	X			*Chromolaena odorata*
sicklepods		X		*Senna obtusifolia, S. hirsuta* and *S. tora*
Singapore daisy			X	*Spagneticola trilobata*
thunbergia	X			*Thunbergia annua, T. fragrans* or *T. laurifolia*
thunbergia		X		*Thunbergia grandiflora*
tobacco weed		X		*Elephantopus mollis*
water hyacinth		X		*Eichhornia crassipes*
willow			X	*Salix spp.* other than *S. babylonica, S.* x *calodendron* and *S.* x *reichardtii*
witch weeds	X			*Striga spp.* other than natives

Source: Adapted from *Land Protection (Pest and Stock Route Management) Regulation 2003*, Department of Natural Resources, Mines and Energy, Queensland.

Growth management

6

All cattle destined for slaughter have production targets to meet in order to comply with specific market requirements. Nutrition, animal health and genetics will determine an animal's growth and how well it will achieve annual and final growth targets. Animal performance can usually be improved with better nutrition, husbandry and inputs, but the cost of improving performance may outweigh the financial benefit gained on sale.

Meeting market targets

See the Cooperative Research Centre for Cattle and Beef Quality in Useful contacts pg 170

Figure 6.1 shows the major beef slaughter markets. They are defined in terms of weight for age. Typical growth pathways of cattle are also shown. Short periods of high weight gain through production feeding to reach certain markets are indicated by the dashed red lines. The table highlights the limitations of some production systems. For example, it is unlikely that cattle grown on poor native pasture will reach the weight for age specification for the European (EU) market. However, young cattle grown on sown pasture and finished on grain will easily meet the specifications for the domestic trade.

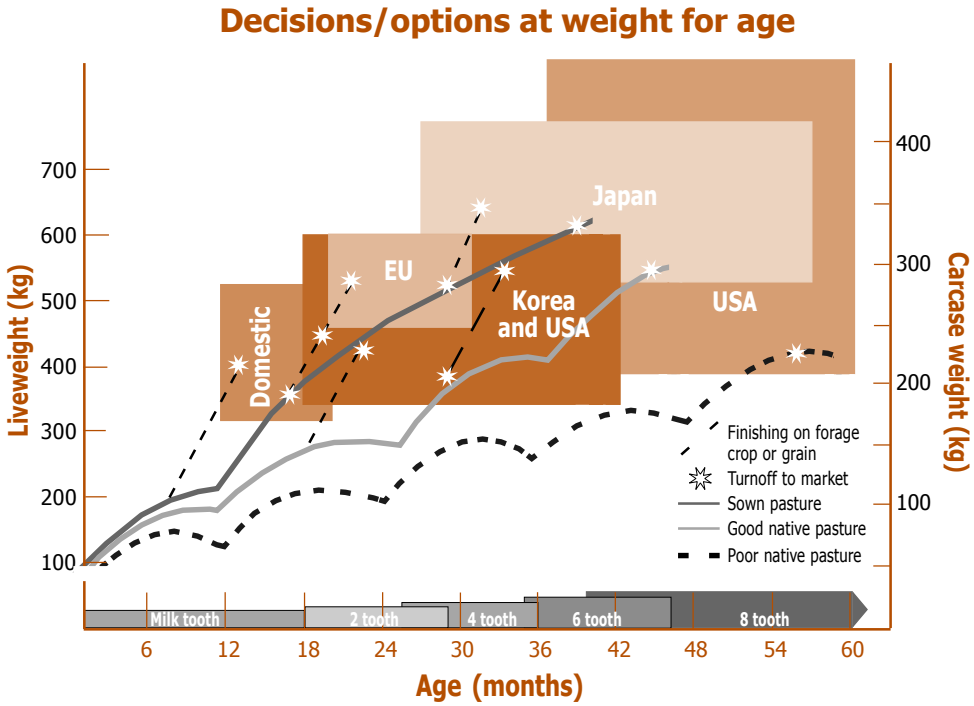


Figure 6.1 *Major beef slaughter markets and typical growth pathways to meet these markets*

To manage growth to achieve production targets, you need to

- know the specifications of the target market, in particular age, weight (live or dressed), fat depth, breed restrictions, feeding requirements, and other restrictions such as prohibited inputs
- consider the capability of your country and whether it is possible to achieve the weight gains required to meet a particular target market on pasture alone
- continually assess pasture quantity and quality in relation to animal production targets
- assess the value of providing additional feed if animals will not achieve required production targets on pasture alone.

Table 6.1 (page 73) outlines the major management actions required at each of the four common age groups.

Table 6.1 *Major cattle age classes, respective markets and key management decisions*

	Age (months)	Liveweight range (kg)	Health and husbandry	Market options
Birth to weaning	0 – 6	30 – 180	Vaccinate at branding and 4 to 6 weeks later with booster. 5-in-1 or 7-in-1. Brand, castrate, and dehorn.	Vealers
Weaner to yearling	6 – 8	180 – 310	If a tick region, vaccinate for tick fever at weaning. Three-germ vaccine is reccommended.[1] Check worm, tick and buffalo fly burdens and treat if necessary. Weigh animals to check how they are performing in relation to production targets. Consider market options and need for supplementation to increase weight gain during winter.[2]	Stores and light domestic trade
Yearling to steer	18 – 30	310 – 450	Check for cattle tick and buffalo fly and treat if necessary. Weigh animals to check if they will achieve target weights. If not on target, review options: Feed for production, target another market, or sell as stores.	Domestic slaughter Stores Export slaughter markets[2] – Japanese – EU – Korean
Store to Japanese ox	30 – 42	450 – 630	As for 18 – 30 months	Export slaughter markets[2] – Japanese – EU – Korean

[1] Note: Where practical separate tick fever vaccination from other vaccinations by two to three weeks to avoid incompatibility.

[2] Animals that have been raised on high quality pasture such as developed scrub country may be heavy enough for export slaughter markets by 30 months of age, provided they have the genetic potential to express this level of growth and maturity pattern.

Firstly, determine interim production targets that will need to be achieved on the way to achieving the final target. Then monitor animal performance by regular weighing or observation to determine whether these interim targets have been or will be achieved. If not, determine the cause (disease, parasites, nutrition) and decide on a plan of action. Table 6.2 provides a guide to the minimum daily and annual weight gains required to meet a range of markets.

When considering whether to improve weight gains, first weigh and age animals, and determine

- how much weight they have to put on to meet market specifications
- what time is available
- what improvements in nutrition or other inputs are required
- whether it will be cost effective.

Table 6.2 *Weight gains required to achieve a range of target market weights*

Market	Teeth (permanent incisors)	Liveweight (kg)	Age	Average daily gain from birth[1]	Annual gain (kg)
Domestic	2	420	18 months (550 days)	0.71 kg	260
EU	4	550	30 months (900 days)	0.57 kg	210
Japanese	Up to 7	630	30 months (900 days)	0.67 kg	245
			42 months (1,270 days)	0.47 kg	171

[1]Assumes a birth weight of 30 kg.

Note: An annual weight gain of 200 kg could be expected on the very best native pasture such as blue gum flats. This equates to 0.54 kg gain per day.

Table 6.3 lists a range of management options for improving animal performance.

Table 6.3 *Typical production performance for a range of feeds and HGPs*

Type of feed	Estimated feed intake (kg/ha/day)	Stocking rate (AE/ha)	Daily gain (kg/ha/day)
Feedlotting	12 – 15		1.5 – 2.5
Grain feeding in paddock	5 – 10		0.8 – 1.2
Forage oats		1.5 – 3.0	0.8 – 1.2
Forage sorghum		3.0 – 4.0	0.5 – 0.8
M8U (molasses + 8% urea)	3 – 5		0.3 – 0.5
Molasses/vegetable protein meal/urea	5 – 9		0.4 – 0.9
Leucaena		0.6 – 1.0	0.4 – 1.3
Sown pasture		0.5 – 1.0	0.4 – 0.8
HGP			10 – 20% increase in gain

Source: Adapted from Cheffins (1996)

Nutrition is the most common cause of animals performing below expectation. Another possible cause in south east Queensland could be phosphorus deficiency, as some soil types have less than adequate phosphorus levels. (Refer to *Mineral deficiency*, pages 111–113, for investigating and dealing with phosphorus deficiency). Any decision about feeding stock should be carefully analysed, considering alternatives and outcomes. A series of worksheets are provided in *Useful calculations and worksheets* (pages 157–168), costing inputs and outcomes of feeding grain in the paddock, feedlotting and cropping.

In the short term, your options are to feed to achieve the target market, or target another market

- if it will be too expensive to feed the animals to achieve target weights, sell now
- agist onto better feed to achieve target weight
- feedlot to achieve an alternative market which may be more profitable
- review target markets and sell at the same time as originally planned but at lower weights
- supplement to achieve target weights and performance.

Consider a mob of cattle as individuals, not as a whole mob. In most cases a mob can be divided into smaller mobs which can receive tailored management, optimising cost-to-benefit ratios. A mob can be drafted according to

- those that will achieve target production levels without any assistance
- those that will (economically) achieve production targets with some assistance from, say, supplementary feeding
- those that will not (economically) achieve target production levels, which should be sold into another market.

In the longer term, options include

- review target market
- examine management practices to determine if a change in management is warranted
- examine options to achieve the initial target such as providing sown pasture or crops
- examine composition of land types and consider options, for example changing herd turn-off age, or securing access to fattening country
- implement a system of feed budgeting and review stocking rates.

Compensatory growth

When animals are given access to good feed after a period of slow growth or weight loss, they often achieve better-than-expected weight gain. This is called compensatory growth. For example, cattle not supplemented during the winter will often grow at a faster rate during the following summer than similar cattle which had adequate nutrients in winter. The degree of compensation is variable and can range from 0 to 100 per cent depending on

- the length and severity of the period of poor nutrition
- the level of nutrition offered following the period of poor nutrition
- the age of the animals.

Generally the more severe the reduction in growth rate (or weight loss) and the better the nutrition offered afterwards, the greater will be the extent of compensation.

However even taking this compensatory growth into consideration, weaners fed a protein meal supplement through winter will generally retain only about 50 per cent of their growth advantage over un-supplemented weaners one year later and only about 25 per cent advantage two years later.

Although not always practical, the most benefit from supplementing for substantial growth (production feeding) will be derived by selling the supplemented animals at the end of the feeding period. If the animals are retained for a longer period, the advantage provided by supplementing will be lost.

How compensatory growth works is not fully understood.

Seasonal deficiencies and supplementary feeding

See Dry Season Management of a Beef Business in Recommended reading pg 177

Supplementary feeding is often used to overcome deficiencies of nutrients that may occur in particular seasons (e.g. protein in winter).

Supplementary feeding is used when the majority of an animal's nutrients are supplied from grazing and involves feeding small amounts to correct a deficiency or an imbalance in nutrients. Feeding protein supplements will be successful only if feeding starts early when there is still plenty of dry feed and before the animals have lost too much weight (i.e. are in store condition or better).

When considering supplementary feeding, it is important to identify the primary limiting nutrient, that is, the nutrient lack that is having the greatest effect in limiting production, and address this deficiency first. Feeding a nutrient that is not the primary limiting nutrient will have little, if any, effect on animal production.

See Pasture ecology pp 48–52

Protein and energy levels in pasture plants vary with stage of maturity. Protein and energy are highest in young growing plants and lowest in old, mature plants. When the plant is mature, protein is usually below the level required for cattle growth. Protein is limiting almost every autumn when the pasture plants are mature and may be frosted. As winter progresses, pasture quality continues to fall and energy can become limiting.

Energy in pasture plants declines with digestibility as shown in Table 6.4 on page 76.

See Nutrient requirements pp 45–47

Feeding other nutrients without addressing the protein deficiency will have little or no effect on performance. However, daily energy intake will probably be the single factor most affecting animal performance. Irrespective of the quality of the diet, the more an animal eats of a particular feed, the better it will perform.

Measuring the protein in dung provides an indication of the level of protein in the diet. For example, when the protein in the dung of young cattle is less than 6 per cent, the protein in their diet is below that required to maintain weight. A number of commercial laboratories measure faecal protein levels.

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

Table 6.4 *Approximate Dry Matter Digestibility (DMD), Metabolisable Energy (ME) and Protein content of some feeds*

Feed	Description	DM (approx)	Digestibility (%)	ME		CP (%)
Grain		90%	90	13	8 – 12	
Molasses		75%	90	13	4.3	
Tropical grasses						Tropical grass + legume*
Phase 1	Early, rapid growth	Low (<30% DM)	70	10	10 – 16	12 – 16
Phase 2	Beginning to grow stem, mostly green	Med (30 – 50%)	60	8.5	8 – 10	10 – 12
Phase 3	Flowering and seed set, growth slow 10-30%, green	Med–High (50 – 70%)	55	7.5	6 – 8	7 – 10
Phase 4	Senescence, no growth, no green	High (>80%)	50	6.5	3 – 6	7

Figures for temperate pastures can be estimated by adding the following to the figures above: Digestibility +10; ME + 1.5; Protein +2 to 4.

* Tropical grass plus legume. These figures would apply only where there was sufficient legume in the pasture to increase animal liveweight gain.

Protein supplements

Rumen microbes use ammonia to form protein in their own bodies. Hence a source of nitrogen which breaks down in the rumen to form ammonia can be fed to cattle to increase the protein available to the animal. Urea is a common source of nitrogen which can be fed to cattle.

The main methods of supplementing with protein are

- commercial blocks, liquids and mixes
- urea – molasses (roller drums)
- dry licks based on salt and urea
- urea fed via the drinking water
- vegetable protein meals
- homebrew.

A typical supplement contains nitrogen in the form of urea. Nitrogen stimulates both rumen function and intake of dry pasture, thereby increasing energy intake. The daily cost of these supplements is relatively low.

Start feeding early, before the animals have lost too much weight and while there is still plenty of dry feed. Feed supplements to all susceptible animals, for example weaners, breeders and replacement heifers. Desired intake of protein is shown below.

Class	Protein (g)	Urea (g)
Weaners	75	30
Breeders	150	60

Poorly mixed urea forming a crust on a fortified molasses mix

Urea

Poisoning is a concern whenever urea is fed to cattle. Feed preparations containing urea must be properly mixed and maintained to avoid any possibility of water containing concentrated levels of urea collecting on the supplement

- Make sure supplements containing urea and molasses (including 'fortified molasses') are properly mixed. Use mechanical mixers whenever practical. Poorly mixed brews of fortified molasses will develop a crust of urea on the surface; rain dissolves this crust, and cattle drinking the resulting concentrated urea will almost certainly die from urea poisoning.
- Salt – urea licks, commercial blocks and mixes, and homemade blocks are vulnerable to becoming waterlogged by rain. Place these sorts of supplements under shelter, or otherwise check them regularly during rainy weather to remove water.

Refer to *Urea poisoning* (pages 113–114) for information on diagnosing and treating urea poisoning.

Horses, unlike cows and other ruminants, cannot use the nitrogen in urea to make protein. Thus horses do not benefit from urea supplements. Horses can cause problems for cattle around supplement feeders. Horses often 'boss' the cattle, keeping them away from the supplement. Horses can dent roller drums, allowing uncontrolled access to the liquid.

Commercial blocks, liquids and mixes

These preparations are very convenient to feed as little or no preparation is required. Obtaining the desired intake is a major problem with commercial preparations. Intakes can vary considerably between individual animals and between paddocks on the same property. Buy only a small number of blocks to trial until you are satisfied your cattle will eat them at approximately the desired rate. Compare prices on the basis of percentage of the nutrient you require, usually protein or phosphorus. Store and provide blocks to cattle under cover.

See Calculating the cost of dry matter and nutrients pg 193

Urea – molasses roller drums

The advantage of this time-tested system is the mixture can be adjusted to suit individual properties or paddocks. The main disadvantages are the cost of equipment for storage, mixing and feeding, and the time involved in feeding the lick.

A common mix would contain

- 60 kg (45 L) molasses
- 90 L water
- 14 kg urea
- 1 kg Gran-am (sulphur source).

This amount of mix would be sufficient to supplement 40 head of breeders for one week at a daily intake of 50 g urea and 210 g molasses (to make the mix palatable – see following section).

The urea level should be built up gradually over three feeds, as follows

1st feed: 50/50 molasses and water, to get the cattle accustomed to using the roller
2nd feed: Add ¼ of the final amount of urea
3rd feed: Increase to ½ of the final amount of urea
4th feed: Include the full amount of urea
5th feed: Add Gran-am

At each feed during the build-up period, provide enough to last the cattle about 3 to 4 days. If larger amounts are given, the build-up period will take too long.

Urea molasses roller drum, a cheap and low cost method of feeding urea

Salt and urea dry licks

Dry licks are often more convenient than urea–molasses in roller drums because only dry ingredients need to be mixed.

Dry licks have a long introduction period to ensure the rumen microbes adjust to the new diet. (Too rapid a change in diet can kill cattle, as explained in ***Ruminant nutrition***, pages 44 – 47). Thus it is essential to start introducing the supplement before a significant deficiency occurs.

Mixes need to include sulphur (usually in the form of Gran-am), which is required by the rumen microbes to process nitrogen. Sulphur needs to be incorporated in the ratio of 1 part sulphur to 10 parts nitrogen.

A program for introducing a dry lick is

Week 1: Free choice of salt to satisfy any craving
Week 2: Free choice of salt and **record intake**
Week 3: *For each 50 kg salt eaten in Week 2,* mix 10 kg urea and 40 kg salt
Week 4: *For each 50 kg salt eaten in Week 2,* mix 20 kg urea and 30 kg salt
Week 5: *For each 50 kg salt eaten in Week 2,* mix 25 kg urea and 25 kg salt, plus 2.5 kg Gran-am
Week 6: *For each 50 kg salt eaten in Week 2,* mix 25 kg urea and 25 kg salt, plus 5 kg Gran-am
Week 7 onwards: Adjust urea:salt proportions, aiming for a daily urea intake of 30 g for weaners and 60 g for adult cattle (one 40 kg bag urea per 115 head per 7 days). Ratio of urea to Gran-am should be 5:1.

After the cattle have adapted to the urea, a suitable mix for 115 breeders for one week is

- 1 bag salt (50 kg)
- 1 bag urea (40 kg)
- 8 kg Gran-am.

In areas where the stock water contains high salt levels, it will be difficult to achieve adequate intake of the supplement. In such areas, it may be necessary to pour a small amount of molasses on top of the mixture. For safety, make sure this supplement is protected from the weather.

Urea in drinking water

Providing urea in the drinking water is a low-cost approach that ensures the supplement is consumed equally by all animals. However it will work only where no other surface water is available. A number of dispensers are available; some are more reliable than others, and some suit certain situations better than others. Gran-am should be added to the urea at the rate of 5 parts urea to one part Gran-am.

Vegetable protein meals

In Australia it is illegal to feed any meals derived from animals to beef and dairy cattle and other ruminants (sheep, goats, deer, alpacas and llamas). Animal meals include meals made from meat, bone, blood, poultry offal, feathers and fish. It is still permissible to feed animal and fish meals to pigs, poultry and horses because these animals are not ruminants. Producers who own pigs, horses and poultry as well as cattle need to ensure that feed for cattle is not cross-contaminated with feed provided for non-ruminant animals. It is still permissible for tallow, gelatin and milk of Australian origin, and milk products made in Australia and derived from milk of Australian origin, to be fed to both ruminants and non-ruminants.

Table 6.5 *Analysis of the comon vegetable protein meals*

Meal	Protein %	Calcium %	Phosphorus %	Energy Megajoule/kg	Intake of meal to give 150 g protein
Canola	38	0.70	1.10	10.9	400 g
Copra	15 – 20	0.06	0.50	13.5	1,000 – 750 g
Cottonseed	38 – 40	0.17	1.27	10.5	400 – 375 g
Linseed	34	0.45	0.90	12.1	405 g
Palm kernel	18	0.21	0.15	11.5	830 g
Peanut	46	0.15	0.60	12.1	330 g
Sunflower	30 – 38	0.40	1.03	12.5	500 – 400 g

The required intake of meal needs to be calculated according to its protein content to achieve protein intakes of 75 g/day for weaners and 150 g/day for adult cattle. Table 6.5 shows likely ranges of nutrients in common vegetable protein meals. Actual content levels may vary depending on the processing method.

Most vegetable protein meals are very palatable, so regulating intake can be a problem. Feed only once or twice a week and allow plenty of trough space so that all animals can feed together. Alternatively, put weldmesh on top of the meal so that animals have to lick rather than take mouthfuls of meal, slowing down their rate of intake.

Homebrew

Homebrew is generally based on grain and/or molasses with urea and/or vegetable protein meal as the protein source. Generally there is no need for an introductory period; cattle can be put straight onto the final mix.

The mix can be tailored to meet particular requirements. To control intake to obtain a desired level of performance, adjust the level of salt and molasses (Table 6.6). An intake of 500 g/hd/day of the following homebrew will provide a protein intake of 150 g/day.

A cement mixer makes mixing easy (otherwise mixing can be time-consuming). To mix a homebrew, dissolve the urea in 10 L of water, add molasses and mix thoroughly. Then add all the dry ingredients. Once thoroughly mixed, the mixture can be poured into bags for transporting to the paddock. This mix can be stored for up to one month.

Table 6.6 *High and low palatability homebrews*

Homebrew	Parts by weight	
	High palatability	Low palatability
Crushed grain	40	32
Coarse salt	20	32
Molasses	20	15
Urea	10	10
DCP (dicalcium phosphate)	7	7
Vegetable protein meal	5	5
Total	102	101

Other supplements

Fortified molasses, whole cottonseed and grain provide a higher level of nutrition than urea-based supplements. These energy-rich supplements can be fed at lower levels than urea-based supplements, and the start of feeding can be delayed by one or two months. Refer to *Fortified molasses* (page 88) for a suggested fortified molasses mix.

Regulating feed intake

Maintaining feed intake at the desired level is often a problem. With palatable supplements, such as those based on molasses and vegetable protein meal, animals often eat too much. With dry licks, such as those based on salt, it is often a problem getting animals to eat enough.

Intake will always vary with local conditions. The following methods are useful for managing intake.

Appetisers	Limiters
salt	salt
molasses	urea
vegetable protein meal	monensin
	intermittent feeding
	weldmesh

Salt

Salt is best used in dry licks based on urea or vegetable protein meals. The quantity of salt must be determined to suit the individual group of cattle and the type of country.

In conditions where cattle are 'salt hungry', adding salt will increase the intake of the supplement. By contrast, where cattle do not crave salt, adding salt as a carrier will dilute the supplement and so reduce intake of the key ingredient i.e. urea.

Molasses

Cattle readily eat molasses, so it is often added to make a supplement more palatable and thereby increase intake.

Vegetable protein meal

With the exception of canola meal and palm kernel extract, vegetable protein meals such as cottonseed meal can be added to a supplement to increase intake.

Urea

Urea is added to control intake in fortified molasses licks. A level of 4 to 5 per cent urea is usually required before any intake control is achieved.

Monensin

See Rumen modifiers pg 80

Monensin is both a rumen modifier (which may improve feed conversion efficiency) and a coccidiostat (kills the organism that causes coccidiosis). Rumensin Premix® contains 10 per cent monensin, and is cheaper than urea.

Adding 1 gram of Rumensin Premix® (that is, 100 mg monensin) per kilogram of molasses in a 4 per cent urea – molasses mix can reduce intake to the same level as increasing the urea component to 8 per cent urea – molasses mix. Using Rumensin® to control intake may be cheaper than using urea for regulating intake of supplements.

If monensin is used to control intake, a suggested mix is

- 650 kg (100 gallons) molasses
- 26 kg urea (4 per cent)
- 650 g Rumensin Premix®.

Do not feed monensin to horses.

Intermittent feeding

Feeding only once or twice a week will control overall intake. The entire supplement may be eaten in one or two days, then the animals go without until

Cattle on pasture like this will benefit from a protein supplement

the next feeding day. This approach works better with some supplements than others. Feeding vegetable protein meals once a week gives similar results as feeding daily. However, irregular feeding of other types of supplements, such as fortified molasses or urea-based mixes may, reduce their efficiency.

Allow enough trough space for all animals to feed together.

Weldmesh

Placing weldmesh on top of the lick forces animals to lick rather than gorge on the supplement. This method has been successfully used to control intake of vegetable protein meals. The mesh should have 25 to 40 mm (1 to 1½ inch) squares. The feed trough must have vertical sides so that the mesh can move down as the supplement is eaten.

Performance modifiers

The two common forms of performance modifiers, hormonal growth promotants (HGPs) and rumen modifiers, have quite different modes of action. Rumen modifiers act within the digestive system to improve feed conversion, whereas growth promotants alter the animal's hormonal status to boost growth rates. Nutrition and the animal's genetics will influence the effectiveness of both types of modifiers.

Hormonal growth promotants

Hormonal growth promotants (HGPs) are chemicals that alter the hormonal status of the animal, promoting growth and usually altering carcase composition.

There are two broad types of hormones: oestrogens (female hormones) and androgens (male hormones). Oestrogen-based HGPs (oestradiol) stimulate the pituitary gland to release more of the animal's own growth hormones, resulting in cell growth, increased feed efficiency (and intake), and increased lean meat production. Oestradiol-based HGPs offer the greatest benefits during the animal's growth period. Androgen-based HGPs (testosterone and trenbolone acetate) stimulate tissue production by direct action on the cells. Implants containing trenbolone acetate offer the greatest advantage during the finishing phase, providing the animal is feeding on a high plane of nutrition.

Providing implantation coincides with a time of weight gain (when animals are growing at more than 0.25 kg per day), HGPs can be expected to increase growth by 10 to 20 per cent, so that the animal will achieve market specifications at a younger age. While HGPs will increase growth rates at all ages, the best liveweight response and best economic outcome are achieved by implanting in the final finishing phase, that is, between 200 and 400 days prior to slaughter. There is little or no benefit to be gained from using HGPs when cattle are losing weight, although implanted cattle may lose less weight than non-implanted cattle.

Side effects such as high tail, prolapses of the pizzle, and the development of secondary sexual characteristics (heifers and steers looking like bulls) are sometimes seen in HGP-implanted cattle. These side effects are more pronounced when animals have received two or more implants in quick succession or when implants are incorrectly positioned.

All currently registered HGPs are administered as ear implants. Each company makes a specific implant tool for its product with clear instructions for correct placement.

See Tail tags pg 14,
European Union pg 32,
Quality assurance systems
pp 137–138

Implanted cattle must be permanently identified with a triangular mark in the animals off-side (right) ear. Animals implanted with HGP are not eligible for EU markets. Other main markets are not restricted, but buyers in certain specialised and well-defined premium markets may specify HGP-free beef.

Rumen modifiers

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

All rumen modifiers have similar effects on cattle performance, increasing liveweight gains by about 0.08 kg/day (range 0 to 0.17 kg/day) and feed conversion efficiency by about 8 per cent.

Only very small quantities of rumen modifiers are required. They should be fed as part of a complete ration and according to manufacturer's recommendations.

Rumen modifiers should not be fed to horses.

Finishing

'Finished' is a term used to describe an animal that meets the requirements of a particular slaughter market. Animals are said to be finishing when they are in the final stages of being prepared to meet a particular market specification. This may be 3 months in a feedlot or up to 12 months on pasture.

The majority of animals will finish on pasture. If they will not finish on pasture there are four finishing options a producer may use

- feeding in the paddock
- feedlotting
- crop finishing
- finishing on sown pasture.

In the *Useful calculations and workshops* (pages 157 – 168), a series of worksheets and worked examples are provided for working out the relative costs of each of these finishing options for your own particular circumstances.

Feeding in the paddock

This option is unlikely to be profitable unless the value of the carcase ($/kg) is increased, for example going from export ox (suitable for the US export market) to Japanese ox (suitable for the Japanese market). Feed conversion rates are very variable, with 1 kg of extra carcase requiring 10 kg to 40 kg of feed. Conversion rates on grain-based rations are usually better than those on molasses-based rations. Dressing percentage of cattle eating high quality ration is usually two to three points higher than for similar grass-fed animals. The Feeding cost worksheets in *Useful Calculations and worksheets* (pages 157 – 160) can be used to work out the viability of finishing by feeding in the paddock in your situation.

Animals finished on high quality rations in a paddock (where they are still able to graze) are, in most cases, still classed as 'grass-fed' at sale. Only cattle fed in an accredited feedlot are classified as 'grain-fed'.

Table 6.7 *Recommended rations for fortified molasses mixture for ad lib or restricted feeding*

Product	%
molasses	85
vegetable protein meal	10
urea	3
salt	1
Kynofos 21®	1
rumen modifier	As per manufacturer's recommendations

Table 6.8 *Suggested grain mixture for ad-lib or restricted feeding*

Product	%
grain	85.5
protein meal (40% crude protein)	10
urea	1
limestone	1
bentonite	2
Gran-am	0.5

Supplement intake will vary with pasture quality, being highest on poor quality pasture and lowest on good quality pasture.

When feeding on good quality pasture

- animals will substitute feed (supplement) for grass
- performance may not be improved as much as the feed intake suggests it will be
- higher stocking rates may be possible because of the substitution of feed (supplement) for grass.

When feeding on poor quality pasture

- there will be less substitution of feed for grass than on good quality grass
- animal performance should be improved greatly
- potential stocking rates will not change very much.

The ration needs to be balanced nutritionally, especially when intakes are relatively high (more than 50 per cent of daily feed intake). Table 6.7 and Table 6.8 suggest recipes for a fortified molasses mixture and a grain-based mixture. Commercial premixes are available for feeding in molasses. These should be mixed and fed according to the manufacturers' recommendations.

Feed preparations containing urea must be properly mixed and maintained to avoid urea poisoning. Refer to *Protein supplements* (pages 74 – 78) for information on preparing and putting out supplements containing urea, and *Urea poisoning* (pages 113 – 114) for information on diagnosing and treating urea poisoning.

Feedlotting

Feedlotting requires good management for best results. Growth rates range from 1.8 to 2.5 kg/hd/day. Dressing percentage, at 54 to 56 per cent from full liveweight, is usually 2 to 3 percentage points above grass-fed animals. However, it will only be viable to feed the cattle that will fit a particular market specification, considering their time on feed, carcase weight, fat depth, fat and meat colour, and age. The Feedlot costs worksheet in *Useful calculations and worksheets* (pages 161 – 164) provides a format for costing up feedlotting in your situation.

The following need to be taken into account when calculating the economics of feedlotting

- feed accounts for 60 to 80 per cent of total cost
- opportunity cost of money tied up in feed and cattle
- management costs – stock and feed handling
- veterinary costs and deaths
- capital tied up in equipment.

To be eligible for 'grain-fed' classification, cattle must be fed in an accredited feedlot.

See Quality assurance pp 19–20
Quality assurance systems pp 136–137
AUS-MEAT pg 169

Feed intake is 2.5 to 3 per cent of liveweight (on a dry matter basis), with younger animals and animals in poor condition having intakes at the top end of this range. Expected feed conversions for two age groups are

Class	kg of feed for 1 kg liveweight gain
Weaners	4 – 5
Steers	8 – 10

Crop finishing

In addition to finishing cattle, forage crops provide the benefit of being able to reduce grazing pressure on the remainder of the property. Excess forage can be conserved as hay or silage. Table 6.9 shows expected performance on a number of different forage species.

Table 6.9 *Typical production performance for a range of feeds and HGPs*

Crop	Stocking rate (AE/ha)	Grazing days	Growth rate (kg/day)
Forage sorghum	3 – 4	100	0.7
Forage sorghum + lablab	3 – 4	100	0.9
Silk sorghum	2	100	0.6
Hybrid millets	2 – 3	85	0.8
Forage oats – young cattle	2 – 3	100	0.8 – 1.0
Forage oats – older cattle	1.5 – 2	100	0.8 – 1.0
Lablab	2	90	0.9

AE = adult equivalent (see *Glossary page 181*) Source: Adapted from Cheffins (1996)

The Costing a grazing crop and Calculating cropping costs worksheets in *Useful Calculations and worksheets* pages 165 – 168 provide formats for considering the costs and benefits of crop finishing in your situation.

Sown pasture

Leucaena

See Leucaena – the shrub legume for cattle feed in Recommended reading pg 175

Leucaena is a leguminous grazing shrub. Once established (12 to 18 months after planting), it can be grazed (with continued access to pasture) at stocking rates of 0.6 to 1.0 AE per ha, depending on grazing management and seasonal conditions. Annual liveweight gains of 210 to 285 kg can be achieved. Daily gains vary with the season, being 0.8 to 1.0 kg/hd/day in the growing season (October to May) and 0.3 to 0.5 kg /hd/day during the cooler months. Cattle can also be grazed on immature leucaena (9 to 10 months) for no more than 14 days, with expected weight gains of 0.5 to 0.7 kg/hd.

Grass and legume pastures

See Sown pastures pp 55– 60

Including a perennial legume such as a stylo, Wynn cassia or mixes of legumes into native or sown pasture can generally increase annual liveweight gains by about 30 kg/hd/yr (refer to Table 5.2, page 59). The legume component of the pasture would have to be greater than 10 to 20 per cent before benefits will be seen. Stocking rates will also influence weight gains.

It is essential to fully investigate the long-term economics of sowing pastures. In many cases it will be more economic to maintain native pasture in good condition. In the short term, fully sown grass pastures will provide increases in individual animal performance as well as carrying capacity. However to maintain these pastures in a highly productive condition, they will need to have fertiliser applied and/or mechanical renovation. Without fertiliser and/or renovation, production from sown pastures will return to pre-development level irrespective of pasture composition.

Managing drought

7

Dry seasons extending into droughts are a common feature of climatic conditions throughout Queensland. Opinions differ on the difference between a normal dry season and a drought.

The often slow onset of drought conditions provides an excellent opportunity for sound planning. Lack of early planning and preparation for drought is often the biggest contributor to drought management problems. Drought management plans should be flexible to account for unforeseen changes in seasonal conditions.

Planning for drought

See Dry season management of a beef business pg 177

A drought management plan should consider the impacts on land and pasture, property finances, and people. Cattle should be viewed as capital assets that can be sold, not as essential items that must be kept and fed at any cost.

In developing a drought plan, consider

- availability of feed, water and finances
- likely long-term effect on the land
- number of cattle, classes and condition
- time and labour available
- management skills
- effect on family and health
- time of year and long term weather forecast.

Managing for drought means assessing pasture regularly, and then making changes such as

- reducing animal numbers
- weaning early
- feeding selected animals.

See Forage budgeting pp 154–156 and Example of a monthly feedplan for a native pasture system pg 134

When the spring rains fail to come, review your dry season pasture budget drawn up a few months before in March/April in the light of current pasture conditions. Recalculate the forage budget for a further period without rain to see how many cattle can be carried, and therefore how many will have to be sold or agisted.

Consider doing a Stocktake and/or Grazing Land Management Workshop phone DPI&F Call Centre 13 25 23

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

Strategies

Reducing numbers

Reducing stock numbers on the drought-affected property should be a major part of your drought management plan. Consider how selling or agisting certain animals at this time will affect income in the years immediately after the drought.

Selling

Which stock to sell will depend on the extent of the drought and the current markets. Traditional markets may not always be the best. Two issues to consider are that breeders cost more to feed than steers, and cows on their first calf and those 8 years or older are at greatest risk during drought.

Suggested order of sale

- normal sale cattle
- breeders over 8 years old
- cull heifers (perhaps sold as weaners rather than as finished animals)
- next year's sale cattle.

See Breedcow & Dynama pg 175

One of the programs in the Breedcow & Dynama computer package 'Destock', allows investigation of the most economic way to destock considering present and future income.

Agisting

Cattle on agistment generally receive less attention than on the home property, so it is better to agist steers than breeders. Agisting steers closer to market on country where they can reach market weight can be profitable.

Contract finishing in feedlots is also an option but the costs need to be assessed carefully. Selling the animals as stores may prove more cost-effective.

Weaning early

During drought, pastures cannot supply sufficient nutrients to meet the needs of lactating cows. A lactating cow has very high requirements to enable her to produce sufficient milk for adequate growth in the calf as well as at least maintain her own body weight. Weaning the calf (from 60 kg liveweight onwards) will more than halve the cow's nutrient requirements. In many drought situations, this will mean the cow will survive with little or no supplement, and the total cost of feeding the calf and the cow separately will be much less than feeding the lactating cow. However, the weaned calf requires special attention, especially with feeding.

Calves under 6 months of age can be weaned successfully and suffer no ill effects, provided they are fed and managed well. Weaners that are not adequately supplemented will fail to thrive and may be poor doers all their lives. Calves should be drafted by weight into the following groups

- less than 60 kg
- 60 to 120 kg
- 121 to 150 kg
- over 150 kg.

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

Weaner growth rates

The following growth rates are the minimum required for calves of various weights and/or ages to grow into 'normal' adults.

Size class (kg)	Age range (months)	Minimum growth rate	
		(g/day)	(kg/mth)
Less than 120	3	400	12
121 to 150	3 – 6	200	6
More than 150	6	100	3

Calves are unlikely to achieve these growth rates on pasture during drought, so supplementary feeding is recommended.

See Compensatory growth pp 72 – 73

All weaners lose weight when they go onto green feed, including when the drought breaks. It is best to supplement for moderate growth rates only (less than 0.5 kg per day) during the dry season/drought. Weaners on high gain

supplements (growing at up to 1 kg/day) lose so much weight when the wet season starts that by the end of it, they are not as well grown as weaners that were gaining at only a moderate rate during the dry season/drought.

See Protein supplements pp 74 – 78

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

Feeding early weaned calves

All calves must start feeding as soon as possible after weaning. Calves must be trained to eat supplement in the yards while being weaned. A couple of older cattle in with the weaners will demonstrate going to a trough for feed. Shy feeders should be drafted out for special training.

Levels of supplements shown in Table 7.1 should enable calves to hold weight or gain some weight. These levels are a guide only. How each calf actually performs compared to desired performance is the best indication, and intakes should be varied accordingly. Other factors to keep in mind are

- Weigh calves regularly and draft them into the heavier group as they reach the threshold weight. This will reduce competition in the lower weight group and may reduce the cost of feeding.
- For best results, separate the calves in the 60 to 120 kg weight group into two groups: 60 to 100 kg and 101 to 120 kg. Their feed requirements are the same, but the lighter calves may be bullied by the heavier calves and therefore will perform better if in a group on their own.
- Do not feed more whole cottonseed than the amounts indicated. Whole cottonseed contains gossypol, which can cause digestive problems and, in extreme cases, death in young calves. If more supplement is required, combine whole cottonseed with one another supplement.

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

Table 7.1 *Recommended feed and supplements for calves weaned early*

Size class (kg)	Feeding rate
60 – 120	Unlimited pasture, if available, or 0.25 – 0.5 kg/hd/day of grassy lucerne, good quality grass or good quality forage hay (beware of scouring particularly when feeding lucerne hay), **plus ONE of the following:** • 0.5 – 1 kg/hd/day grain mix (3 parts crushed grain, 1 part vegetable protein meal) • 0.25 – 0.5 kg/hd/day vegetable protein meal • calf pellets/crumbles/meals fed as per manufacturer's recommendations • free access to molasses plus 12 – 15% vegetable protein meal (beware of scouring)
121 – 150	Unlimited pasture or hay, **plus ONE of the following:** • free access to molasses plus 12 – 15% vegetable protein meal • 1 kg/hd/day grain mix • 0.5 kg/hd/day vegetable protein meal • 0.5 kg/hd/day whole cottonseed • calf pellets/crumbles fed as per manufacturer's recommendations
More than 150	Unlimited pasture or hay, **plus ONE of the following:** • 1 kg/hd/day of molasses plus 3% urea and 5 – 10% vegetable protein meal • 0.5 kg/hd/day whole cottonseed • 0.5 kg/hd/day vegetable protein meal

Parasites

Treat all calves for internal and external parasites 4 to 6 weeks after weaning. Young calves are susceptible to parasites. A few parasites might cause no problems when a calf is sucking but become a major problem when the calf is stressed. To avoid contaminating feed with dirt or dung that may contain parasite eggs, feed hay in racks.

Water

A supply of good clean water is essential. Troughs in yards where calves are fed will need to be cleaned regularly, especially when feeding with grain.

Feeding adult stock

Deciding whether to supplement adult stock will depend on your performance objectives. Weaners and breeders (heavily pregnant or lactating) are the two classes of cattle most affected by nutritional stress.

Compared with supplementary feeding for seasonal nutritional deficiencies, supplementary feeding during drought is usually at a better nutritional level and for less time (from August or September until perhaps November, when even light rains are usually sufficient for some pasture to become available).

Cattle supplemented during winter will be in a better condition in spring, and won't need drought rations for a few weeks longer than unsupplemented cattle. Unsupplemented cattle will be in a lower body condition when supplementary feeding commences, and they will require higher quality feed, making it more expensive per day to provide feed.

A typical drought feed contains energy (molasses or grain) and protein (urea and/or vegetable protein meals). The main supplements are

- fortified molasses
- whole cottonseed
- grain
- hay and silage
- vegetable protein meals.

Homemade fortified molasses mixer. This mixer attaches to a post hole borer on a chainsaw. It is useful for mixing small quantities of supplement.

A well-constructed molasses mixing trailer suitable for feeding large groups of cattle

Fortified molasses

Fortified molasses combines a low cost energy source with a nitrogen source, either urea or vegetable protein meal or both. This supplement is very popular and has been used successfully for all classes of cattle.

Some basic rules should be followed when feeding fortified molasses

- Molasses contains virtually no protein and is of little value if used as a feed on its own. To balance energy and protein add 3 per cent urea or 10 to 15 per cent vegetable protein meal.
- Intake may be reduced by adding urea. Mixes of up to 8 per cent urea can be fed successfully, provided a mechanical mixer is used.
- Feed preparations containing urea must be properly mixed and maintained to avoid urea poisoning. Refer to *Protein supplements* (pages 74–78) for information on preparing and putting out supplements containing urea, and *Urea poisoning* (pages 113–114) for information on diagnosing and treating urea poisoning.

A suggested mix for breeders, often called M8U, is 92 per cent molasses and 8 per cent urea. A mix for weaners where some weight gain is desired is 87 to 92 per cent molasses, 3 per cent urea, and 5 to 20 per cent vegetable protein meal. Feed these mixes at the rate of 1 to 3 kg/day.

Whole cottonseed is a very useful supplement. It can be fed on the ground or...

... in low cost troughing made from mine belting used for feeding in the paddock

See Acidosis pg 121

Whole cottonseed

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

Class	Feeding rate (kg/hd/day)
Weaners	0.5
Breeders	2 – 3
Bulls	4

Feeding hints

- Breeders will regulate their own intake and can be given free access to whole cottonseed.
- Excessive intake of gossypol from feeding on whole cottonseed has been implicated in causing infertility in bulls. This has not been confirmed. Restrict feeding for bulls to a maximum of 4 kg/hd/day to avoid any possible problems.
- Whole cottonseed can be stored in the open if the site is well drained and the heap is kept in a cone shape. However it will not auger – a front end loader or belt conveyor is required to handle large quantities.

Grain

Grain usually contains about 10 per cent protein and provides 40 per cent more energy than molasses on a dry matter basis. In most areas, grain is a more expensive form of energy than molasses.

Class	Feeding rate (kg/hd/day)
Weaners	1
Breeders	3

Cattle are liable to engorge themselves on grain causing acidosis. Adding 2 per cent bentonite can reduce this problem. Grain self-feeders should be fitted with slides to enable the supply of grain to be regulated. One 3 m (10 foot) self feeder will be sufficient for 50 weaners or 35 breeders. When using open troughs, allow 40 cm of trough space per adult beast, and more for horned cattle.

Vegetable protein meal

When used as a drought feed, vegetable protein meals should be fed at a rate of at least 250 grams per day for weaners and 1 kg per day for adult cattle. Most meals are very palatable and controlling intake to desired levels can be a problem. Feeding once or twice per week can overcome this problem.

Hay

Because of the cost, feeding hay is only recommended when paddock feed is very limited or non-existent. In this situation the cattle should be confined to a yard or small holding paddock.

Lucerne hay is a common supplement, although it is generally more expensive than other types of hay. Failed legume crops not harvested for grain contain a high protein level and are often used for hay. Hay made from crop residues following harvest varies in quality and will usually require additional protein. If buying hay, make sure it comes from a chemical residue and weed-free source, and that it is accompanied by a Fodder Vendor Declaration form stating this.

When there is still plenty of paddock feed of low nutritional value, medium to high protein hay (6 per cent) can be fed at the rate of 1 to 2 kg/hd/day.

The protein content of poor quality hay can be improved by adding urea. This can be done by treating a bale 12 to 24 hours before feeding with the following mix **(which must not be fed directly to cattle)**

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

One litre of this mixture contains 150 g of urea, which is sufficient to treat a 20 kg bale. To treat a bale, stand it on its side with the cut edge upwards, cut the top string, and pour the mixture evenly over the surface. Round bales can be treated by pumping the mixture into the bale with a spear spray.

Table 7.2 *Feeding rates when paddock feed becomes scarce*

Crop	Fodder (kg/hd/day)	
	Treated stubble	Legume hay
Weaners	2.0	1.5
Breeders – early pregnancy	3.5	3.0
Breeders – late pregnancy and lactating	3.0 – 6.0	2.5 – 5.0
Dry cattle older than 18 months	3.0	2.5

Haylage and silage

See Prime Notes CD in Recommended reading pg 179

As a general rule, feed values for well-made silage and haylage will be slightly higher than for hay made from the same base material, because in the process of making hay some of the higher value leaf matter is lost. The ensiling process does not improve the digestibility of feed; it just captures more of the nutrients than haymaking.

Wrapped, round bales are expensive, especially if they are not rolled to maximum density and the crop is high in moisture content. Ideally, standard wrapped round bales should weigh about 600 kg or more with optimum moisture content of 50 per cent and a maximum of 60 per cent, regardless of the crop. Because silage has much higher moisture content than hay, more has to be fed to achieve the same intake of dry matter. Transport costs will be much higher per tonne of dry matter.

Wrapped haylage should be considered only for short term storage. The wrapping will deteriorate in 12 to 18 months.

Breeding

8

See Markets and selling pp 26–36

Before developing a breeding program, determine what markets you are targeting, because market requirements will have a major impact on your breeding decisions. Once you have determined your breeding objectives, other major considerations are

- breeding program to achieve those objectives
- bull and female selection and fertility
- calving pattern
- managing calving
- timing of weaning
- herd health and nutrition.

Genetic improvement

Genetic improvement means improving herd productivity by selecting genetically superior parents to produce better replacements or sale stock. Genetic improvement has a permanent, cumulative effect on the quality of the total herd.

All progeny receive half of their genes from their sire and half from their dam, but the relative contribution by bulls and cows to the total genetic gain in a herd is different. The selection pressure achievable in bulls is much larger than that achievable in cows because you purchase, or retain, few bulls but lots of heifers. Each cow will usually contribute only one or two progeny to the future breeding herd, compared with twenty or more contributed by each bull. The relative gain from bulls is 60 to 80 per cent and from cows, it is 20 to 40 per cent.

Commercial breeders need to buy bulls from seedstock producers who have compatible breeding objectives and who select for the traits that the breeders are trying to improve. If you continue to purchase bulls from the one seedstock producer over a number of years, you will make genetic improvement in your own herds at the same rate as it being made in the herd supplying the bulls.

Heritability

See Bull selection in Recommended reading pg 178

Heritability (h^2) is the proportion of the measured variation between animals that is due to genetic differences between the animals. Non-genetic variation is due to nutrition, management, disease and all other environmental factors.

Most of the growth characters in beef cattle have heritabilities of between 30 and 50 per cent. This means that between 30 and 50 per cent of the measured differences between animals are due to genetic factors and between 70 and 50 per cent are due to non-genetic environmental factors. In contrast, the heritability of most fertility traits is in the order of 10 to 20 per cent, which means that nutrition and environment play a considerably greater role in determining herd fertility than genetics (Table 8.1 page 95).

However this doesn't mean that selecting for fertility should be ignored. While the potential gains in herd genetics might be less than for other traits, the economic benefits of those gains, in terms of increasing herd size, are usually higher.

Table 8.1 *Heritability estimates for some characters in beef cattle in temperate and tropical environments*

Trait		Heritability level	Heritability (%)	
			Temperate	Tropical
Reproduction	Conception	low	0 – 5	5 – 20
	Days-to-calving	low	7	9
Growth	200-day weight (weaning)	medium	18	28
	400-day weight (yearling)	medium	25	37
	600-day weight (final)	medium	31	42
Carcase	Carcase weight/day of age	medium	41	29
	P8 rump fat	medium – high	27	27
	Intramuscular fat (IMF%)	medium – high	12	12
Other traits	Cancer eye susceptibility	medium	20 – 40	N/A
	Eye pigmentation	high	45	N/A
	Temperament	medium – high	27	25 – 50
	Hip height (400-days)	medium – high	59 – 66	N/A

N/A: Not available

Source: Adapted from *Bull Selection* (2003)

Variation of traits

Some traits vary more than others. Traits with greater genetic variation provide more scope for change by selection, and significant changes are possible even in traits with low heritability.

Most traits governed by more than one gene fit a 'normal' distribution (Figure 8.1). This means most animals are close to the mean (or middle) and few are at the extremes on either side. A trait with a large variation will have a lower wider curve (more animals further from the mean) while a character with small variation will have a higher narrower curve (more animals close to the mean).

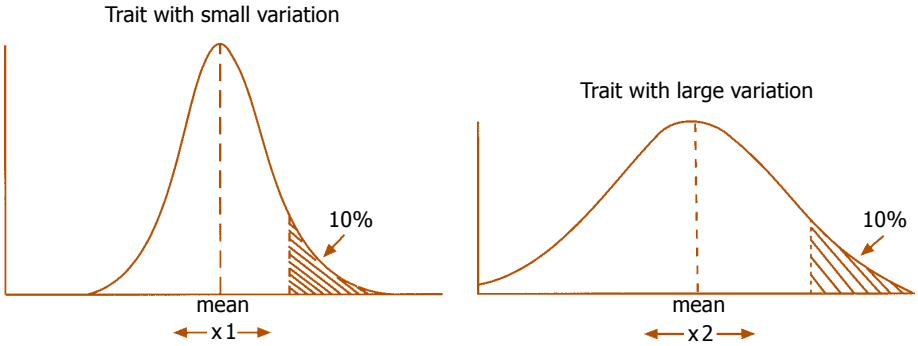


Figure 8.1 *Normal distribution for traits with small and large variations*

Intensity of selection

The rate of genetic change will be influenced by heritability and variation of the trait, as well as the intensity of selection.

Intensity of selection is related to the proportion of animals selected from a group. When selecting heifers, it is normal to select a large proportion. In this situation, the advantage of the selected group over the mean of the group (called the selection differential) will be small. When selecting bulls, a smaller proportion is usually selected, so the advantage of the selected group over the average of the group will be larger. The selection differential will be larger where the proportion selected is small, the herd size large, and the variation large.

The proportion selected, and therefore the intensity of selection, is affected by a number of factors relating to herd management such as generation interval, herd reproduction rate and bull percentages used.

Breeding programs

Breeding programs involve systems of management as well as systems of breeding. The basic objective of animal breeding is to enhance the efficiency of production and the quality of the product for the consumer through planned genetic change.

See BREEDPLAN in Useful contacts pg 170

BREEDPLAN

BREEDPLAN is a genetic evaluation system for growth, carcase and fertility traits of beef cattle. It is run by the Agricultural Business Research Institute (ABRI) at the University of New England, Armidale.

BREEDPLAN compares the genetic potential of large numbers of animals, improving the opportunity to select the highest performing animals. BREEDPLAN

- compares across groups and uses information from relatives and associated traits
- compares the progeny of the same animals in different years, herds or management groups
- compares relative genetic potential in different years, herds, and management groups.

There are two forms of BREEDPLAN in Australia. BREEDPLAN compares animals within one herd whereas GROUP BREEDPLAN compares animals within a breed across several herds.

Objective selection for growth can be based on weight, average daily gain, and weight ratios combined with BREEDPLAN estimates of genetic merit. Selecting animals on a single measure of liveweight or on daily weight gain does not take into account differences in age or variation in the management of animals within the group. BREEDPLAN can correct for these sorts of variations between animals within a group. BREEDPLAN calculates Estimated Breeding Values (EBVs), which express an animal's genetic potential for a particular trait as a deviation (positive or negative) of that individual animal's merit from a breed base.

BREEDPLAN provides breeding value estimates for the following traits in some breeds

Growth traits	Carcase traits	Fertility traits
birth weight (optional)	carcase weight	scrotal circumference + size (cm)
200 day growth	eye muscle area	days to calving
200 day milk	fat depth (rib, P8)	gestation length
400 day weight	retail beef yield	calving ease (direct, daughters)
600 day weight	intramuscular fat	
mature weight		

See Evaluating and reporting bull fertility pg178 and Bull selection in Recommended reading pg 178

BREEDPLAN is continuing to develop EBVs for more traits of economic importance in more breeds. Structural soundness, some measures of reproductive soundness and maturity pattern have in the past required subjective assessment and judgement, but these are now being evaluated in some breeds. Temperament has also been scored subjectively, but it can now be scored objectively using a measure such as flight time (the time it takes for an animal to move a set distance when leaving a crush).

Comparing bulls using EBVs

When deciding between two bulls, such as when buying or selecting from within a herd, EBVs provide useful data for making decisions. Remember that half the genes come from the sire and half from the dam, so the impact on the herd will be half each bull's EBV. The accuracy of an EBV depends on the amount of information available on that particular bull's genetics.

If Bull A and Bull B (in Table 8.2) are mated to genetically equivalent groups of cows, the progeny of Bull A compared to the progeny of Bull B will be

- lighter at weaning by 2 kg due to their mother's ability to produce milk, but heavier at weaning by 3 kg due to their own growth genes (a net gain at this stage of 1 kg)
- heavier at 400 days by 5 kg
- heavier at 600 days by 10 kg.

Table 8.2 *A comparison of two bulls for milk and weight EBVs*

	EBVs expressed in kg			
	200 day milk[1]	200 day weight[2]	400 day weight	600 day weight
Bull A	+2	+10	+20	+40
Bull B	+6	+4	+10	+20
Difference of Bull A over Bull B	-4	+6	+10	+20

[1] Difference in growth to 200 days than can be attributed to mother's ability to produce milk.

[2] Difference in growth to 200 days that can be attributed to inherent genetic capacity for growth.

Source: Bull Selection (2003)

Breeding objectives

For most cattle producers, the overall breeding objective is to maximise net profit. The emphasis placed on particular traits as breeding objectives depends on how much those traits contribute to profit.

The profit equation is *Profit = (number sold x weight x price) – costs*

Traits that determine profit are therefore numbers sold, weight, price and costs.

Determinant of profit	Trait
Number sold	death rate, herd fertility, calving ease, maternal ability
Weight	breed or cross, milk production, growth rate
Price	market suitability, breed, age at turn-off

Traits need to be heritable, measurable (either directly or indirectly) and economically important to be included in the breeding program. Economic weightings for particular traits depend on the relative economic benefits from unit increases in each of the traits. These can be calculated, enabling you to define breeding objectives that will be most profitable. Select for traits that are a high priority for your business, not just because data is available on them.

More progress can be made in individual traits if you concentrate on a small number of traits. The more traits included, the less progress in individual traits.

It is important for both commercial breeders and seedstock producers to regularly review their breeding objectives to ensure they continue to address target markets and current production and management constraints.

See BREEDPLAN in Useful contacts pg 170

A computer program called BreedObject can be used to set breeding objectives (Table 8.3 page 98). BreedObject is available through BREEDPLAN and most breed societies.

Table 8.3 *Example of an exercise in establishing breeding objectives where the main target market is feeder steers for the Japanese market*

STEP 1 Traits of economic importance	STEP 2 Future customer's requirement	STEP 3 Future herd production targets	STEP 4 Current performance levels	STEP 5 Breeding goals	STEP 6 Selection criteria
Sale weight of steers	380 – 420 kg @ 16 months	380 – 420 kg @ 16 months	360 – 400 kg @ 16 months	Increase steer weight at turn-off	↑ EBV 600 Wt
Carcase weight	400 – 420 kg @ 26 months		370 – 400 kg @ 26 months	Increase carcase weight of steers	↑ EBV 600 Wt
Saleable meat yield	67 – 69%		65 – 68%	Increase saleable meat yield	↓ EBV P8 Fat ↑ EBV EMA ↑ EBV EMY%
Marble score	>3		1 – 4	Increase marble score	↑ EBV IMF%
Heifer calving difficulty		<5%	5%	Maintain calving ease	↑ EBV CE DIR ↑ EBV CE DTR - EBV Birth Wt
Weaning rate		>90%	85%	Improve female fertility	↑ EBV SS ↓ EBV DC

Source: Parnell (1988)

Breeding systems

See Breeding for profit in Recommended reading pg 178

Breed selection

Variations within breeds are often nearly as great as variations between breeds, and while breeds may be known for having or not having certain traits, it is still possible to find animals that break the rules.

When selecting a breed, consider

- suitability to the environment
- nutrition
- desired growth rates
- target markets
- market versatility.

For example, a producer may want to target the domestic market, which prefers high *Bos taurus* content and offers premiums for marbling and tenderness. However the property is a coastal property with a heavy tick burden, requiring some *Bos indicus* content. By using BREEDPLAN EBVs for intramuscular fat, a Brahman sire can be identified that offers tick resistance as well as genes for marbling.

Straight breeding

Straight breeding refers to breeding pure breeds such as Hereford, Brahman and Angus as well as stabilised breeds (formed by crossing of two or more breeds) such as Droughtmaster, Santa Gertrudis and Belmont Red.

Some of the advantages of straight breeding are

- few management changes are needed
- genetic evaluation systems such as BREEDPLAN and GROUP BREEDPLAN are easily used for both bulls and cows
- breed characteristics in production and adaptation can be utilised.

The turn-off animals will be relatively similar. Store buyers whose criteria for selection are based on looks rather than extra growth rate or liveweight often pay a premium for even lines of straight-bred animals.

The straight-bred herd is self replacing. Straight-bred herds will continue to be in demand for supplying straight-bred cows for crossbreeding.

Crossbreeding

No single breed has all the desirable qualities, so many producers cross breeds to better achieve their breeding objectives. Crossbreeding systems can be once-off to introduce a new characteristic or continuous.

Crossbreeding may be used to take advantage of the good qualities of two or more breeds to develop cows that are more environmentally adapted to thrive and reproduce at a high rate and bulls that are more market orientated.

Crossbreeding also supplies heterosis (hybrid vigour) to give an additional boost to production and survival. The more diverse the breeds crossed, the higher the heterosis.

When selecting for traits, remember that breed types are more important than individual breeds. For example, in tropical conditions, a level of tropical breed types is essential (in fact, more than 75 per cent of Queensland cattle have *Bos indicus* genes). European breed types will usually have higher growth rates, but they are also usually later-maturing types that do not finish well. By contrast, the British breed types will usually be earlier-maturing types with a higher level of finishing and, generally, a better propensity to marble.

Crossbreeding is not a cure-all for management problems. Disadvantages include

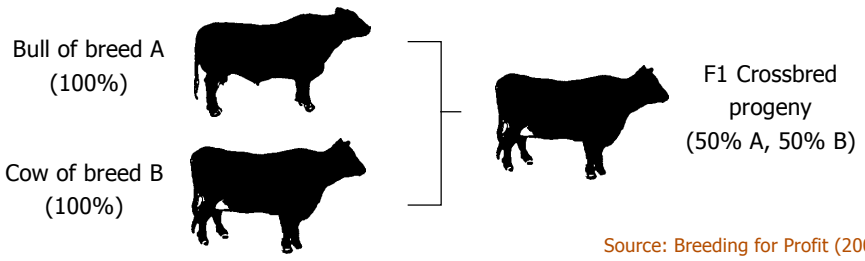
- some breeding systems are difficult to manage
- replacement cows may need to be bought in from outside herds
- considerable variation can occur in the early stages of crossbreeding
- a higher level of management and often a higher level of nutrition will be required to see the full benefits.

There are a number of crossbreeding systems available to the commercial beef producer, including

- two breed cross
- back cross
- three breed cross
- rotational cross
- composite breeding.

Two breed cross

This system produces first cross or F1 progeny. The progeny are all sold. This system is frequently used in northern New South Wales where there are specific F1 sales.



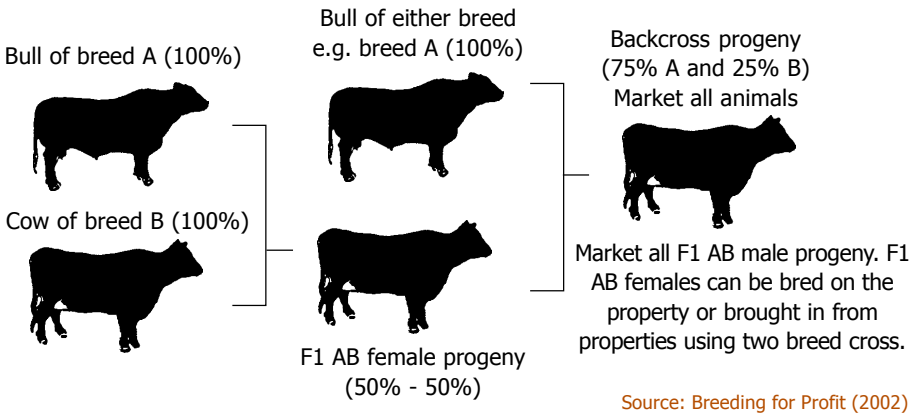
Source: Breeding for Profit (2002)

Figure 8.2 *Two breed cross: Breed A and Breed B are two purebreds and the F1 progeny (AB) contains equal parts of the two breeds*

Backcross

This breeding system takes full advantage of hybrid vigour for fertility and half of the possible hybrid vigour for growth. In a backcross system,

- the first cross is produced and all male calves are sold
- the F1 crossbred females are mated to bulls of one of the parental breeds and all progeny are sold.



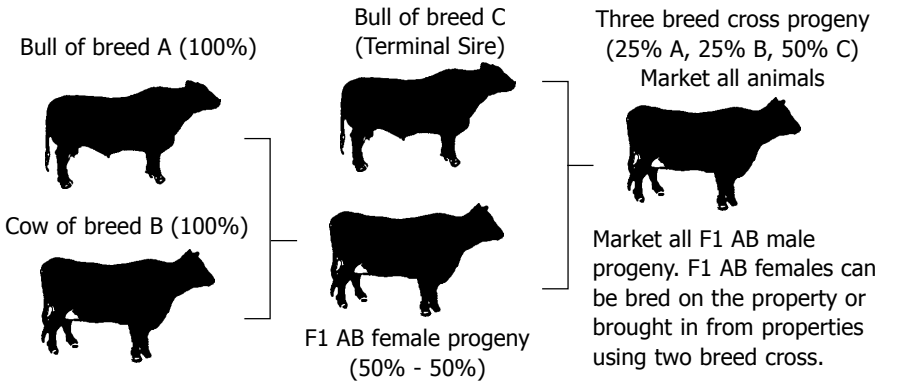
Source: Breeding for Profit (2002)

Figure 8.3 *Backcross: All the cows from a two breed cross are mated to a purebred bull of one of the original breeds. All the backcross progeny are marketed.*

Three breed cross

Along similar principles to the backcross, in a three breed cross

- the first cross is produced and all male calves are sold
- the F1 crossbred females are mated to bulls of a **third, unrelated** breed and all progeny are sold.

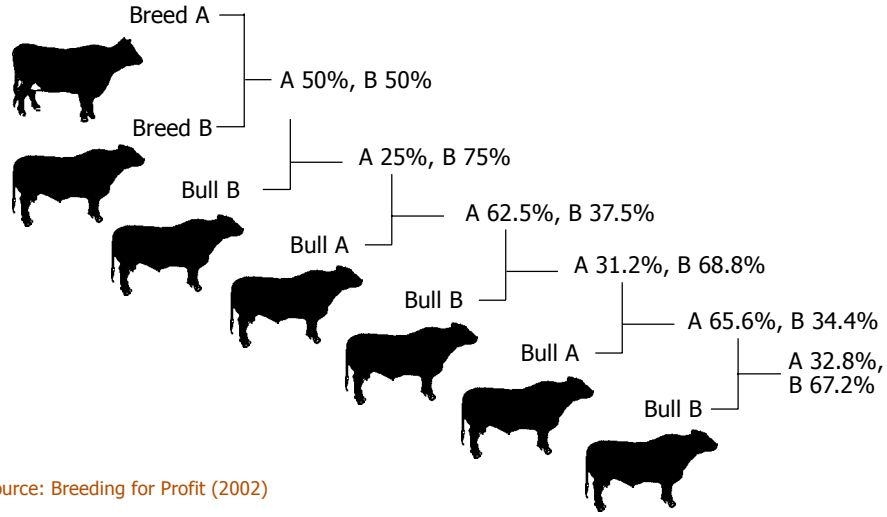


Source: Breeding for Profit (2002)

Figure 8.4 *Three breed cross: All the cows from a two breed cross are mated to a bull of a third, unrelated breed. All the three breed cross progeny are marketed.*

Rotational cross

Rotational crossbreeding is when bulls of two or more breeds are mated to crossbred cows in a sequential system. Each breed contributes its strengths and weaknesses equally to the production system over a number of years. Levels of hybrid vigour achieved depend on the number of breeds involved.



Source: Breeding for Profit (2002)

Figure 8.5 *Starting at 50/50%, the rotation stabilises at around 65/35%, giving around 65% from the last sire line used*

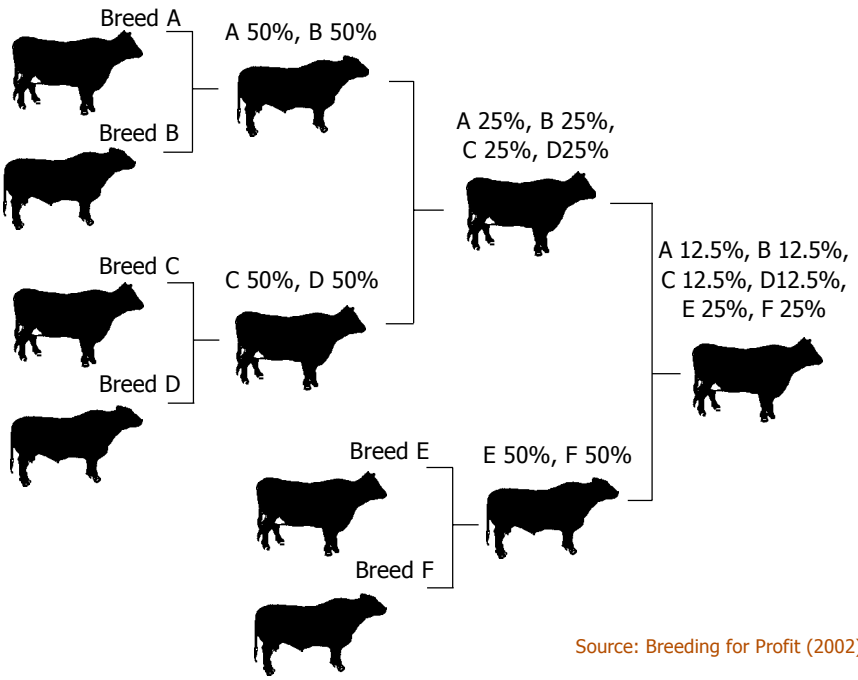
Composite breeding

Another form of crossbreeding is the development of a composite or synthetic breed, which is a stabilised crossbred line. Cross breeding is used in the initial development phase. After this, straight breeding is used and management inputs are reduced, which is the primary advantage of composite breeding over three breed rotational cross. However hybrid vigour will not be as high.

Composite breeding requires a large herd size or a group of co-operators. The percentage of hybrid vigour incorporated in the composite increases as more breeds contribute equally in the initial mating program.

Examples of composite breeds are

- Braford (3/8 to 5/8 Brahman and 3/8 to 5/8 Hereford)
- Beefmaker (1/4 Simmental and 3/4 Hereford)
- Belmont Red (1/2 Africander and 1/2 Shorthorn/Hereford).



Source: Breeding for Profit (2002)

Figure 8.6 *One approach to a composite breed*

The initial choice of breeds should be based on those that have desirable traits for the environment and markets. As market requirements change, new breeds can be incorporated into a composite, although there is also potential to introduce undesirable traits as a result of a change in direction.

Reproductive management

Reproductive efficiency needs to be high to

- achieve high turn-off numbers from the minimum number of breeders
- maximise scope for selecting and culling breeders.

Calving percentage, a commonly used measure of reproductive efficiency, is calculated by dividing the number of live calves born by the number of cows joined to produce those calves and multiplying by 100.

$$\text{Calving percentage} = \frac{\text{calves born}}{\text{cows joined}} \times 100$$

Calving percentages in Queensland beef herds vary widely; the average is around 75 per cent, indicating that reproductive efficiency is an important consideration for many beef producers.

However other terms, such as percentage of calves weaned or weight of calf weaned per cow joined, are more useful measures of reproduction, feeding, selection and management.

$$\text{Weaning percentage} = \frac{\text{calves weaned}}{\text{cows joined}} \times 100$$

$$\text{Weight of calf weaned per cow joined} = \frac{\text{total weight of all calves at weaning}}{\text{number of cows joined}}$$

Reproductive efficiency also relates to the calving pattern, which is the proportion of cows calving in each three week period. In most circumstances, the aim should be to have more than half of the cows calving in the first three week period.

The calving period should be as short as possible. A realistic target, under reasonable environmental conditions, is 12 weeks or less because

- supplementary feeding costs (if required) will be reduced because cows only need be fed when the need is greatest, e.g. immediately after calving
- labour costs can be significantly reduced because less time will be needed to supervise calving and for operations such as branding and vaccinating.

Bulls

See Bull selection in Recommended reading pg 178

A bull's main function in a breeding operation is to get a high proportion of cows in calf early and to sire market-suitable offspring. To achieve this, bulls must be physically and reproductively sound, willing, and capable of serving a high percentage of the cows. Bull costs per calf are high and range from $8 to $60 per calf, depending on factors such as the price of the bull, calving rates and mortality rates.

Provided the bull is fertile, healthy and in good body condition, a bull should successfully join up to 50 cows over three months. As bulls age, they become less fertile and generally more difficult to handle, so it is advisable to cull bulls over 6 or 7 years of age.

Bull fitness is very important in determining fertility. Prolonged under-feeding will reduce fertility. Grain feeding of bulls and stresses (such as at auction) may significantly reduce semen quality for 3 to 6 months. Plan to give bulls a good plane of nutrition about three months before joining to have them in good condition by mating time.

The following is a guide to managing the mating season and bulls throughout the year

Before mating (one to two months before)	Check bulls for physical soundness (feet, legs). Get a vet to check bulls for breeding soundness (testicles, sheath etc.). Vaccinate bulls for vibriosis, 2 injections initially with annual booster.
At mating	Mate at 1 bull to 30 to 50 cows, with a lower ratio possible in large paddocks with a lot of watering points. Mate for a minimum of 3 months in the period from November to April. Where possible, have bulls of similar age sharing paddocks to reduce bossing.
During mating	Check bulls regularly for injuries; if badly injured, replace.
End of mating	Check physical soundness, and cull any with defects. Cull bulls over 6 or 7 years of age. Keep retained bulls until following breeding season in a special bull paddock or in a paddock with steers, away from any females.

Request a Bull Breeding Soundness Evaluation (BBSE) certificate from the vendor

See Evaluating and reporting bull fertility in Recommended reading pg 178

When buying a bull or selecting from your own herd, thoroughly inspect each animal for genetic suitability, fertility, physical fitness, and temperament. Semen testing can be of value as about 15 per cent of bulls will be found to have a problem. Under extensive conditions, bulls have to be capable of walking long distances and serving large numbers of cows. Consider being trained by professionals in bull examination techniques.

Yard inspection

While the bull is moving around the yard, check

- **gait** – ideally, the back feet should step into the footprints left by the front feet
- **shape and structure of the limbs** – specifically look for post legs, sickle hocks, pigeon toes, bow legs
- **temperament** – bulls with bad temperament should not be bought or sold for breeding.

Crush inspection

Some characteristics require closer inspection. While the bull is restrained in a crush (to limit injury to bull and operator), check the following

- **head** – look for incorrect hooding, pigment and eye set as these can lead to eye problems; check the muzzle for an under-shot jaw and then check the teeth
- **front and back legs including hocks** – check for swelling
- **feet, particularly the claw structure** – look for overgrown, worn, uneven claws or weak pasterns
- **penis and the sheath** (if it is safe to do so) **–** palpitate to check for a haematoma of the penis; check the angulation of the penis
- **testicles** – measure scrotal circumference (a minimum of 32 cm at 24 months is required); palpitate the testicles, checking for unevenness and tone

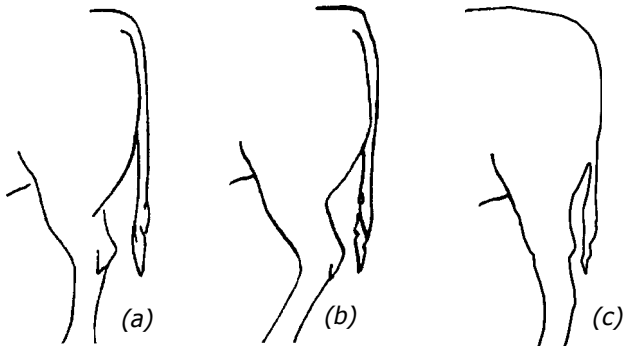
- **age –** older bulls are often less fertile and may have other problems such as arthritis; if scrotal circumference is decreasing as the bull ages, this could indicate testicular degeneration
- **general injuries** – check for injuries that may have been sustained in fights with other bulls that may affect the bull's stamina or ability to serve.

A veterinarian can conduct other tests to determine the breeding soundness and libido of bulls. These tests include serving capacity, serving ability and semen testing.

If you are unable to conduct a serving ability test, consider observing your bulls mating cows in the paddock. This will reveal problems such as spiral deviation of the penis that can only be detected when the bull is actually serving.

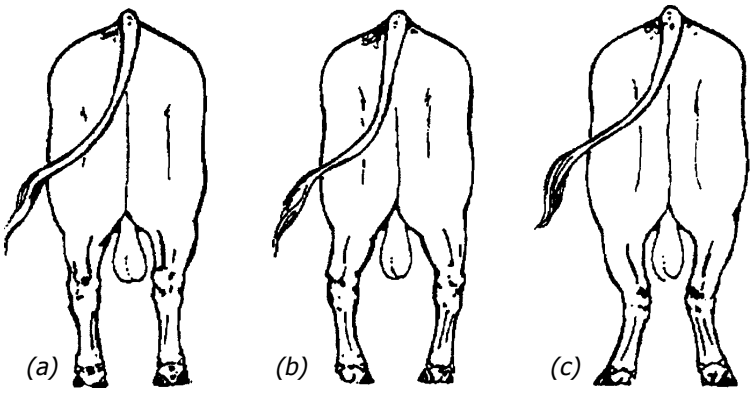
Finally, consider the condition of your bulls. Bulls that are over-fat may have poorer quality semen, while bulls that are in poor condition may be unable to maintain serving rates.

Bull soundness (legs)



Source: Evaluating and reporting bull fertility (2003)

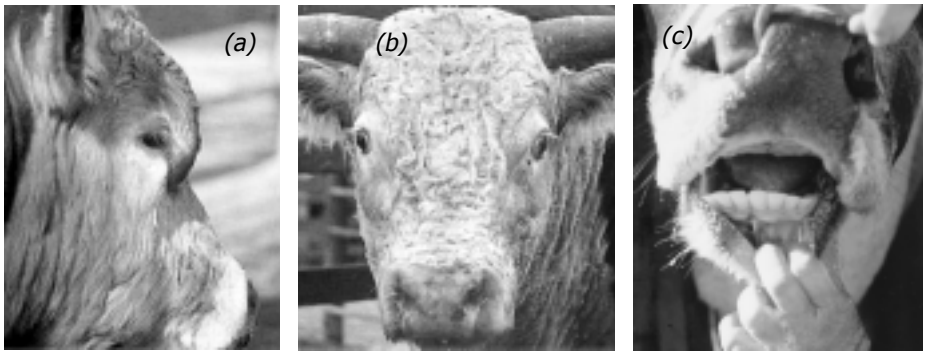
Figure 8.7 *Hind leg conformation (a) normal, (b) sickle hocked, (c) post leg*



Source: Bull Selection (2003)

Figure 8.8 *Hind leg conformation (a) normal, (b) bow legged, (c) cow hocked*

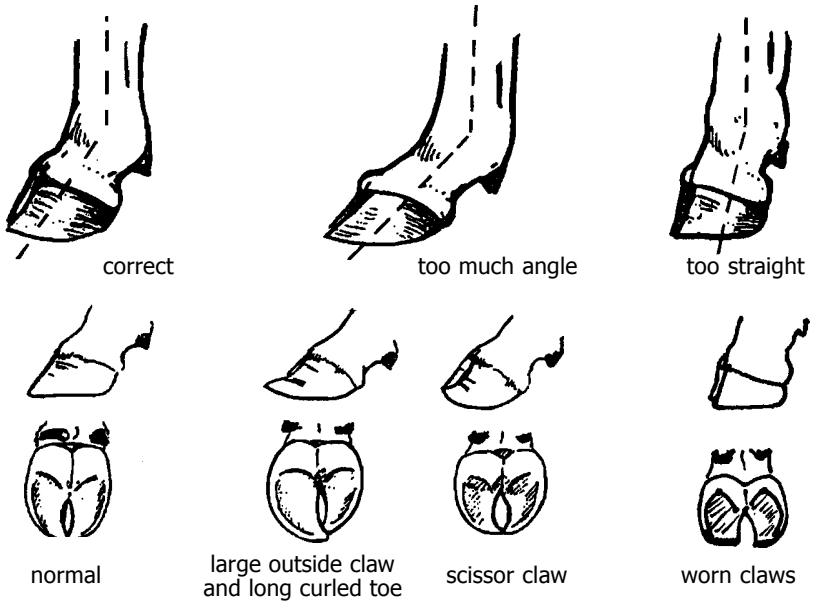
Bull soundness (head)



Source: Bull Selection (1995)

Figure 8.9 *(a) Well set and hooded eyes (b) The bull has poorly pigmented eyes that are poppy and unprotected. He is prone to eye cancer (c) Bulls should have a proper jaw set and good teeth*

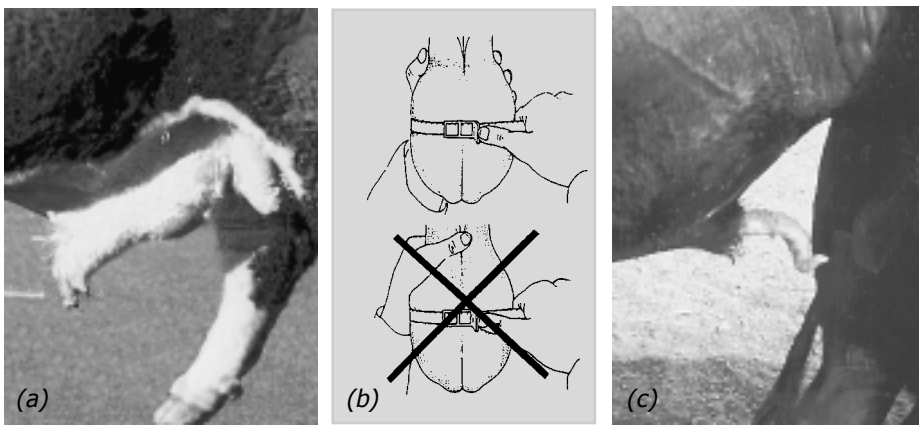
Bull soundness (feet)



Source: Bull Selection (2003)

Figure 8.10 *Pastern angle of front and hind legs and associated claws*

Bull soundness (reproductive organs)



Source: Bull Selection (2003)

Figure 8.11 *(a) Haematoma of the penis (b) Correct method of measuring scrotal circumference (c) Spiral deviation, or corkscrew penis, is a fault likely to prevent full service. It is more common in poll breeds than in horned breeds.*

See Female selection in Recommended reading pg 178

Females

Selecting females

Females can be selected either pre- or post-mating.

From observations of the animal, pre-mating selection can be based on traits such as growth, temperament and structural soundness. Selection for traits such as fertility and carcase attributes would normally be based on pedigree information and EBVs, where available. Fertility EBVs can be obtained for traits of days to calving, calving ease and scrotal size in bulls. (Bulls with higher EBVs for scrotal size produce female progeny with improved fertility, particularly age at first calving and intercalving interval.)

Post-mating selection is mostly based on observations of fertility. Post-mating selection improves herd profitability in the short-term by removing non-productive females (culling) and in the long-term by selecting the more fertile females for the breeding herd. The intensity of post-mating selection can vary from retaining all pregnant and all lactating cows, to retaining only lactating pregnant cows, to retaining only those cows expected to wean calves within a defined period.

Heifers

The selection and management of replacement heifers has a major influence on current and future herd productivity because

- it largely determines the heifers' subsequent reproductive performance
- heifers that calve late first time will tend to calve late for the rest of their lives
- future herd productivity depends on the genetic potential of the heifers coming into it.

Heifers are traditionally mated at 27 months. However beef heifers can be mated at 14 to 15 months (called yearling mating) to calve at two years of age, provided they are well grown. A high standard of management and extra feeding is usually required to achieve this but the profit from the extra calf produced usually outweighs the extra cost of feeding and labour. However this should be calculated for your situation as it is usually only viable on highly fertile country.

The liveweight at which 85 per cent of heifers will conceive in a 6 week mating period is about 280 kg for British breed heifers and about 320 kg for European and *Bos indicus* breeds.

With the maiden heifers, start with a 3 to 4 month joining period from November to February, so that the resulting calf crop is from August to November. If maiden heifers and first-calf cows calve at the desired time, the calving pattern becomes 'set' for future years.

Calves of heifers may need to be weaned earlier to allow the heifers (now called 'first-calf cows') more time to recover before the next mating season. Select and cull to ensure only easy-care, productive cows enter the cow herd.

Consider attending a Breeding for Profit Workshop to learn this technique, phone DPI&F Call Centre 13 25 23

If dystocia (calving difficulty) is a problem in heifers, identify and use bulls with a potential for low calving difficulty. Consider using bulls of a smaller breed or selecting bulls based on calving ease, birthweight and gestation length.

If dystocia is common in all cows, cull affected breeders and ensure that heifers are well grown before attempting to mate them. Employ aids such as internal pelvic measurements on heifers and cull heifers with small pelvic size.

Cows

The better a cow's nutritional status before calving and the higher her body condition score at mating, the better is the chance that she will go back in calf before weaning. Lactating first-calf cows are most likely to suffer nutritional stress because they are still growing while rearing a calf. Their body condition needs to be monitored to avoid foetal losses in their next pregnancy.

Mating

The choice of mating and calving period will vary between areas. Generally you should calve 6 to 8 weeks before the expected improvement in feed conditions. In south east Queensland this usually occurs from October or November onwards. Calves should be born from August onwards and before December to take full advantage of the summer season.

Matching mating and calving periods to seasonal conditions (referred to as 'seasonal calving') will ensure

- average weight at weaning will be heavier, because calves born after December, which often grow poorly, will be eliminated
- peak nutritional demand (during lactation) occurs when the best feed is available, and cows are in better condition because they are not lactating during winter
- bulls can be managed to ensure they are in good working condition at the start of mating season
- the age of turn-off is more uniform, with benefits in terms of husbandry procedures and marketing
- weaning and pregnancy testing can be carried out as a single operation once a year.

Seasonal calving relies on sound heifer and breeder management, with the aim of having breeders in at least store to forward store condition at joining to maximise pregnancy rates during the limited joining period.

In dry years, it may be necessary to lengthen the mating period to achieve adequate conception rates, but consider the ramifications for mating and calving in subsequent years before doing this.

A risk with seasonal mating is being 'stranded' in a drought with a large number of lactating cows, leading to high drought management costs and reduced conception rates for that year. If drought occurs during the joining period, sound breeder management with supplementation should overcome potential conception problems.

Calving

During the calving period, check your cows regularly. If you find any in difficulty beyond your expertise to assist, seek professional advice. Identify cows that have problems calving for later culling.

Diagnosing the cause of low pregnancy rates

It is not uncommon for pregnancy rates to suddenly drop from 85 per cent to below 50 per cent from one season to the next. A low pregnancy rate can be devastating to a business for many years after the event, affecting cash flow, stock flow, cow replacement program and long-term female numbers.

First, determine whether the cows are not getting in calf, or whether they are getting in calf and aborting. Generally, if the cows are not getting in calf, suspect

a bull problem. If the cows are getting in calf and aborting the foetus, suspect a cow problem.

See Diseases pp 121–128

Poor nutrition is the most common cause of low pregnancy rates in Queensland, particularly with first-calf cows. Improved management, such as early weaning and supplementation, will benefit pregnancy and birth rates. Fertility diseases such as Akabane, leptospirosis, vibriosis and pestivirus also commonly reduce pregnancy rates. Vaccination and management programs to develop immunity within the herd will assist with eliminating disease problems.

Gathering information

To assist with diagnosing the problem, collate information on the herd

- post-natal deaths, suspected abortions, still births, or unusually weak calves
- breed
- mating period
- natural or AI breeding program
- body condition score of cows prior to and during mating
- pasture quality and overall nutrition prior to and during mating
- percentage of herd showing fertility problems
- previous reproductive performance
- culling program, particularly for cows pregnancy-tested empty
- age of cows
- introduction of new animals, which may have brought in diseases for which existing cows had no immunity or protection by vaccination
- country type and any inherent deficiencies, such as phosphorus or copper
- supplementation program
- annual vaccination program.

See Record keeping pp 127–134

With this information, potential causes can be diagnosed. Taking blood tests from the most severely affected cows may also be helpful.

Investigating the bulls

Consider the following points

See Bulls pp 99 – 102

- Were the bulls tested for fertility and soundness prior to mating?
- Were the bulls proven sires?
- Were enough bulls put to the cows, given the bulls' age and experience?
- Have the bulls received annual vibriosis and three day (bovine ephemeral fever) booster vaccinations?

Breeding your own bulls

If bulls with high genetic merit have been used in your herd over an extended period, you might consider breeding bulls from your own herd. Once a breeding program has reached a certain level, selecting bulls from an established gene pool of homebred cattle may provide more consistency than continuing to buy in bulls with unknown characteristics.

To breed your own bulls, establish and segregate an elite breeding herd (called a nucleus herd)

- Select cows and bulls for the nucleus herd based on objective thresholds for all important traits. Animals must continue to meet these thresholds to remain in the nucleus herd.

- Individually identify all nucleus herd cattle and keep good records of events and characteristics such as pregnancies, number of calves weaned, progeny performance, ability to hold condition in dry seasons, behaviour, weight, frame size, and tick resistance.
- When selecting heifers for the nucleus herd, take account of their history, for example age at weaning, time of weaning, and management.
- When selecting bulls from the nucleus herd to put to the commercial herd, consider the environment and management conditions these bulls have grown with. Bulls working at 18 months under range conditions may never reach their growth potential, but their genetic merit is unchanged. On the other hand, do not select young bulls as potential sires while they are still suckling or at weaning; the dam's milk may disguise real genetic merit.

Most nucleus herds should remain open to outside bloodlines to minimise the possibility of inbreeding problems. Single sire mating is not essential, but it is useful for comparing individual sires by the performance of their progeny.

Artificial insemination

See Artificial breeding of cattle in Recommended reading pg 177

Matings can occur naturally or through artificial insemination (AI). Artificial insemination of cattle is often used by producers to

- assist them achieve their breeding program's objectives, in straight breeding and crossbreeding systems, increasing the intensity of selection by selecting suitable AI sires
- try new breeds or access the genetics of superior sires at low cost
- link their herds into genetic evaluation schemes such as GROUP BREEDPLAN
- improve their bull breeding herds.

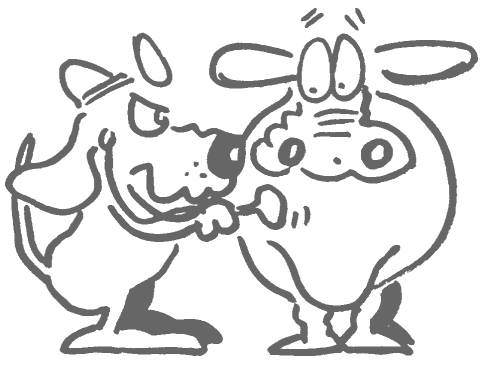
Artificial breeding is not magic. AI is a specialised operation, requiring professional advice from a veterinarian or AI consultant. Acceptable results will be obtained only with thorough planning and meticulous attention to detail. Even in ideal conditions the best possible result for a single insemination will be about 75 per cent. In programs involving large numbers of non-pregnant, non-lactating females, it is realistic to budget on obtaining one live calf for every two straws of semen used.

Cows or heifers should be healthy, non-pregnant and cycling. Artificial insemination is most suited for use on maiden heifers. It is less suitable for cows, especially cows still suckling calves. Lactation requires a great deal of the cow's available energy and the action of the calf suckling will delay a cow's return to cycling and depress fertility. The presence of calves will also drastically interfere with heat detection and with drafting and insemination routines. Weaning is a great way to get cows to recommence cycling.

The use of oestrus-synchronising drugs should be considered for programs involving large numbers of cows. Correctly used, these drugs reduce manual labour requirements, shorten the length of the AI program, concentrate heat detection requirements and, when effective, allow most inseminations to be conducted at times to suit the operator. If the drugs are used incorrectly or without sufficient attention to detail, they will reduce conception rates and add greatly to the cost of each calf born.

Health

9



Diagnosing disease and deficiencies

Diseases and parasites can severely limit production and in severe cases cause the death of a number of animals. Diagnosing a disease or parasite that is affecting herd production can be difficult and often requires professional assistance. Certain diseases are well-known in the region; others, such as exotic diseases of concern to the beef industry, require vigilance on the part of producers.

Normal beef cattle functions

The following table indicates normal ranges for important cattle functions

Body temperature (daytime rectal average)	38.6°C
Pulse	50 – 80 beats/minute
Respiration	10 – 30 breaths/minute
Puberty (age at first cycle)	12 – 18 months
Oestrus (duration)	14 hours (10 – 18 hours)
Return to oestrus after calving	41 – 60 days
Length of cycles if not pregnant	21 days (18 – 24 days)
Gestation period (conception to calving)	282 days (272 – 292 days)

Diagnosing the causes of ill-health

Animal diseases are complex to diagnose. To the untrained eye the symptoms of many diseases look similar. Determining what disease is present and what action to take is a job for a professional. Compiling comprehensive information about the affected animals, the whole herd, and the progress of the disease will greatly assist a vet or Stock Inspector with diagnosing disease or other causes of poor condition and advising courses of action. The *Disease Investigation Form* on page 113 provides a guide to the information required.

Sick animals will often be displaying the effects of multiple challenges, making conditions more difficult to diagnose. For example, animals described as 'wormy' are commonly suffering from malnutrition. Malnourished animals will be more susceptible to parasites than a healthy animal in the same environment.

There are three main causes of malnutrition

- insufficient feed
- a lack of one or more nutrients in the diet
- an imbalance of one or more nutrients in the diet.

See Ruminant nutrition pp 44–47

A look at the feed available in the paddock will show if insufficient feed is causing malnutrition. Determining if a lack or imbalance of nutrients is the cause of malnutrition is more complicated and may require professional advice.

With some experience it is easy to recognise the main external parasites: ticks, buffalo fly and lice. However determining whether an animal is affected by internal parasites is not so easy. Often faeces testing will be necessary to determine whether an animal is infested with worms, what types of worms, and to what extent.

To a certain extent, diseases and other causes of ill-health can be broadly categorised according by their main impact (Table 9.1).

Table 9.1 *Symptoms and diseases and other conditions that cause them*

Sudden death	**Diseases** blackleg botulism tetanus	**Feed-related** urea poisoning prussic acid poisoning
Fever and possible death	**Diseases** three day sickness (ephemeral fever) tick fever	**Feed-related** acidosis
Reproductive problems	**Diseases** akabane leptospirosis pestivirus trichomoniasis vibriosis	
Body abnormalities	**Diseases** blight or pink eye cancer eye lumpy jaw warts (papillomas)	
Diarrhoea	**Diseases** coccidiosis white scours black and green scours	
Failure to reach growth targets	**Deficiency** phosphorus	**Parasites** buffalo fly cattle ticks lice worms

Table 9.2 (over the page) provides a starting point for analysing ill-health in cattle, listing the most common causes and symptoms for the diseases, parasites, deficiencies and poisonings described in this book.

Table 9.2 *Common cattle diseases, parasites, deficiencies and poisonings and their obvious symptoms*

	poor growth rate	low pregnancy/calving	abortion	sudden death	wasting and possible death	fever	diarrhoea	discoloured urine	bloating	frothing at mouth or drooling	breathing difficulties	paralysis	tremors, convulsions	lameness, muscle weakness	physical abnormalities	rough coat	hair loss	bone chewing	animals appear unsettled
akabane		XX	XX																
blackleg				XX										X	XX				
blight or pink eye															X				
botulism				XX								XX							
buffalo fly	X																		XX
cancer eye	X				XX										XX				
cattle tick	XX				X											X			
coccidiosis	XX				X		XX												
leptospirosis		XX	XX	X		X		XX											
lice	X															XX	XX		
lumpy jaw															XX				
other mineral deficiency	X	X														X			
pestivirus		XX	XX		X	X	X			X			X	X					
phosphorus deficiency	XX	XX																XX	
poisonous plants			#	#	#		#		#		#	#	#	#	#		#		
protein deficiency[1]	XX	X														X		X	
prussic acid poisoning	X			XX						XX	X		X	XX					
scours – black and green							XX												
scours – white	X						XX							X					
tetanus				XX					X			XX							
three day sickness						XX								X					
tick fever			X	XX		XX		XX						XX					
trichomoniasis		XX	XX																
urea poisoning				XX			XX		XX	X	X		X	XX					
vibriosis		XX	XX																
warts (papillomas)															XX				
worms	XX				X		XX								X	X			

Notes: XX Indicates the most obvious symptoms. X Indicates the less obvious symptoms.
Symptoms will depend on the particular plant eaten. [1] Refer to *Seasonal deficiencies and supplementary feeding* pp 73 – 78 for more information.

Disease Investigation Form

Animals involved

Species ..... Breed .....

Age ..... Sex: M F Mixed

Class of animal Bulls, Breeders (pregnant/lactating), Steers, Heifers, Weaners

Homebred ..... Introduced (when/where from).....

Total number on property ..... Number in 'at risk' group .....

When were first symptoms observed?.....

When did the first death occur?.....

How long was the animal sick before it died .....

Are affected animals:
All in the same paddock
In adjoining paddocks
All over the property
Only in one group (i.e. weaners)
In a number of groups

Number affected: Dead..... Sick.....

Other species of stock on property.....

Other species of stock showing any symptoms.....

Stock showing symptoms on neighbouring properties.....

Previous disease history on the property

.....

Changes in climate

Rainfall: When ..... How much .....

Temperature ..... Humidity .....

Pasture response to climate changes .....

Recent management practices (e.g. branding, joining)

What ..... When .....

Other comments .....

Animal Treatments

When ..... With what .....

Other comments (e.g. dose rate) .....

Humans on the property

Any sick ..... Been abroad.....

Septic tank overflow from the house - animal contact .....

Water supply to the house - same as the animals .....

Animal movements

When..... Number transported.....

Where from .....

Transport firm.....

Journey time..... Animals per deck.....

Spelling: Where..... How long.....

Condition on arrival: Satisfactory..... Ill..... Dead.....

Management prior to movement .....

Management at destination: Yard/Paddock.....

Water..... Feed .....

Any other relevant history

.....

.....

Source: Cottam and Berry (1998)

Mineral deficiency

Of the 15 minerals important for cattle production, few are deficient in the diet of grazing cattle in south east Queensland. However phosphorus deficiency is common in most coastal soils, and deficiencies of copper, cobalt and selenium occur in isolated areas.

Diagnosing a mineral deficiency usually requires the analysis and interpretation of blood samples and possibly faecal samples. Local knowledge and understanding of soil types will contribute to this analysis. It is advisable to seek professional assistance in this situation.

Phosphorus

Investigating phosphorus status

To investigate whether the soils on your property are phosphorus-deficient

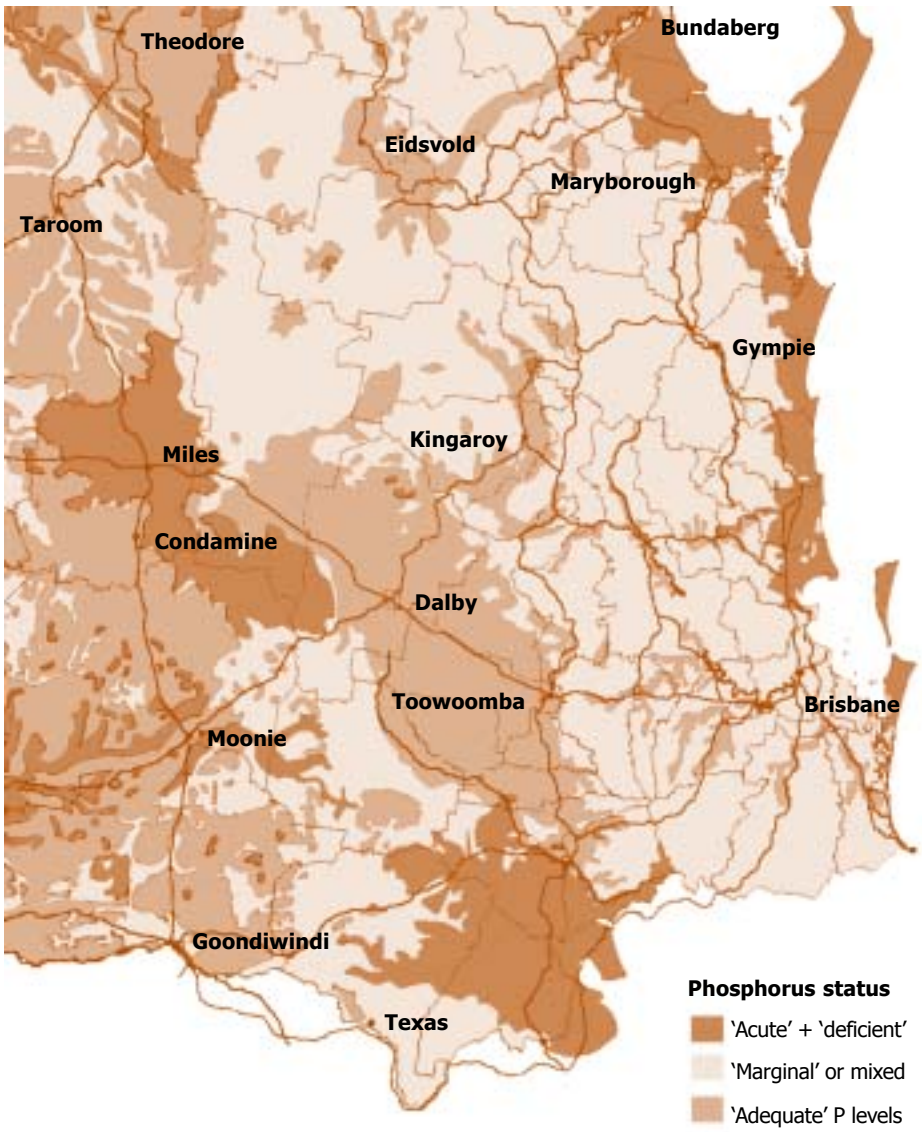
- Consider the land type on your property; some land types are more likely to be phosphorus deficient than others. Table 9.3 lists common south east Queensland land types and likely phosphorus status in the soils.
- Look at a soils map to determine if your property is in a phosphorus-deficient area. When interpreting these maps, be aware that the maps are very broad and areas classed as phosphorus-deficient may encompass smaller areas where soils are not deficient. Also talk to your neighbours and industry advisers such as the DPI&F.
- If it appears you are in an area with a soil type that is likely to be phosphorus-deficient, seek professional advice to test for phosphorus-deficiency in your cattle and to interpret the results. Deficiency levels can range from just below adequate, at which feeding may not be economical, to grossly deficient, at which production would be very limited without phosphorus supplementation.
- If tests indicate an economically significant deficiency, supplement your cattle with phosphorus and measure the results.

See Phosphorus nutrition of beef cattle in northern Australia in Recommended reading pg 177

Table 9.3 *Likely phosphorus status of major landtypes in south east Queensland*

Land type	Phosphorus status
Brigalow/softwood scrub	Adequate
Vine scrub	Adequate
Blue gum flats	Adequate
Silver-leaved ironbark slopes	Adequate
Narrow-leaved ironbark slopes	Adequate to marginally deficient
Spotted gum ridges	Marginally deficient to acutely deficient
Box flats	Adequate to marginally deficient
Gum-topped box flats	Marginally deficient
Wallum/coastal lowlands	Acutely deficient

Source: Adapted from McCosker and Winks (1994)



Source: McCosker and Winks (1994)

Figure 9.1 *The phosphorus status of land in southern Queensland as it relates to animal performance*

Symptoms

General symptoms of phosphorus deficiency are low pregnancy, calving or branding rates, and poor growth rates. Phosphorus deficient cattle have a 'depraved' appetite and will chew bones and other foreign objects. This may result in an increase in the incidence of botulism.

Phosphorus deficiency may be more pronounced in good seasons with rapid pasture growth which will result in lower phosphorus levels in the pasture.

Supplementing for phosphorus deficiency

If you decide to supplement with phosphorus, it is recommended that phosphorus be fed to breeding animals all year round and to other classes of stock only during the growing season (summer to autumn). A number of phosphorus supplements are available on the market, ranging from ready-to-feed products to others that require some preparation. Phosphorus supplements are fed as a lick, usually in an open trough.

Table 9.4 *Supplementary needs for phosphorus (g P/hd/day) on two categories of country for dry stock weighing between 200 and 600 kg at low (250 g/hd/day) or high (750 g/hd/day) rate of gain*

Liveweight (kg)	Acutely deficient soil		Marginally deficient soil	
	Low gain	High gain	Low gain	High gain
200	4	8	1 – 2	5 – 6
300	3	7	0 – 1	2 – 5
400	3	7	0	0 – 3
500	3	6	0	0 – 1
600	3	5	0	0

Source: Adapted from McCosker and Winks (1994)

Between country that is very deficient in phosphorus (acute) and country that has plenty of phosphorus (adequate), there is a lot of country (marginal/mixed) where levels could be anywhere from just above acutely deficient to not quite adequate. Thus the level of feeding/supplementing should be adjusted according to the severity of the deficiency. Table 9.4 and Table 9.5 list supplementary needs of various classes of stock.

Table 9.5 *Additional supplementary needs for phosphorus (g P/hd/day) on two categories of country for pregnant or lactating stock of two age brackets*

Age group	Acutely deficient soil			Marginally deficient soil		
	Late pregnancy	Peak lactation	Late lactation	Late pregnancy	Peak lactation	Late lactation
Young cows	2 – 4	6 – 8	2 – 4	0 – 2	1 – 5	0 – 2
Mature cows	1 – 4	4 – 7	0 – 4	0 – 1	0 – 4	0 – 1

Source: Adapted from McCosker and Winks (1994)

Feed-related poisoning

Urea poisoning

Urea poisoning is a concern whenever cattle are fed urea. Proper attention to mixing and feeding will greatly reduce the incidence of poisoning.

Poisoning usually occurs when supplements containing urea are not mixed correctly and/or are consumed too quickly. Rain, causing water to pool on urea licks, can be a source of poisoning.

Symptoms

Symptoms of urea poisoning include

- animal/s dead near the urea source
- severe stomach pain
- proppy gait
- muscular tremors
- slow, deep and laboured breathing
- weakness and collapse
- bloating
- frothing at mouth
- regurgitation of rumen contents
- violent struggling just before death.

Reducing incidence

Refer to *Protein supplements* (pages 74 – 78) for information on preparing and putting out supplements containing urea to prevent urea poisoning.

Treatment

Immediately drench with 4 to 8 litres of a mixture of equal parts water and vinegar. Repeat dose after one hour. This treatment will only work if given soon after the urea has been eaten.

Prussic acid poisoning

All sorghums, including Johnson grass and silk sorghum, can cause prussic acid poisoning by releasing the toxic compound hydrogen cyanide (HCN) when the animal consumes leaf material. Cattle are most commonly affected, but goats, sheep and horses have also been poisoned. However compared to the number of stock grazing sorghums, the number of deaths due to prussic acid poisoning is small.

Stock losses mostly occur if prussic acid content in the sorghum is high and the fodder is eaten quickly by hungry stock. Avoiding these situations helps avoid losses.

Prussic acid levels are highest in

- young plants
- early regrowth
- plants stressed from lack of moisture, cold weather, or attack by grasshoppers or other insects
- plants grown with high nitrogen in low phosphorus soils.

Grain sorghums, sweet sorghums and perennial forage sorghums can contain the highest concentrations of HCN. Sorghums x Sudan grass hybrids have intermediate amounts. Sudan grass has the least.

Common varieties and relative HCN content are shown below.

Variety	Prussic acid risk
Super Sudax	Very low
Sudan	
Speedfeed	
Zulu	
Cow Chow	
Jumbo	
Sugardrip	
Sugargraze	High

Acute poisoning

The clinical signs are seldom seen because most HCN-poisoned animals die so quickly. Once the toxic agent gets into the blood stream, usually within 15 to 20 minutes after consuming the forage, death comes within a matter of minutes.

Cyanide acts by preventing the release of oxygen in the blood and the animal virtually suffocates. Blood remains bright red. This contrasts with nitrate poisoning in which the blood goes chocolate brown.

Symptoms include

- rapid heavy breathing
- frothing at the mouth
- muscular twitching/convulsions
- staggering and severe difficulty in breathing
- coma.

Treatment for acute poisoning

Poisoned animals can be saved if promptly treated. Remove affected animals from the source of toxin. Under field conditions, oral drench treatments with photographic sodium thiosulphate (hypo) are usually the most practical. Treatment for cattle consists of 55 g hypo in 500 ml water.

Repeat the drench hourly until the animal recovers. Drench other animals that have been exposed to the plant but not showing clinical signs as a preventative measure.

These rates can also be injected directly into the rumen (through the top left flank) using a syringe. Intravenous and subcutaneous injection techniques can also be used but are best administered by qualified persons.

Chronic poisoning

In most cases the economic impact of high HCN levels is depressed weight gains or milk production. These sub-lethal effects tend to be masked by seasonal conditions and often go undetected. Sulphur is used to detoxify prussic acid, and most sorghum species contain marginally adequate amounts in forage. Free choice salt with 5 to 12 per cent added sulphur can improve weight gains and help reduce poisoning risk.

Prevention

To minimise risk

- Wait until the crop or regrowth is at least 80 cm high before grazing (or for Sudan grass, at least 50 cm high).
- Do not put hungry cattle onto a suspect crop, and introduce only a few animals at first.
- Watch stock continuously for the first hour and then intermittently over the next few days.
- Avoid grazing troublesome plants after a light frost or after rain has ended a summer drought. Wait at least a week after a killing frost before grazing.
- Ensure the crop has adequate phosphorus nutrition to lower the risk.
- Consider providing animals with a sulphur supplement.
- Analyse suspect forage samples before feeding.

HCN levels in hay and silage

Some reduction in HCN potential occurs during hay-making, but this does not necessarily render the sorghum safe for livestock. Do not make hay from sorghum crops that are considered unsafe for grazing. If suspect hay must be used, it is wise to get it analysed first and either test-feed it or blend it with safer forage.

Sorghum silage that has been stored for several months is much safer than hay because the acid fermentation process normally releases any HCN present.

If in any doubt, have forage, suspect hays or silage analysed before feeding. Consult a testing laboratory for information on taking representative samples, labelling and handling.

Acidosis

Grain poisoning, also called acidosis or founder, can occur if cattle eat too much grain too quickly or if there is a sudden change from one grain to another. A change in diet must be carried out gradually so that rumen micro-organisms have a chance to adapt. This applies whether cattle are adapting from grass to grain or from one grain to another.

Symptoms

Acidosis can cause lameness (laminitis). Affected animals go off their feed, walk with a tight tip-toed gait, and develop colic and scour.

Prevention

Some suggestions to minimise grain poisoning are

- Gradually introduce the grain
- Add 2 to 4% bentonite
- Allow plenty of room or trough space
- Pre-feed with hay or mix some hay with the grain
- Avoid cracking grain too fine
- Change from one grain to another gradually (blend the grains)
- Call cattle to the feeding points
- Use close observation and be prepared to segregate non-eaters and poor doers
- During cold wet weather, increase feeding levels by 20% using hay
- Use greater care with wheat. Wheat is more likely to cause grain poisoning than other grains as it ferments more readily in the rumen.

Treatment

Mild cases respond to a drench of 120g of baking soda (bicarbonate of soda) in a litre of water, followed by a half dose within a few hours. Severe cases are treated surgically in conjunction with antibiotics and veterinary advice should be sought. Antihistamine injections help prevent founder developing. Affected cattle should be fed a reduced grain diet and increased roughage.

Parasites

Buffalo fly

Buffalo fly are bloodsuckers which inflict a painful bite at least every half hour, causing constant irritation. Buffalo fly can reduce growth by up to 16 per cent. A small parasitic worm associated with buffalo fly bites causes skin lesions. Dark coated cattle, bulls, older cattle and those in poor condition usually attract the heaviest infestations. Fly activity is greatly reduced or stops completely in most southern Queensland areas over winter.

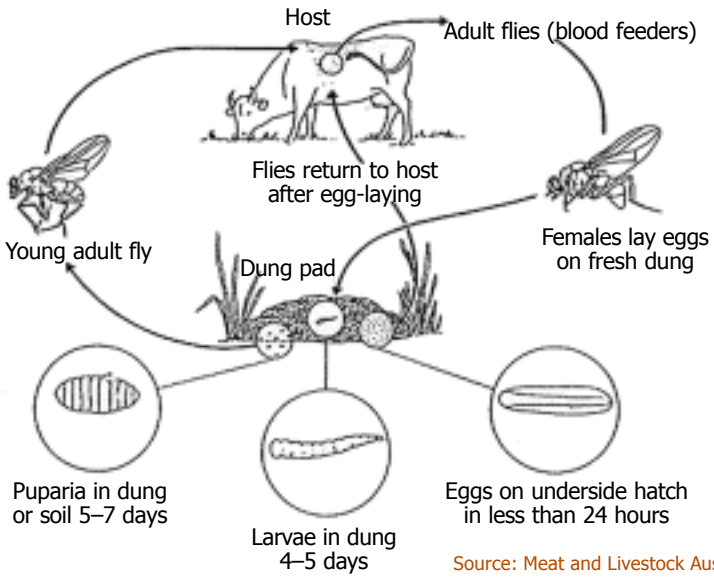
Control

Current buffalo fly control strategies (Table 9.6, over the page) aim to

- reduce buffalo fly numbers to acceptable levels
- provide for animal welfare
- minimise chemical residue risks
- reduce reliance on chemicals.

Buffalo flies tend to congregate on the neck, dewlap and shoulders

To minimise buffalo flies developing resistance to chemicals and to reduce chemical residue risks, it helps to tolerate some level of fly burden. Monitor fly numbers and delay treating cattle until fly worry is obvious on the most susceptible cattle or when animals are carrying more than 200 flies per side. Organophosphate chemicals can be used for opportunistic spray treatments when cattle are in yards for other husbandry purposes. Chemical resistance can be minimised if neighbours cooperate by using the same chemicals and treating at the same time.



Source: Meat and Livestock Australia (2001)

Figure 9.2 *Buffalo fly life cycle*

The dung beetle is the most common non-chemical preventative strategy. Dung beetles destroy the breeding sites of the buffalo fly. Buffalo fly traps can be effective (several designs are available) but they are costly to buy and cattle need training to use them.

Buffalo fly numbers can also be controlled with walk through buffalo fly traps. There are two traps currently on the market. The CSIRO developed trap relies on physical removal of buffalo fly as the animal walks through. The buffalo fly then

Table 9.6 *Advantages and disadvantages of buffalo fly control methods*

Application method	Advantages	Disadvantages
Ear tags	Effective for 8 or 16 weeks Cattle usually only need to be tagged once each season Nil withholding period (WHP) and Export Slaughter Interval (ESI)	Labour intensive to apply Tags must be removed 10 or 16 weeks after insertion Tags must be removed before slaughter Failure to remove tags may promote resistance
Sprays	Relatively cheap	Multiple treatments required throughout the season Up to 21 days ESI for some products Chemicals must be mixed and applied correctly Many spray products toxic to dung beetles
Pour-ons	Easy to apply Can be used for integrated parasite control as many pour-ons also treat worms, ticks and lice	Long ESI for most products Repeated treatments required Some products expensive Some products may be toxic to dung beetles if applied at times of the year when immature beetles are present
Back rubbers	Low cost Self treatment	No control over dose per animal 10 day ESI Must use clean oil
Dust bags	Low cost Self treatment Nil WHP and ESI	Daily application needed Suitable hanging site essential for effective control Fly control may not occur for 1-2 weeks after cattle begin using bag because insecticide concentration must build up on coat

Source: Meat and Livestock Australia (2001)

The Buffalo fly trap. Preliminary results suggest a 60-80% reduction in fly numbers is achievable. Plans are available from the DPI&F.

become trapped in the upper part of the trap where they die. The DPI&F developed tunnel trap relies on a change in light intensity at the tunnel entrance to cause the fly to lift from the animal. As the animal walks through the trap the fly follow them in but are attracted to the light coming through a pair of windows on each side of the tunnel. The fly become trapped in a pair of cages attached to the outside of the tunnel.

Cattle tick

The cattle tick (*Boophilus microplus*) causes great economic losses to the cattle industry. A heavy infestation of cattle ticks causes loss of condition from loss of blood. Cattle ticks can also carry and transmit tick fever. Cattle ticks can be controlled, but for any program to be effective it is necessary to understand the habits and life cycle of the parasite.

The best time to identify the cattle tick is when the tick is at the adult stage. Other ticks commonly found on cattle in Queensland are scrub (paralysis) ticks and New Zealand cattle (or bush) ticks. Ticks can be found anywhere on the body when cattle are heavily infested, but they tend to congregate in the inside back legs, tail butt, belly, shoulder, dewlap and ear.

See Moving cattle pp 17 – 18

Movement restrictions

Stock moving from a tick-infested area to a tick-free, protected or eradication area must be inspected as clean and treated under the supervision of a Stock Inspector before entering the new area. There are also restrictions on stock movement interstate. Stock owners must provide sufficient preliminary treatments to ensure their cattle are tick free when presented to the inspector for examination, with the most recent treatment being four or more days prior to examination.

Life cycle

The cattle tick spends the parasitic stage of its life cycle on its host, cattle. This stage takes about 21 days during which time the tick changes from a minute larva to a nymph and finally to an adult. Adult males feed occasionally but do not fill with blood. They wander over the animal for two months or more, mating with females. Adult females feed slowly for about a week, filling rapidly with blood at the end of this time. They then drop into the pasture, lay up to 3,000 eggs, and die.

Cattle tick

Bush tick

Paralysis tick

Figure 9.3 *Fully fed adult females*

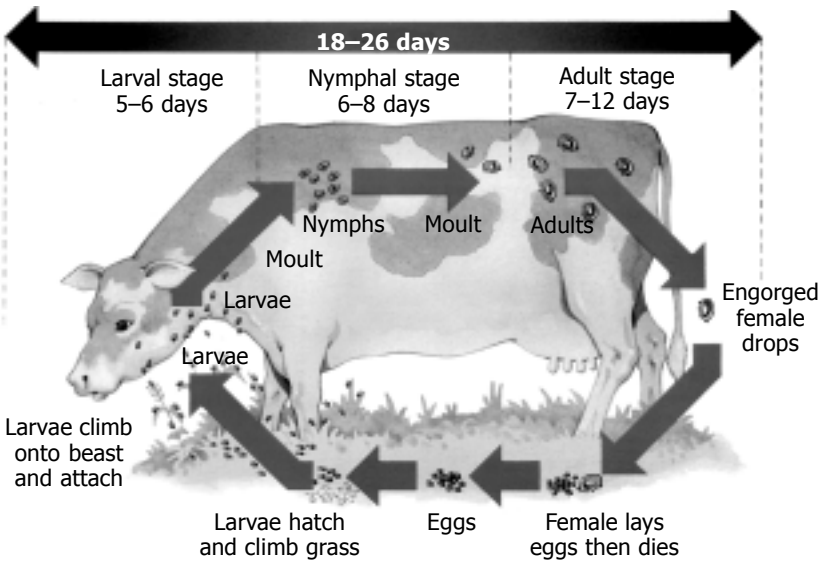


Figure 9.4 *Cattle tick life cycle*

Eggs hatch to produce larvae that remain on the pasture until they are picked up by a suitable host, or otherwise they eventually die. This non-parasitic stage can vary from about two months in summer to 6 to 7 months in cooler periods.

In southern Queensland, ticks that fall to the pasture from late autumn and into winter (mid-April to late June) produce virtually no progeny. However engorged female ticks dropping in early autumn (March to mid-April) can produce larvae that will survive the winter and eventually result in a 'spring rise' in tick numbers. If not controlled, these ticks will breed to a stage where there are great numbers in the autumn and early winter of the following year.

Extremes of temperature and moisture adversely affect cattle tick survival.

Control

Cattle ticks can be controlled to varying degrees with combinations of resistant cattle, pasture spelling, and strategic treatments with chemicals.

Tropical (*Bos indicus*) breeds and their crosses have better immunity to cattle ticks than British and European (*Bos taurus*) breeds.

Pasture spelling will be effective only if the pasture is completely destocked and spelled until most larvae on the pasture are dead (at least 3-6 months).

In south east Queensland the most efficient chemical method for controlling ticks on tick-susceptible cattle is strategic dipping. This means timing treatments to target various stages of the tick's life cycle using conventional acaricides. At the start of the spring rise in tick numbers (usually mid to late October), commence a program of 5 to 6 dippings at 21-day intervals. This will break the life cycle by preventing engorged females from dropping off to lay eggs and reinfest the pasture. The depletion in this generation will reduce the build-up in the following three or four generations. Some chemicals provide similar control with less frequent treatments.

Pour-ons or injectable acaricides may be used, but the number of treatments and intervals will depend on the specific products used (see recommendations on the label).

Lice

Cattle lice are divided into two broad categories of biting and sucking, which refers to the way they feed. Both types irritate cattle.

Cattle lice range from 1.5 to 4.5 mm in size, the smallest being about the size of a pinhead. Most are dark red-brown. Mixed infestations of both biting and sucking lice occur frequently.

Lice are usually found on the neck, brisket, dewlap, head, base of tail, between the legs, and around the udder and scrotum. In severe infestations they can be found over most parts of cattle.

Life cycle

The female louse attaches her eggs to the hairs on cattle. Nymph forms (young lice resembling adults but smaller) hatch and pass through three intermediate or nymphal stages to become adults. The complete cycle, from egg laying until the next generation is mature and laying eggs, takes about 28 days, but can vary from 21 to 30 days. All these stages take place on the animal.

Temperature plays an important part in affecting lice numbers. The optimum temperature for development through the life cycle is 16°C. Heaviest lice

infestations occur during winter to early spring although isolated infestations may occur at other times of the year.

Healthy cattle in good condition seem to develop some form of natural resistance that controls a lice burden. Cattle in poor condition and on poor nutrition are more likely to build up bigger burdens of lice and the lice are likely to remain on them longer.

Symptoms

Lice irritate the skin when feeding. To seek relief, some cattle will rub against trees and posts, removing hair and often damaging their skin. (Although rubbing is a good indicator of lice infestation, cattle will also rub for other reasons, such as when shedding their coats.)

Cattle severely infested with sucking lice may become anaemic because of the amount of blood lost.

Treatment

A range of products is available for treating cattle lice, from high volume sprays to pour-ons. Most cattle tick control chemicals will also control lice.

Chemicals must be used according to manufacturers recommendations and withholding periods and Export Slaughter Intervals strictly adhered to.

Worms

Worms are generally only a problem in younger stock. Worms can be particularly damaging at times of stress such as weaning.

It is difficult to estimate the worm burden just by looking at an animal. Many other conditions can make cattle look 'wormy'. It is best to assess the worm burden accurately by using a test kit such as the Wormcheck kit, available at larger rural services outlets and some veterinary practices. General signs include

- rough coat and dull appearance
- loss in condition
- scouring
- sunken eyes and paleness of eyes and lips
- bottle jaw (swelling under the jaw).

Worm burdens are measured by counting the number of eggs in the dung, expressed as eggs per gram (EPG), and the extent of the problem depends on the type of worms present as well as their numbers (Table 9.7).

Table 9.7 *Problem worm egg counts in cattle at 6 to 12 months of age*

Type	Eggs per gram
Haemonchus (barbers pole worm)	500–700 serious, 1,000 serious to fatal
Cooperia (small intestinal worm)	10,000 serious
Oesophagostomum (nodule worm)	800 serious, 1,000 fatal
Bunostomum (hookworm)	300 – 500 serious
Trichostrongylus (black scour and small intestinal worm)	Not known to cause a problem 100 – 150 normal, 500 abnormal
Ostertagia (small brown stomach worm)	1,000 – 4,000 serious

Control

To reduce the worm population on the pasture, use drenches in combination with grazing management techniques to reduce larval pick-up after drenching.

For example, use pasture rotation to prevent reinfestation from contaminated pastures, and graze young cattle in a paddock before older cattle to minimise transferring worms from older to younger stock. Dung beetles should always be encouraged to help reduce larval numbers on pasture.

At weaning, check weaners for worm burdens. If these are found to be significant, drench and move the weaners to clean pasture.

Worms are rarely a problem in cattle over 12 months old. Always check the worm burden in older cattle before deciding whether to drench.

Deciding to drench will depend on the number of eggs per gram, the species of worms present, the condition of the animal, and the feed. As a general guide

- below 200 EPG – do not drench
- 200 to 1,000 EPG – drench, depending on the species of worm present
- above 1,000 EPG – drench irrespective of species.

There are four types of cattle drenches

- clear drenches – broad-spectrum drenches containing levamisole
- white drenches – broad-spectrum drenches containing benzimidazoles
- endectocides – broad-spectrum drenches with external parasite control
- specific drenches – narrow-spectrum drenches or broad-spectrum drenches with specific activity for other parasites such as liver fluke.

The three broad-spectrum groups will control economically important problem worms in Queensland cattle. Some drenches have a residual protective effect. The choice of drench will depend on

- efficacy required (the percentage of worm burden to be removed)
- method of application
- cost
- class of cattle to be treated, e.g. lactation status
- withholding periods for slaughter for domestic and export markets and Export Slaughter Intervals.

Diseases

Akabane disease

Akabane disease is a virus that occurs as periodic, seasonal outbreaks after conditions favourable to the biting midges that spread it. It causes its greatest impact in pregnant cattle and because the virus is active in most parts of Queensland in most years, heifers and cows normally get exposed and develop protective immunity before they get in calf.

Symptoms

Symptoms of akabane disease in cattle that are not immune to it include late abortions, stillbirths and deformed calves depending on the stage of pregnancy when the cow was infected. The virus can cause bent legs in calves. It can also result in calves born without part of the brain. These calves can have head tremor, lack coordination and cannot suck.

Prevention

Due to the minor and sporadic occurrence of akabane disease it is generally not a concern under Queensland conditions. In parts of New South Wales the virus can cause significant calf losses and dystocia because it occurs less frequently, and pregnant naïve cows and heifers can be exposed during the critical stages of

pregnancy in large numbers. Regular surveillance for this and other insect-borne diseases is undertaken as part of the National Arbovirus Monitoring Program (NAMP).

Treatment

There is no feasible way to control akabane disease under Australian conditions.

Blackleg

Blackleg is a bacterial disease of cattle that can develop rapidly in association with bruises, wounds or other injuries. Blackleg is usually fatal. The organism is present in soil and in the intestines of normal healthy animals.

Symptoms

Blackleg affects rapidly growing beef cattle between 4 months and 2 years of age. Animals are often found dead without clinical signs. If found alive they are dull, lame in one or more legs, and will not eat. Swelling occurs in the large muscle groups of the hindquarters, shoulders or neck. Swollen areas are cold to touch and may contain gas.

Prevention

If blackleg is known to occur in your herd or area, routinely vaccinate calves at 2 to 3 months of age and again 4 to 6 weeks later, using either a specific vaccine or a multi-valiant vaccine such as 5-in-1. If an outbreak occurs, vaccinate all animals of 2 months to 2 years of age. Revaccinate 4 to 6 weeks later. Burn the carcasses of affected dead animals.

Treatment

Large doses of penicillin given early in the disease may save the animal, but muscle damage will be permanent.

Blight or pink eye

Early stages of blight

Blight is a common contagious disease affecting young cattle in summer. European and British breeds that have light eye pigmentation are more susceptible. It is rarely seen in tropical breeds.

Symptoms

Affected animals suffer from temporary or permanent blindness, weight loss and reduced milk yield. The first sign of blight is a clear discharge from the eye with the eye sensitive and kept shut. There is reddening of the eyeball and membranes around the eye. A shallow ulcer may develop on the surface of the eye, which becomes cloudy as blood vessels start to grow. It may take up to a month to heal and small scars will often remain.

Deeply ulcerated eyeball which will result in permanent blindness of the affected eye. This could be confused with eye cancer.

Treatment

There are several commercial treatments. However the value of treatment is questionable as mustering and yarding can encourage the spread of the disease.

Botulism

The botulism bacterium produces a potentially fatal toxin that will be present in the decaying carcases of affected animals. Most cases of botulism in cattle occur in stock grazing phosphorus-deficient country, where phosphorus-deficient cattle often chew bones. Cases can also occur where feed is contaminated by dead animals such as snakes or rodents in hay or silage.

Symptoms

Cattle suffering from botulism show few signs. Botulism could be suspected if several animals are found dead with no distinguishing signs. Animals suffering a prolonged condition will lie down and normally die in one to two days.

See Phosphorus
pp 111–113

Prevention

All animals should be vaccinated in high risk areas with bivalent vaccine with an annual booster. Supplementing cattle with phosphorus and nitrogen will reduce the problem of bone-chewing in phosphorus-deficient country. Dispose of all carcasses by burning.

Treatment

Provide animals that are down with water, shelter and feed. However there is no treatment for botulism-affected animals. If botulism is confirmed, destroy the animals and dispose of the carcasses by burning.

This animal shows hind limb paralysis and cannot raise its head

Cancer eye

Cancer eye occurs mainly in Herefords and cattle with light eye pigmentation. Cattle on a high plane of nutrition are also more susceptible to the disease than other cattle.

Symptoms

Cancer eye is a wart-like growth that enlarges and can involve the whole eye and surrounding tissue. It results in blindness, and may eventually cause death. Carcases are downgraded at slaughter, resulting in loss of income.

Prevention

When selecting animals, pick and breed from those that have dark pigmentation around the eye and do not breed from cattle surgically treated for eye cancer. Cull susceptible animals.

Treatment

There is no effective treatment for cancer eye. In the early stages of the disease a veterinarian may surgically remove growths. Cattle with open, discharging, bleeding or foul-smelling eye lesions are not permitted to travel from their property of origin. In the early stages of the condition, affected cattle may be able to travel to sale for slaughter or direct to slaughter at an abattoir on a 'suspect cattle' travel permit.

Coccidiosis

Coccidiosis is a cause of serious parasitic scours, generally occurring in calves between 2 and 12 weeks of age.

Symptoms

Signs of infection are straining and general sickness. The calf is off its feed and may lose condition and become anaemic. It can die in 4 to 7 days. Clots of blood and shreds of mucous membrane are passed in a dark, tarry, foul smelling scour. In less severe cases, the diarrhoea is yellowish and streaked with blood.

Prevention

Poor nutrition and poor environmental conditions may be one cause of coccidiosis in early-weaned calves. These conditions can be avoided by moving calves and cows to clean pasture, rotating paddocks frequently, and feeding weaned calves well. This enables calves to resist attacks of coccidiosis and build up an immunity with minimum stress, body weight loss and disruption to growth.

Treatment

Isolate affected calves, preferably on to concrete where droppings can be removed, and treat as prescribed by your veterinarian.

Leptospirosis

Leptospirosis is a contagious cattle disease that can seriously affect beef production by decreasing branding percentages. There are two strains of leptospirosis, *L. hardjo* and *L. pomona*.

Symptoms

Acute leptospirosis is seen mainly in calves. They show signs of fever, go off their feed, pass red urine, and are jaundiced. Many die within three to 5 days. Survivors are usually unthrifty for the rest of their lives. Leptospirosis also causes abortions in late pregnancy and stillbirths. A cow may show no signs of illness before or after the abortion or stillbirth. Leptospirosis can reduce calf drop by 40 per cent or more during a bad epidemic.

Leptospirosis in humans

Leptospirosis can be transmitted from cattle to humans. Humans can become infected either by direct contact with infected urine when handling cattle, for example at milking or branding, or indirectly through contact with leptospirosis-contaminated waterholes. Leptospirosis in humans can vary from a mild, influenza-like condition to a fatal infection.

Spread and survival of leptospirosis

Cattle that recover may become carriers and shed the organism in their urine. In a favourable environment, for example moist, shaded areas with moderate temperatures, the bacteria can survive for up to 6 months. Leptospirosis is very common in wet coastal areas of Queensland. In drier inland areas, it is usually restricted to heavier soils where it is held in clays and released during heavy rainfall periods. It is also found in areas of swampy ground or adjacent to watercourses.

Prevention

The reproductive form of the disease can be controlled only by vaccination. To fully vaccinate an animal, give two doses of vaccine 4 to 6 weeks apart followed by an annual booster. With calves, give the first dose at 1 to 3 months of age, then a second dose 4 to 6 weeks later. Give the annual booster to older animals at about the mid-stage of pregnancy. In an outbreak of leptospirosis, all calves on the property should be vaccinated. Vaccine is also available now as a 7-in-1, which is the normal 5-in-1 plus two leptospirosis strains.

Treatment

After leptospirosis has been confirmed by a blood test (to detect antibodies), it can be treated with an antibiotic. Seek advice from your veterinarian.

Lumpy jaw

One group of organisms that cause lumpy jaw gain access via injuries to the mouth or tongue and cause immoveable swelling in bony tissue in the lower and

upper jaw (*actinomycosis*). A related condition occurs in soft tissue and the 'lump' is moveable (*actinobacilliosis*). When the tongue becomes infected, the condition is often referred to as 'wooden tongue'.

Prevention

Early culling of infected animals will decrease the incidence in the herd and control the disease.

Treatment

Seek a veterinarian's advice to determine treatment, for example surgical drainage and/or medication. Affected cattle are not permitted to travel when abscesses are discharging, or are likely to discharge.

Pestivirus

Bovine pestivirus is widespread throughout the Australian cattle population with 70 to 90 per cent of herds infected. A high proportion of animals in infected herds are immune. The main cause for concern is when cows become infected during pregnancy. There is no vaccine for the virus and management is by ensuring heifers contract the disease and have antibodies before becoming pregnant.

Pestivirus is also referred to as 'bovine viral diarrhoea virus' (BVD) and 'mucosal disease virus'. It causes a number of disease patterns in cattle herds.

Symptoms

The infection generally goes unrecognised because symptoms are mild. If a cow does not have immunity to the virus and is infected while pregnant, the infection crosses the placenta and infects the developing foetus. The effect on the foetus will depend on the stage of pregnancy when infection occurs (Table 9.8).

Table 9.8 *Symptoms of bovine pestivirus during different stages of pregnancy*

Stage of pregnancy	Effect
First month	Abortion occurs.
Second to sixth months	Abortion may occur, or the calf may be born weak, dwarfed, stillborn and persistently infected.
Around six months	Calves that survive beyond birth will be persistently infected, and will retain a wobbly gait and permanent head tremor. Calves may be unable to stand or suck. Some calves will be born blind.
After six months	Foetus will produce antibodies, and infection will produce no negative impact.

Foetuses infected prior to six months of pregnancy will have the virus in their system when their immune system subsequently develops (at around six months of pregnancy). Because the virus is present at this time, the foetal immune system does not recognise it as foreign and will not mount an immune response to it. Thus the virus persists in the foetus and subsequently in the calf for the rest of its life.

Mucosal disease may develop in persistently infected cattle, which become infected with a 'killer' form of pestivirus so closely related to the virus they are already infected with that their immune system does not recognise it as foreign.

Mucosal disease is the syndrome most often recognised by producers. Affected cattle drool excessively, are depressed and feverish, have persistent bloody diarrhoea and sometimes a soft cough and lameness. The severity ranges from the acute form, which results in death, to a chronic wasting illness.

Bovine viral diarrhoea occurs when healthy, normal cattle are infected with pestivirus. It is rarely recorded in Australian cattle as it is frequently unnoticed. Signs may include a transient fever, a depressed hollow appearance, diarrhoea, a slight cough and increased susceptibility to other infections.

Spread

Bovine pestivirus is spread through direct contact between animals. It does not persist in the environment and is rapidly killed outside of cattle. It can be present in large quantities in blood, saliva, tears, nasal discharge, milk and semen. The greatest period of spread is during yarding, particularly when cattle from different groups or herds are mixed.

Diagnosis

Pestivirus can be identified by testing for antibodies in blood from a live animal or tissues from an aborted foetus.

Management

Because there is no vaccine for this disease and the chances of animals becoming infected are high, maiden heifers should be given every opportunity to become infected before they are mated. This can be done either by mixing weaners together before selecting the biggest and best heifers as replacements or by retaining a known persistently infected animal to mix with replacement heifers prior to breeding.

Scours – black and green

Black and green scours can be caused by worm infestations from 2 to 12 months of age. These sorts of scours are generally only a problem with hand-reared calves. Weaning onto rich pasture, e.g. lucerne, can also cause green scours.

Symptoms

The scour is black or green in colour, usually with a foul odour. The calf is obviously sick and will be 'tucked up' in the stomach. Affected calves will not eat.

Control

Improving the nutrition of calves, rotating calf paddocks and carrying out a careful program of drenching for worms can control the condition. An early supply of colostrum is also essential to the calf to provide antibodies against infection.

Scours – white

A diarrhoea that, in severe cases, can result in death.

Symptoms

A yellowish, white diarrhoea with a pungent smell is observed. The calf is dull and ill, has sunken eyes, and a stiff gait due to abdominal pain. Some calves will die quickly while others may live with signs of lung damage and joint infection. They become lame and pot-bellied.

Treatment

The calf should be removed from all sources of milk. This rests the gastro-intestinal tract and gives the body a chance to repair damage to the intestinal lining. As scouring calves are dehydrated, they should be rehydrated. If the calf is standing, give electrolytes orally. The calf should be given about 4 L of electrolyte each day (for a 40 kg calf) by either drenching or using a stomach tube. An electrolyte solution can be made if commercial electrolytes are unavailable: 4 teaspoons salt plus 2 teaspoons baking soda plus 2 cups glucose in 4 L of water.

Binding agents, such as kaolin or sodium bentonite, may be given. Anti-scour powders are available from veterinarians and stock and station agents. As the condition is infectious, oral antibiotic treatment may be necessary. If the calf has been off milk, it should be gradually re-introduced to milk over several days.

Tetanus

Tetanus occurs throughout Australia. The bacterial spores enter the animal through wounds, burns or surgical incisions that have been contaminated with soil or manure. The bacteria produce a powerful toxin that affects the nervous system.

Symptoms

Signs include stiff muscles, spasms, tremors, lockjaw, unsteady gait and a stiffly held neck and tail. The third eyelid becomes visible. Animals become dehydrated and commonly bloat. In the terminal stages, the animal falls, with neck and back arched and the legs fully stretched out. Tetanus can occur in calves after castration and in cows after calving, especially if the afterbirth is retained.

Prevention

Vaccinate with 5-in-1 or 7-in-1. For short-term prevention (10 to 21 days) following surgery or injury, inject with tetanus antitoxin.

Treatment

Treatment is usually impractical. Confirmed cases should be destroyed and all carcasses disposed of by burning.

Three day sickness

Bovine ephemeral fever, commonly known as three day sickness, is widespread in Queensland. It is caused by an arbovirus that is spread by mosquitos and sandflies. The disease is most severe in bulls, fat cattle and well-conditioned pregnant and lactating cows.

Symptoms

The symptoms of three day sickness include a short fever, shivering, lameness and muscular stiffness. Initially affected animals suffer from fever, depression, drooling, and eye and/or nasal discharge. They then go down and experience muscle stiffness and some lameness. As animals recover, they start eating and drinking again. Recovery is from one day to several weeks.

Prevention

Calves possess high immunity until they are about 6 months old. A vaccine is available for cattle older than 6 months. Provide two vaccinations, 4 to 6 weeks apart, followed by an annual booster to maintain a good immunity.

Treatment

Affected animals should be made comfortable with shade and water, then left alone to recover quietly. Do not drench affected animals because paralysis of the throat muscles may let fluids pass into the lungs, causing pneumonia. Medication may relieve muscle stiffness.

Tick fever

See Tick Fever Centre in Useful contacts pg 174

Two forms of tick fever are transmitted by ticks

- *Babesiosis*, often referred to as 'red water' because animals with this disease often pass blood in their urine
- *Anaplasmosis*.

Babesiosis (red water) – *Symptoms*

The disease is characterized by fever, loss of appetite, depression, reluctance to move and an increased respiration rate, especially after exertion. Red urine is commonly seen, as are anaemia and jaundice (pale or yellow membranes). However red urine does not provide a definitive diagnosis; other diseases also cause the urine to be red.

Older animals are more acutely affected than calves. Pregnant cows may abort. Nervous symptoms are sometimes seen. Death may occur with little warning and the mortality rate may be high, especially in British or European breeds.

Treatment

Imidocarb is highly effective for treating *babesiosis* if it is given during the early stages of the disease. The drug is marketed in Australia under the trade names Imizol® and Imidox® and the treatment dose is 1.2 mg/kg or 1 ml/100 kg given subcutaneously. Given at a higher dose of 3 mg/kg or 2.5 ml/100 kg, it has a preventative effect lasting at least 4 weeks.

Supportive treatment is advisable, particularly in severe cases and when valuable animals are involved. This may include anti-inflammatory drugs, antioxidants and corticosteroids. For a choice of drugs, see your vet.

Anaplasmosis – *Symptoms*

The symptoms of *anaplasmosis* are very similar to those of *babesiosis* except that the course of the disease is more protracted, fever not as marked, and the urine is brown, not red. This disease affects all breeds of cattle but rarely causes heavy losses.

Treatment

Tetracycline antibiotics and imidocarb are effective for treating *anaplasmosis*. Tetracycline is marketed under a number of trade names, including Terramycin®, Engemycin®, Bivatop®, Alamycin®, Oxytet® and Tetravet®, and the dosage depends on the formulation of the drug. When imidocarb is used, the high dose of 3 mg/kg or 2.5 ml/100 kg should be used.

Animals treated promptly in the early stages of the acute disease usually survive. Blood transfusions to partially counter the anaemia greatly improves the survival rate of severely affected cattle.

Withholding periods

Both imidocarb and tetracycline antibiotics have withholding periods for meat and milk which must be adhered to.

Prevention

The Department of Primary Industries and Fisheries produces a vaccine that is very effective in the prevention of tick fever. One vaccination is usually sufficient to give life-long protection. Vaccinations should be given to

- all calves at weaning
- all cattle introduced to your property, whether they come from tick-free or infested country.

Cattle from tick free areas must be kept tick-free for 28 days after vaccination because the vaccine does not provide immunity against one of the tick fever strains for this length of time. This is best managed by vaccinating the cattle at their property of origin at least 28 days before they are moved to the tick-infested area. Cattle from a tick-free area, which will have had no previous contact with ticks and thus no immunity, can have a strong reaction when vaccinated as adults.

Vaccinating against tick fever

Trichomoniasis

Trichomoniasis is a venereal disease spread by bulls when mating.

Symptoms

Infected herds have low branding percentages and late calving, usually over a long period, which can lower productivity by up to 20 per cent. Cows keep on returning to the bull for 4 to 5 months after they have been mated and abortions may occur at almost any stage of pregnancy.

Bulls under 3 years old are resistant. Several bulls should be examined and swabs taken by a veterinarian to get a positive diagnosis.

Prevention

The general principle is to rest cows from mating for three months, then use artificial insemination or clean bulls. One way of applying this principle is to remove all bulls older than 6 years and all non-pregnant, dry cows. Another approach is to maintain two herds with young bulls and heifers separated from old bulls and cows, and to cull the aged group until the disease is eliminated.

Treatment

Consult your veterinarian.

Vibriosis

Vibriosis is a venereal disease spread by bulls when mating. Infection in a herd reduces calving rates and prolongs the calving period. Infection will establish quickly in herds with uncontrolled mating. Bulls usually remain infected for life without any effect on physical or reproductive performance.

Symptoms

Low calving rates in maiden heifers and a high percentage of cows calving late in the calving season are signs of the disease. Infected cows fail to become pregnant and return to service at irregular intervals.

Prevention

When cows recover from the infection, they usually have a strong immunity that will prevent re-infection. The best method of control is by vaccination. The vaccine requires two injections, 4 to 6 weeks apart, followed by yearly boosters.

In most cases, vaccination of all bulls and possibly maiden heifers will control this disease. Vaccinate bulls 4 to 6 weeks before the start of the breeding season. The vaccine has an oily base which may leave a temporary swelling at the needle site.

Treatment

Treating individual animals is rarely worthwhile because they become re-infected upon return to the herd.

Warts (papillomas)

Warts (papillomas)

Warts are commonly found on calves, yearling cattle and occasionally on the udders and teats of cows. They are caused by a contagious, viral infection which results in the abnormal and excessive growth of skin. Warts do not affect production.

Prevention

Details regarding papilloma vaccines can be obtained from your local veterinarian.

Treatment

In the early stages the warts can be treated with several commercial products. Healthy calves can normally resist wart infection.

Report unusual signs to your vet, the DPI&F Call Centre 13 25 23 or the exotic disease hotline 1800 675 888

Exotic diseases and pests

Australia is free of many diseases that cause major problems in other beef-producing countries. The livestock industry, including meat and livestock products, is worth approximately $12 billion to the Australian economy each year. An outbreak of an exotic livestock disease would be disastrous for Australia's economy, causing possible losses of billions of dollars in trade. A range of industries and small business would be severely affected, with a possible rise in unemployment of up to one per cent. As well as causing potential devastation to livestock and the export industry, certain disease outbreaks could also endanger human life.

Strict quarantine measures are in place to prevent exotic diseases from entering Australia. To further support these measures

- feeding swill to livestock is banned as this practice could introduce Foot and Mouth and other diseases
- feeding meals derived from livestock, including fish and poultry, is also banned to prevent the introduction of mad cow disease (BSE).

Livestock owners should monitor their stock and report unusual signs including large numbers of dead or sick animals, animals showing evidence of blisters, and animals showing unusual nervous signs. Early reporting of animals showing symptoms would reduce the impact of an exotic disease on the Australian economy. Report unusual signs to your vet or phone the exotic disease hot line, 1800 675 888, the DPI&F Call Centre 13 25 23, or your local DPI&F Office.

For general information regarding exotic diseases see Animal Health Australia in Useful contacts pg 169

Exotic diseases of most concern to the Australian livestock industry include foot and mouth disease (FMD), mad cow disease (also known as Bovine Spongiform Encephalopathy or BSE), rinderpest and screw worm fly.

Foot and mouth disease

Foot and mouth disease is a highly contagious virus that is spread by direct and indirect contact. An outbreak of this disease would trigger the immediate slaughter of all cloven-hoofed animals on the infected property and on any other contact properties. Restrictions would extend for at least a 5 kilometre radius from infected properties. It is estimated that an outbreak, even if quickly contained, could trigger a chain of economic consequences that could have the cumulative effect of wiping out 3.5 per cent of the nation's gross domestic product and possibly raise unemployment by up to one per cent.

Symptoms

The early signs of the disease in cattle are fever, loss of appetite, and a drop in milk production. Excessive salivation is followed within a day by fluid-filled blisters, especially in the mouth and on the tongue. After rupturing, the lesions take about ten days to start to heal. Deaths from foot and mouth disease are usually less than 5 per cent, except in young calves where 50 per cent may die.

Spread

Imports of infected animal products pose the greatest risk for the entry of foot and mouth disease into Australia. The virus can survive in chilled, frozen, salted, cured, and partially cooked meats. Pasteurisation does not reliably kill the virus. There is always the possibility of someone bringing the virus into Australia, either on dirty boots or clothing or by illegally importing material such as meats and meat products (such as salami), cheeses, semen, embryos or live animals.

Feeding of swill to livestock is banned in Australia to help prevent the introduction of foot and mouth disease.

Mad cow disease (Bovine Spongiform Encephalopathy)

The disease was first diagnosed in Britain in 1986 with the number of cases peaking in 1992. There has been a higher incidence of the disease in dairy herds than in beef herds. The disease has been linked to Creutzfeldt-Jakob disease in humans.

Symptoms

Most cases have been seen in cattle over 4 years of age but animals as young as two years may be affected. Apprehension, increased sensitivity and lack of muscular coordination are the main clinical signs. At least one of these signs has been present in 97 per cent of cases. Other common clinical signs include temperament change, cows vigorously kicking when being milked and muscle tremors. The disease has an insidious course with progression of clinical signs over weeks or months leading to debility, loss of weight, inability to stand and death. There is no treatment and no difference in breed susceptibility.

Spread

It is thought that one way the disease is spread is by animals eating infected animal by-products, so the feeding of all animal-derived meals (including poultry and fish) to ruminants is banned in Australia.

Rinderpest

Rinderpest is probably the most lethal virus of cattle.

Symptoms

Cattle infected by the virus experience a sudden onset of high fever, nasal and eye discharge, erosive lesions of the mucous membranes and dysentery. High death rates and high infection rates are key indicators of the disease.

Spread

Rinderpest could only enter Australia through the importation of infected animals. It is contagious but only by close contact with affected animals. The virus does not survive long outside the infected host.

Screw worm fly

All domestic livestock and companion animal (warm blooded) species are susceptible to screw worm fly. Strikes have also been recorded in various wildlife species and occasionally in humans.

Symptoms

Screw worm fly may strike at any site on the body where there is a break in the skin such as a scratch. Common sites for strikes are the head, brisket, genital areas, escutcheon, udder, and navels of newborn animals. In a heavily infested herd, 10 to 15 per cent of cattle may be struck at any one time. Death of newborn calves from navel strike may be as high as 30 to 50 per cent. Strikes can also occur following castration, dehorning or severe tick burdens.

Spread

Livestock, boats, aircraft and people travelling from Papua New Guinea, Asia, the Middle East, Mexico and other parts of central America may increase the threat of screw worm fly entering Australia.

Poisonous plants

Losing stock to poisonous plants is an ever-present threat. However relatively few cattle are lost to plant poisoning. Most poisonings occur when cattle are hungry or unfamiliar with a particular poisonous plant.

Poisoning will often present as dead livestock or livestock showing the symptoms described in Table 9.8 (page 138). The alarm bells often don't start ringing until several animals have died.

Prevention is more cost-effective than treatment. Treating poisoned animals is expensive and often not particularly effective.

Identifying plants

The first step in preventing plant poisonings is to know the plants growing on your property and which of these have the potential to poison stock. A huge number of plants are known to be or suspected of being poisonous but only a small proportion of these pose a significant threat.

See Poisonous plants in Recommended reading pg 177

To identify plants on your property, use a suitable plant reference guide or enlist the help of local people

- neighbours
- produce agents
- local agronomists
- Landcare members or officers
- shire weeds officers
- NRM&E land protection officers
- DPI&F extension officers or agronomists
- EPA botanists or rangers.

The Queensland Herbarium will positively identify plants. The process for getting a plant identified is as follows

1. Collect plant material for two specimens (one for yourself and one to send to the herbarium). Each specimen should include a portion of stem (20 to 30 cm long) with leaves, flowers and/or fruits attached. If the plant is small, collect the entire plant.
2. Record the date and describe the whole plant and its location and the situation in which it is growing, including the soil type or geology.
3. Dry the specimens by pressing between sheets of newspaper. *Do not send fresh plants in plastic bags.*
4. Clearly identify each specimen.
5. Pack one dried specimen flat in a large envelope, using newspaper as the packing material. Attach a cover note detailing the information recorded when you collected the specimen, requesting the information you require, and providing your contact details.
6. Forward the specimen to the Queensland Herbarium.

See Queensland Herbarium in Useful contacts pg 173

Common poisonous plants and symptoms

Table 9.8 (over the page), lists most of the common poisonous plants found in south east Queensland and the symptoms in cattle that eat these plants. Be aware that many of these symptoms can indicate a range of diseases or poisoning by a non-plant source.

Table 9.8 *Plants commonly suspected of stock poisoning and symptoms of poisoning*

Symptoms

1 Difficulty in breathing (often associated with sudden death)
2 Bleeding from body openings and/or massive internal haemorrhage
3 Diarrhoea (or gastro-enteritis or stasis of the bowel)
4 Aimless walking, apparent blindness or mania
5 Staggers, shivers or muscular twitching, convulsions or tetany
6 Heart attack, irregular heat beat, impaired circulation
7 Abortion
8 Oedema (blood blisters under the skin, skin blistering not associated with photosensitivity)
9 Photosensitivity (peeling of the skin on exposed parts such as the nose and ears)
10 Hair loss.

Common name	1	2	3	4	5	6	7	8	9	10	Botanical name
apple-of-sodom			X	X	X						*Solanum sodomaeum*
balloon cotton			X								*Gomphocarpus physocarpus*
Bathurst burr			X		X	X					*Xanthium spinosum*
black bean			X								*Castanospermum australe*
black pigweed			X								*Trianthema portulacastrum*
blue heliotrope				X	X						*Heliotropium amplexicaule*
bracken fern	X	X		X							*Pteridium esculentum*
Brazilian nightshade			X								*Solanum seaforthianum*
button grass	X										*Dactyloctenium radulans*
caustic vine					X						*Sarcostemma spp.*
coffee senna					X						*Senna occidentalis*
corkwood			X	X	X						*Dubosia myooroides*
darling peas			X								*Swainsona spp.*
devil's fig			X								*Solanum torvum*
fat hen	X		X								*Chenopodium album*
fireweed				X							*Senecio linearifolius*
grasstrees					X						*Xanthorrhoea spp.*
green cestrum			X		X	X					*Cestrum parqui*
lantana			X						X		*Lantana camara*
leucaena										X	*Leucaena leucocephala*
liverseed grass	X										*Urochloa panicoides*
mintweed	X										*Salvia reflexa*
morning glory				X	X						*Ipomea muelleri*
mother-of-millions			X								*Bryophyllum spp.*
mulga fern		X	X								*Cheilanthes sieberi*
Noogoora burr			X		X	X					*Xanthium pungens*
oleander											*Nerium oleander*
pigweed	X	X	X								*Portulaca oleracea*
poison peach	X		X		X	X					*Trema tomentosa*
quena			X		X						*Solanum esuriale*
rattlepods – showy				X							*Crotalaria spectablis*
rattlepods – streaked								X			*Crotalaria pallida*
rattlepods – trefoil									X		*Crotalaria medicaginea*
rattlepods – wedge-leaf				X							*Crotalaria retusa*
red head cotton bush			X								*Asclepias curassavica*
rubber vine			X	X	X						*Cryptostegia grandiflora*
ryegrasses					X						*Lolium spp.*
setaria		X	X					X			*Setaria spp.*
sorghums	X										*Sorghum spp.*
stagger weed					X						*Stachys arvensis*
tiebush			X			X					*Wikstroemia indica*
thornapples				X	X						*Datura spp.*
variegated thistle	X										*Silybum marianum*
verbena – common							X				*Verbena officinalis*
verbena – Mayne's pest							X				*Verbena tenuisecta*
verbena – purple top							X				*Verbena bonariensis*
verbena – veined							X				*Verbena rigida*
wax flower			X								*Hoya spp.*
yellow oleander			X			X					*Thevetia peruviana*
zamia			X		X						*Cycas spp. and Macrozamia spp.*

Source: Adapted from Everist (1974)

Managing to avoid poisonings

Certain circumstances commonly lead to poisonings. Most poisonings can be avoided by managing these situations

- **Cattle with no previous experience of a poisonous plant –** This applies to young cattle (calves and weaners) and cattle new to a property. Ensure young and new cattle are released into paddocks free of poisonous plants or where there is plenty of good feed available.
- **Hungry cattle released into pastures containing poisonous plants –** This can occur when cattle are unloaded after a long journey or let out of the yards after a day off feed.
- Feed hungry cattle in the yards or allow them to graze in a weed-free holding paddock before releasing them into the larger paddock.
- **Pasture feed in short supply –** During a drought or when paddocks are overstocked, a lack of feed will cause stock to eat plants they wouldn't usually approach. Urea supplements will exacerbate the situation because the urea stimulates rumen function and appetite. Ensure there is sufficient feed in the paddock. In the early stages of a drought, it pays to reduce the stocking rate.
- **Fresh growth of poisonous plants more attractive than usual –** Following a break in the season or a fire, the new growth on some poisonous plants can be more attractive to stock than usual. Spraying some plants with herbicide (such as 2,4-D) can have the same effect.

See Prussic acid poisoning pp 114–115

- **Feed plants toxic under certain conditions –** Some crops, such as forage sorghum and irrigated ryegrass, become toxic under certain conditions. Be alert to when these conditions occur and divert stock to other paddocks or take appropriate action. For example, if putting stock into a forage sorghum paddock that may contain prussic acid, ensure the stock are not hungry and watch them for the first hour after releasing them into the paddock.

See Natural Resources, Mines and Energy in Useful contacts pg 171

- **Too many poisonous plants –** Many poisonous plants are also weeds. Good pasture management is critical for preventing weed establishment. Controlling weeds, especially poisonous plants, with herbicides is one option; sowing competitive pastures is another. Fire-susceptible species can be controlled with managed burn-offs. Refer to *Declared plants* pages 62 – 66 for dealing with weeds.

Preventative management will significantly reduce plant poisonings, but it will not eliminate them entirely.

Suspected poisonings

If you suspect your cattle have been poisoned, contact your local vet or Stock Inspector for professional diagnosis and advice as soon as possible. Most treatments for stock poisoning can only be administered by a vet.

The vet or Stock Inspector will investigate the circumstances surrounding the suspected poisoning to eliminate other possible causes of the symptoms or deaths. They may do a field autopsy to examine internal organs or to take tissue samples for analysis in a lab. If they suspect plant poisoning, they may also collect rumen samples and look for poisonous plants (and evidence of them having been grazed). The vet will recommend appropriate treatment.

If plant poisoning is diagnosed, the vet or Stock Inspector can assist in developing an emergency management plan. This may involve removing the animals from the poisonous plants (to other paddocks) or removing the poisonous plants.

Appendices

A

Appendix 1

Summary of yearly cattle management activities

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Check bulls for soundness								■	■	■		
Check all classes of breeders for condition	□	□	□	□	□	□	□	■	■	■	□	□
Mating	■	■	□							□	□	■
Evaluate markets and plan sales	■	■									■	■
Branding, dehorning, castrating (calves)	■	■										
First 5-in-1 vaccination (calves)	■	■										
Plan winter supplementation needs			■	■								
Assess pasture and set winter stocking rates				■	■							
Sales		□	□	■	■	■						
Weaning and handling education				■	■							
Tick fever vaccination (weaners)				■	■							
Second 5-in-1 vaccination (weaners)				■	■							
Drenching, if necessary (weaners)				■	■							
Cull bulls				■	■							
Pregnancy testing					■	■	■					
Leptospirosis vaccination (pregnant cows)					■	■	■					
Cull breeders					■	■	■					
Leptospirosis vaccination (heifers)								■	■			
First vibriosis vaccination (heifers and bulls)								■				
Calving							□	□	■	■	■	□
Second vibriosis vaccination (heifers and bulls)									■			
3 day sickness vaccination (bulls)									■	■		
Review supplementary feeding program									■	■		
Tick control	■	■							□	■	■	■

■ *Most likely time to conduct the activity* □ *Possible time to conduct the activity*

Appendix 2
Record keeping

The decisions you want or need to make about managing your beef business will determine the type and depth of information you need to record. Keeping appropriate records will help you monitor and evaluate your progress towards your goals and target markets.

Records may also be needed for quality assurance program requirements or, if you are running a stud, for breed society requirements.

Table A2.1 (page 147) is a summary of animal, paddock and financial records that will assist with ongoing profitable and sustainable beef cattle management.

Identifying cattle

Individual numbering is useful for establishing pedigrees, monitoring and noting health treatments, and recording structural problems in the animal. For example a bad udder at calving may not be discernable at weaning, so recording the cow's number enables you to cull her at weaning. Features most commonly recorded are age, sex, breed and pregnancy status.

Ear tags

When deciding on a numbering system, determine first what you need the system to do for you. Your system needs to be easy to use both in the office (where you don't have the animal) and in the paddock (where you may not have the record books). Numbering systems will need to be adjusted to the requirements of individual herds, depending on herd numbers and how long individual animals are likely to remain in the herd (i.e. more than 10 years). In all situations, the challenge is to design the numbering system to minimise the number of unusable tags left over.

Following are some systems for differentiating tags

- **by year by number –** for example, the fifth calf born/branded in the year 2002 would be tagged with the number 2005
- **by year by colour –** using a different colour for each year
- **by year by letter –** following a notional system under which the letter for the year 2000, for example, is 'V' ('I' and 'O' are not used as they can be confused with numbers)
- **by sex by number –** using odd numbers for one sex and even numbers for the other
- **by breed or sire by colour or number –** for example, by allocating different series of numbers and/or different colours to different breeds/sires.

When choosing ear tag colours, always pick colours that are easy to tell apart

- red and orange are sometimes confused when they are not seen together
- white tags sometimes take on a yellowish/dirty appearance when they age and can be confused with yellow
- dark colours (black, brown and dark blue) are difficult to see in the ear.

National Livestock Identification System (Cattle)(NLIS)

The National Livestock Identification System (NLIS) includes technology for permanently identifying cattle using devices imbedded with microchips, which are read electronically. The microchip device can be incorporated into an ear tag or an indigestible rumen bolus.

See Meat and Livestock Australia in Useful contacts pg 178

The microchip is encoded by the manufacturer with 26 digits that identify each unique radio frequency identification device. This number is linked by the manufacturer to a 16 character NLIS number written on the outside of the device that includes:

1. the 8 character property identification code (PIC)
2. an alpha character denoting the manufacturer
3. an alpha character for the type of device (breeder, post-breeder, bolus or ear tag)
4. the breed plan alpha character for the year of manufacture
5. a five character serial number that may be used as an on-farm management number. (Larger matching management tags are available from some manufacturers).

When the microchip is scanned and this information is uploaded to the NLIS database, the system can check against both the PIC and the individual animal number to confirm that the animal has no health or chemical residue status that would preclude the animal from entering the food chain. Information on the health and chemical residue status of cattle is held in the Extended Residue Program database which is linked to the NLIS database.

The NLIS identification system can also be used for on-farm electronic recording and information storage for management decision making. Where processors are providing uploads of carcase information to the NLIS database, this information is able to be accessed by the vendor of the animal. In future, if processors agree, the breeder may also be able to access this information electronically and link it to on-farm data to update management practices.

NLIS has already been demonstrated to provide rapid and highly reliable traceability, which is increasingly important for domestic and export markets. For instance, the European Union (EU) requires full traceability of all cattle slaughtered for their market. All cattle held on EU-accredited properties must be identified with NLIS-approved devices.

Cattle management and performance

The minimum records you need are

- total number of cattle
- numbers per animal class
- numbers per paddock.

Using these figures in herd flow charts and livestock schedules and with a cashbook, you can analyse the current performance of your business and begin to analyse and compare business options.

The many records you could keep on cattle performance can be grouped into categories such as trading, health, fertility, paddock, supplements, labour, capital expenditure and property maintenance, etc. Within each of these categories, records are kept on a paddock, class of animal and/or individual animal basis. To make sense of all this information, identify which records or information are essential, which are useful, and which are just interesting.

To keep record-keeping manageable and fairly accurate, you will need

- a restricted calving period (9 to 12 weeks)
- similar conditions of feeding and management for all animals within a group
- adequate yards and facilities
- cattle weighing scales
- permanent individual identification of all animals.

Herd flow charts

A herd flow chart is a way of visualising the numbers of cattle that will be in each class at the beginning and end of the year, on average. It shows the effects of losses, calving rates, culling and mating strategies, and purchases. This information can then be used to complete a livestock schedule, Table A2.2 and Table A2.3, pp 148 – 149.

Livestock schedule

A livestock (trading) schedule is drawn up for the next 12 months and sets out the number of livestock on the property with projected natural sales, losses, and purchases. The livestock schedule, in conjunction with the cash flow budget and a 'statement of position', provides a comprehensive statement of the current operating strategies on your beef property. Two examples of livestock schedules are given in Tables A2.2 and A2.3, pp 148 – 149.

Feed plans

A feed plan is a way of budgeting your pasture supply to meet targets. Feed plans incorporate the cattle information discussed above plus pasture information. Pasture information includes

- date, year, season and/or number of days
- land type, pasture community and pasture condition
- pasture yield
- stock production off this pasture
- stocking rate
- grazing pressure
- pasture management.

An example of a 12-month feed plan is given in Table A2.4 on page 150. By maintaining your records of feed plans, you will gain experience and information essential for developing a forage budget at the beginning of each dry season (see *Forage budgeting* in *Useful calculations and worksheets*, pages 166 – 168).

Traceback records for livestock sales and purchases

You need to be able to trace introduced cattle back to their source, and, if necessary, to distinguish them from home-bred cattle on your National Vendor Declaration (Cattle) (NVD) at sale time. Similarly, you need to know which cattle have been sold.

When purchasing cattle, keep

- stock waybills and vendor declarations
- date of purchase and vendor's name
- identification number on the vendor's tags
- description of the cattle, including number, sex, age, brands and ear marks (if these are not on the waybill)
- name of the selling agent and sale (if purchased at auction)
- documentation relating to HGP status (whether free, treated or of unknown status)
- copies of vendor declarations from earlier sales.

When selling cattle, keep details of

- cattle identification
- buyer
- date of delivery.

Check cattle treatment records before consigning them to sale or slaughter. Verify that no Export Slaughter Interval (ESI) or withholding period (WHP) has yet to expire, and disclose any recent treatments.

Veterinary treatments and agricultural chemical usage

Records of veterinary and agricultural chemical treatments are essential components of a quality assurance program, and are very important in minimising the risk of chemical residues. On the NVD, date of treatment, type of agvet chemical used (including HGPs), and expiry dates for WHPs or ESIs are mandatory.

For stock and/or paddocks, record

- date of treatment
- type and amount of agvet chemicals used
- animal(s) administered to (individual, mob or paddock)
- method used to administer the treatment
- expiry date for withholding period (WHP) or Export Slaughter Interval (ESI)
- person(s) who administered the products.

Purchases of stock feeds and supplements

See Australian Fodder Industry and Association in Useful contacts pg 169

Record supplier, date, product and quantity and batch number if available.

Ask all suppliers of feeds to provide a written vendor declaration of the residue status of their product. (The Australian Fodder Industry Association Inc. produces a Fodder Vendor Declaration Form.) Be wary of horticultural products that may have heavy soil contamination, such as potatoes, pumpkins or carrots, and failed agricultural crops or agricultural by-products such as peanut hay.

The NVD also requires you to indicate whether cattle to be sold have been fed any by-product stockfeed in the 60 days before sale. If the cattle have been fed with such a product, you must supply a list of the by-products fed, date when they were last fed, and a copy of an analyst's report if available.

Financial records

With your records on cattle numbers and location, herd flow charts and the livestock schedule, together with related costs and prices, you will be able to analyse your business and production performance and how this is meeting your goals. You will also be able to compare different business or production options and make informed changes where necessary. The financial analyses needed for these decisions include

- gross margin analysis
- break-even analysis
- cash flow analysis
- profit budget.

The minimum financial records you will need to keep are all income and costs, listed in a cashbook. For comprehensive information on rural management, record keeping and decision making, consult *Financing your farm - A practical guide to farm financial planning and management* (details in *Recommended reading*, page 175).

Table A2.1 *Summary of animal, paddock and financial records that assist beef cattle management*

Trading (sales and purchases)	Animal health	Animal fertility	Paddock	Pasture - crop management	Labour	Capital expenditure and maintenance
- Date - No. head - Class - Age / year no. - Tail tag no. - Weight - Price / kg - Price / hd - Freight - Landed price - Venue - Vendor - Description - Brand - Gross income - Net income - Total cost	*All classes* - Paddock - Date - No. head - Age / year no. - Vaccination(s) - Booster - Parasite Treat. - Vet. Treat. *HGP treated* - HGP type - Date of implant - Average weight at implant - Date of final weighing - Average final weight *Bulls* - Breed - Condition score - Semen / structural soundness - Serving capacity test *Calves* - Branding date - No. branded - No. of each sex *Weaners* - Date weaned - No. weaned - Paddock transferred to	- Paddock - No. breeders - Bull ratio - Average bull age - Paddock size - Stocking rate - Average weight - Average daily gain (ADG) - Average condition score - No. pregnant - % pregnant - No. lactating - No. calves branded - Branding % - No. calves weaned - Weaning % - No. bulls in - No. bulls out - Pasture details - No. breeders culled - No. transferred out These records will help you develop a stock schedule.	- Rainfall - Date/year/season/no. days - Land type - Pasture community - Pasture condition - Pasture yield - Pasture production or stock production off pasture - Stocking rate - Grazing pressure - Pasture management These records will help you to develop a feed plan. *Supplements/additional feed* - Date - Paddock - Class - Type of supplement fed - Date / month fed out - Kg fed out - No. head - Average intake per head per day - Cost per head - Response to supplement	*Improvement / renovation* - Date - Paddock - Fertiliser kg per ha - Fertiliser cost $ per ha - Response to fertiliser - Ripping - Seeding rate kg per ha - Seed cost $ per ha - Fuel and machinery cost *Weed control* - Date - Paddock - Weed species/type - Occurrence - Control method - Chemical used - Application rate - Amount used - Cost per ha - Cost per treatment - Response 1, 2 and 3 years after treatment *Fire* - Date - Paddock - Wild or planned - Hot or cold fire - Area burned - Pasture yield - Full recovery - Stock condition	- Date - Paddock - Class - Mustering - Treatment / husbandry procedures - Supplementary feeding - Book keeping / business management - No. days labour - Cost This can be done on a monthly, quarterly, annually and/or on a class of animal basis.	- Start date - Completion date - Improvement or maintenance done, e.g. fencing / yards, roads, water / dams and buildings - Description of work done - Paddock - Distance or area - Material used and costs - Machinery hours / costs - Labour – contracted or your own - Rates and rents (land, water, agistment, etc) - Vehicle repairs and maintenance - Total cost

Table A2.2 *Example of a livestock schedule*

Estimates for period ___ / ___ / ___ to ___ / ___ / ___

Class	At start		Births (b)	Purchases			Deaths & rations (d)	Sales			Transfers		At end	
	No. (a)	Total market value		No. (c)	$ / hd	Value		No. (e)	$ / hd	Value	Out -	In +	No. (f)	Total market value
Bulls														
Cows														
Calves														
Weaner heifers														
2 yo heifers														
3 yo heifers														
Weaner steers														
2 yo steers														
3 yo steers														
4 yo steers														
Total														

Note: If a + b + c = d + e + f then the livestock schedule reconciles.

If a = f then the herd is in a 'steady state'.

Source: Futureprofit: Evaluating beef management options, (1998)

Table A2.3 *Example of a steady state livestock schedule*

Estimates for period ___ / ___ / ___ to ___ / ___ / ___

Class	At start			Births (b)	Purchases				Deaths & rations (d)	Sales				Transfers		At end		
	No. (a)	$ / hd	Total market value		No. (c)	Av. WT (kg)	$ / kg	Total value		No. (e)	Av. WT (kg)	$ /kg	Total	Out -	In +	No. (f)	$ / hd	Total market value
Bulls																		
Cows																		
Calves																		
Weaner heifers																		
2 yo heifers																		
3 yo heifers																		
Weaner steers																		
1 yo steers																		
3 yo steers																		
4 yo steers																		
Total																		

Note: If a + b + c = d + e + f then the livestock schedule reconciles.

If a = f then the herd is in a 'steady state'.

Source: Futureprofit: Evaluating beef management options, Part 2 (1998)

Table A2.4 *Example of a monthly feed plan for a native pasture system*

	1998									1999		
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Herbage mass at start of month (kg DM/ha)	2,000	2,039	1,927	1,822	1,717	1,612	0	505	1,567	2,953	3,396	3,362
Stocking rate (hd/ha)	1	1	1	1	1	1	1	1	1	1	1	1
Weight (kg)	150	162	168.2	168.2	168.2	168.2	168.2	171.3	195.3	226.3	257	285
Liveweight gain (kg/d)	0.4	0.2	0	0	0	0	0.1	0.8	1.0	1.0	1.0	0.8
Dry matter (DM) intake (kg/hd/day)	3.7	3.6	3.5	3.5	3.5	3.5	3.7	4.6	5.3	5.7	6.2	6.4
Feed demand (kg/ha/day)	3.7	3.6	3.5	3.5	3.5	3.5	3.7	4.6	5.3	5.7	6.2	6.4
Pasture growth (kg DM/ha/day)	5	0	0	0	0	0	20	40	50	20	5	5
Change in pasture cover (kg DM/ha/day)	1.3	-3.6	-3.5	-3.5	-3.5	-3.5	16.3	35.4	44.7	14.3	-1.2	-1.4
Change in monthly pasture cover (kg DM/ha/mth)	39	-112	-105	-105	-105	-105	505	1,062	1,386	443	-34	-43
Pasture mass at end of month (kg DM/ha)	2,039	1,927	1,822	1,717	1,612	1,507	505	1,567	2,953	3,396	3,362	3,319
Brief description of activity each month, e.g. hay cut, calving, etc.	Buy weaners						Fire					

Source: Jeffery and McIntosh (2000)

Appendix 3

Quality assurance and other management systems

The main forms of quality assurance (QA) systems currently operating in the beef industry are

- Livestock Production Assurance (LPA)
- CATTLECARE
- Meat Standards Australia (MSA)
- National Feedlot Accreditation Scheme (NFAS)
- National Saleyards Quality Assurance program (NSQA)
- Livestock Export Accreditation Programme (LEAP)
- European Union (EU) accreditation
- Organic
- Environmental Management Systems (EMS)
- Hazard Analysis Critical Control Point (HACCP).

Beef producers also growing grain and/or run sheep may also be involved in

- Graincare
- Flockcare
- Livestock Production Accreditation Scheme (LPAS).

Contact details for most of the organisations mentioned in this section are provided in *Useful contacts*, pages 169 – 174. Most of these organisations base their quality systems on the international standards published by ISO.

The International Organization for Standardization (ISO) is an international, non-governmental organisation. The work of ISO results in international agreements, published as standards, which encourage the international exchange of goods and services. Standards are documented agreements containing technical specifications or other precise criteria or specifications to be used consistently as rules, guidelines, or definitions of characteristics, to ensure that materials, products, processes and services are fit for their purposes.

ISO9000 and ISO14001 are two of ISO's most widely known standards. ISO9000 is concerned with quality management, which is what a business does to enhance customer satisfaction by meeting customer and applicable regulatory requirements and what it does to continually improve performance in this regard. ISO14001 is primarily concerned with environmental management, which is what a business does to minimise harmful effects on the environment caused by its activities and what it does to continually improve its environmental performance.

Livestock Production Assurance (LPA)

See Meat and Livestock Australia in Useful contacts pg 172

Livestock Production Assurance (LPA) is an on-farm food safety certification program designed to help the beef, sheep and goat industries strengthen the food safety systems currently in place. LPA will help Australia maintain its reputation and competitive advantage for selling safe red meat and livestock both domestically and internationally.

LPA is designed to help producers deliver product that satisfies their customers' basic food safety requirements. It is based on a revised National Vendor Declaration (NVD) backed up by a set of guidelines, record keeping and random,

free audits to help producers declare and prove that their livestock are safe from disease or chemical residues. In Queensland the NVDs incorporate waybills.

LPA will address the essential requirements for

1. Property food safety risk assessment, eg chemical residues
2. Safe and responsible agricultural and veterinary chemical use, eg withholding periods and export slaughter intervals are adhered to
3. Safe and responsible use of stockfeeds, eg no meat or bone meal fed to ruminants
4. Preparation and dispatch of livestock, eg to minimise bruising and enable trace back
5. Livestock transactions and movement, eg for trace back.

CATTLECARE

See AUS-MEAT in Useful contacts pg 169

CATTLECARE is a quality assurance program developed by the Cattle Council of Australia to provide a framework for beef producers to adopt quality assurance on their properties. It is an accredited program that complies with the internationally recognised ISO 9001:2000 standard. CATTLECARE-accredited producers are externally audited.

CATTLECARE deals with

- Management – staff training, internal auditing, documenting
- Chemicals – chemical residues in soil, chemical safety and usage, storage, documenting paddock treatments
- Livestock – animal welfare, livestock identification, transaction and movement records, preventing bruising and hide damage, transport, stockfeed, and treatment records for soil, vegetation and animals.

Meat Standards Australia (MSA)

See Meat and Livestock Australia in Useful contacts pg 172

Meat Standards Australia (MSA) is a paddock-to-plate beef grading program that aims to describe the eating quality of domestic retail beef products by labelling meat with a guaranteed grade and best cooking method to maintain premium beef eating quality. Meat that is reliably graded for eating quality and clearly labelled can provide a basis for improving consumer demand. MSA is a voluntary cooperative program throughout the domestic supply chain which requires all participants to be licensed. License conditions require detailed auditing and total product integrity.

Palatability and tenderness are the overwhelming quality determinants of the MSA grading system. A wide range of cattle breeds, management practices, processing systems, cuts, ageing periods and cooking methods have been researched to determine the impact each has on eating quality. Each carcase is graded, and a grade for each individual cut of beef is calculated.

The aims of MSA include

- removing the need for consumers to have specialist beef knowledge
- providing retail labels advising the correct cooking method for every piece of beef and guaranteeing the eating quality result
- labelling product as meeting consumer-set standards at one of three quality levels: 3 Star (Tenderness Guaranteed), 4 Star (Premium Tenderness) or 5 Star (Supreme Tenderness)

- involving all sectors of the beef production chain, from paddock to plate
- providing detailed feedback on eating quality to the processor, feedlot and the producer.

Producers wishing to supply cattle for MSA must

- be registered as an MSA producer
- make sure an MSA vendor declaration and a National Vendor Declaration (Cattle) accompany cattle to MSA-licensed abattoirs
- comply with the MSA vendor declaration, confirming that MSA guidelines for cattle handling and trucking have been followed, and recording *Bos indicus* content
- keep all MSA feedback provided on cattle consigned for MSA.

National Feedlot Accreditation Scheme

See AUS-MEAT in Useful contacts pg 169

The National Feedlot Accreditation Scheme (NFAS) is an industry-based self-regulatory quality assurance scheme for beef feedlots. NFAS accreditation requires external auditing. To be accredited a feedlot operator must

- have documented procedures in place, specifically for their feedlot, which meet the requirements of the industry standards
- maintain records that these procedures have been adhered to for all cattle prepared at the feedlot
- undergo a third party audit of these procedures, records and facilities at the feedlot.

National Saleyards Quality Assurance programme

See AUS-MEAT in Useful contacts pg 169

The National Saleyards Quality Assurance programme (NSQA) compliments the National Standard for the Construction and Operation of Australian Saleyards. The NSQA program is a transparent, independently auditable means of managing and assessing compliance with the Standard. To be accredited a saleyard must

- train staff in the development and management of the QA program
- assess existing facilities and modify or redevelop as necessary to meet the requirements of the National Standard
- develop a site-specific QA manual
- submit the manual for a desk audit and have it approved
- have the saleyard assessed under a site audit during a sale.

Livestock Export Accreditation Programme

See LiveCorp or AUS-MEAT in Useful contacts pp 169-170

The Livestock Export Accreditation Programme (LEAP) is an industry-based quality assurance scheme. LEAP provides exporters with the opportunity to demonstrate their commitment to achieving accepted industry standards within their operating procedures and practices. LEAP accreditation is also a condition of the Livestock Export License. To become accredited, exporters must establish quality assurance systems that achieve the standards set out in the Australian Livestock Export Standards document. The standard covers all operational and management activities from the issue of instruction to purchase through to

shipment aboard the export vessel (ship or aeroplane). To be accredited, exporters must

- have documented procedures in place, specifically for their company, which meet the requirements of the Australian Livestock Export Standards
- maintain records that these procedures have been adhered to for each export consignment
- undergo a third party audit of these procedures, records and facilities.

EU accreditation

Stringent requirements are in place to meet the conditions set down by the European Union (EU) for supply of meat into this market

- the property must be EU-accredited
- all animals on the property must be identified with a National Livestock Identification Scheme (NLIS) tag
- all animals coming onto the property must come from another EU-accredited property
- animals must be slaughtered in an EU-accredited abattoir
- no animal on the property can ever have been treated with hormone growth promotants.

The Australian Quarantine and Inspection Service (AQIS), with support from the cattle industry and States and Territories, has developed a voluntary scheme (QA process) for producing cattle for the EU market. This scheme involves

- accreditation for the property and the property manager under the *Commonwealth Export Control Act*
- specific cattle status requirements on accredited properties
- EU Vendor Declarations (EUVD) and specific (lime-green) tail tags
- permanent identification of cattle on accredited properties using NLIS-endorsed tags.

See your local stock inspector

To maintain EU eligibility status, property managers must keep auditable records.

Organic

See Useful contacts pp 170, 172 – 173

The National Standard for Organic and Bio-Dynamic Produce is the minimum standard for produce to be exported as 'organic'. This Standard is also used to regulate the domestic organic market. Certification means having your farm and production system inspected by an accredited organic certifying group to ensure they comply with the National Standard. There are two levels of organic certification

- 'Certified' or 'Certified A' is the full organic certification awarded after a farm has been operating and complying with the National Standard for at least three years
- 'Certified in Conversion' or 'Certified B' is the transition level awarded prior to full organic status, which is for a period of at least two years prior to full certification.

The following organisations are accredited as organic certifiers

- Biological Farmers of Australia Cooperative Ltd (BFA)
- The National Association for Sustainable Agriculture (Australia) Ltd (NASAA)
- Biodynamic Research Institute (BDRI), also known as DEMETER
- The Organic Food Chain (OFC)
- Tasmanian Organic-Dynamic Producers (TOP)
- Organic Vignerons Association of Australia Inc (OVAA).

Environmental Management Systems (EMS)

Phone the DPI&F
Call Centre on 13 25 23

Environmental management systems (EMS) are relatively new in Australian primary industries. An EMS is a voluntary management tool that any business can use to control the impacts its activities have on the environment. It is a structured framework for achieving continual improvements in environmental performance, based on a standard management cycle of

- plan (impacts, policy, objectives)
- do (records, procedures, training)
- check (monitoring, internal audit)
- improve (review system).

Once an EMS has been established, a business may choose to have its system certified through either a second- or third-party audit. Certification to the international standard IS014001 by an accredited external auditor enables a business to make public declarations of its environmental responsibility. Businesses can then proceed to develop an eco-label to differentiate their product in the market place.

One of the main benefits of an EMS is that it can be used to integrate other management activities, for example: property management planning, best practice management, quality assurance schemes and OH&S. Other benefits of EMS include

- maintaining and, potentially, improving market access – satisfying customer demands for environmentally certified produce
- building community goodwill – greater public confidence in agriculture through demonstrating environmental responsibility
- increasing operational efficiencies – by using inputs more effectively and spending less on correcting environmental problems
- improving resource management – by systematically identifying opportunities for environmental improvement
- reducing legal liability – a way of demonstrating due diligence to reduce legal liabilities.

See the Grains Council of Australia in Useful contacts pg 171

Graincare

Graincare provides growers with a way of satisfying customer requirements for food and feed safety quality assurance. Graincare is auditable. The 13 elements of Graincare are

- paddock selection and preparation
- crop management
- persistent chemicals in soil
- paddock, crop and grain treatments
- chemical purchase and storage
- inputs and service suppliers
- harvesting and harvest equipment
- on-farm storage and handling
- off-farm transport
- training
- internal auditing and corrective action
- quality records
- document control.

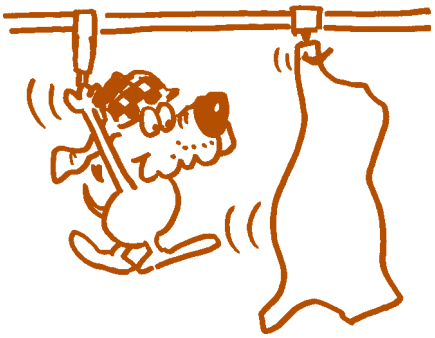
Graincare is compatible with CATTLECARE and Flockcare.

Hazard Analysis Critical Control Point (HACCP)

Hazard Analysis Critical Control Point (HACCP) is a process used to analyse food production (paddock to plate) to identify hazards and put into place preventative measures. HACCP has been mandatory in some food processing sectors since 1974.

HACCP was developed so that 100 per cent assurance could be given that products produced were not contaminated with microbial pathogens, toxins, toxic chemicals or physical hazards. The seven HACCP principles are

1. conduct hazard analysis and risk assessment
2. determine the critical control points (CCPs)
3. establish specifications for each CCP
4. monitor each CCP
5. establish corrective action to be taken when a deviation occurs at a CCP
6. establish a record keeping system
7. establish verification procedures.



Appendix 4

Terms used to describe live animals, carcases and meat

The national livestock language defines commonly used terms that describe important commercial traits in breeding, feeding and slaughter livestock for the beef industry. The language is designed for a variety of uses including trading of livestock in the domestic and export sectors, reporting market information and trends in livestock prices, and education and training in all sectors of the meat and livestock industry. Most of the terms discussed here have been developed by the meat and livestock industry under the auspices of AUS-MEAT.

Describing live animals

A common language is used to describe all live animals, whether intended for breeding purposes or destined for slaughter.

Continually assess your cattle to determine how they are performing in relation to destination market requirements. Cattle can be assessed physically or in comparison to processors' feedback on similar cattle.

Weight

Liveweight

Estimating liveweight accurately is difficult. Cattle should be weighed with scales. Liveweight is stated in kilograms. Time off feed and water, feeding and handling will affect the weight.

Age

Age is measured in two ways

1. chronological age, which refers to how long the animal has lived
2. physiological age, which is affected by the impact of the animal's environment throughout its life on its growth rate.

Chronological age is determined from the animal's birth date and is not considered to be an accurate guide for describing growth and development and anticipating meat quality. For example, an animal may weigh 600 kg at 18 months or at 36 months.

Dentition is traditionally used to measure physiological age. The eruption of teeth in cattle is affected by nutrition and environment, breed, and individuality within a breed. The degree of variation increases as animals get older.

Dentition

Dentition refers to the number of permanent incisor teeth on the lower jaw of an animal. There are eight incisor teeth on the lower jaw and no incisor teeth on the upper jaw. As the animal matures, the temporary (milk) teeth are progressively replaced, in pairs from the centre outwards, by larger permanent teeth. Ageing by teeth is expressed as

Milk teeth	No permanent incisor teeth
Two teeth	Two permanent incisor teeth
Four teeth	Four permanent incisor teeth
Six teeth	Six permanent incisor teeth
Eight teeth	Eight permanent incisor teeth

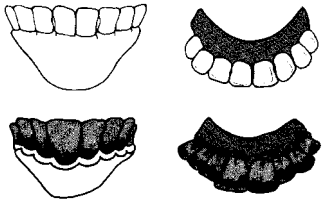
Bos taurus breeds erupt teeth at a younger age than *Bos indicus* breeds.

Pair of permanent teeth	No. of teeth	British (months)	Brahman cross (months)
1st	2	21 – 27	23 – 29
2nd	4	26 – 36	28 – 38
3rd	6	32 – 44	35 – 48
4th	8	39 – 54	44 – 58

Basic categories

Veal V

0 permanent incisors
Female or entire male with no S.S.C. 0-70 kg H.S.C.W. 70.1–150 kg when carcase shows youthfulness and pinkish flesh



Beef .... A

0-8 permanent incisors
Greater than 70 kg H.S.C.W. Female or castrate male or entire male with no S.S.C. of any age

Bull .... B

0-8 permanent incisors
Entire male or castrate male bovine showing S.S.C.

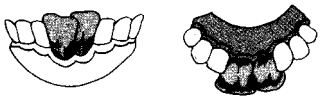
S.S.C. = Secondary sexual charateristics H.S.C.W. = Hot standard carcase weight

Source: AUS-MEAT (1998)

Alternative categories to Beef

Yearling beef...Y
Yearling steer...YS

0 permanent incisors
* Up to 18 months



Young beef...YG
Young steer...YGS

0-2 permanent incisors
* Up to 30 months

Young prime beef...YP
Young prime steer...YPS

0-4 permanent incisors
* Up to 36 months

Prime beef... PR
Prime steer... PRS
Ox (female)... S

0-7 permanent incisors
* Up to 42 months

Ox (male)... S
Steer... SS

0-8 permanent incisors
Any age

Cow... C

8 permanent incisors
Over 42 months

* Chronological age as shown is approximate only

Source: AUS-MEAT (1998)

Frame score

Frame score is the height of an animal (over its hips) at a given age. Frame score can be used to predict the growth and fattening pattern of a beast, as well as its mature size. The height or 'frame' of cattle of a given age is closely related to maturity type (early to very late maturing).

Most animals maintain the same frame score throughout their life, while their actual height increases with age. Thus one frame score value can be used regardless of when the animal is evaluated. However environmental factors, such as nutrition and age at first calving, can alter an animal's growth rate from its genetic capability and hence alter its eventual height. Thus frame scores should be used as guides only. Inaccuracies can also be introduced by

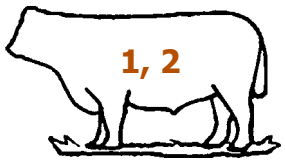
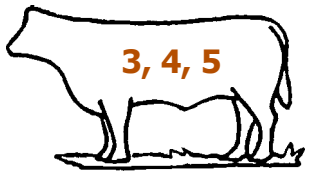
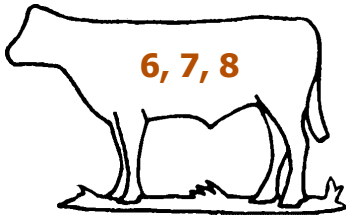
- inaccurate measurement such as by measuring the wrong point on the back or not having the cattle standing on level ground
- angulation of joints, for example straight hocks and straight stifle joints can add considerably to the height of the animal but not change its maturity pattern.

Evaluating body and frame type

The recommended point for linear height measurement is a point directly over the hips from a level surface. Body types (frames) are scored from 1 to 11. A score of 11 indicates size only. No single frame type will suit all markets and circumstances. Economic returns should determine the optimum frame type for individual properties. For example, taller animals generally grow more quickly but lay down less fat than shorter animals.

The frame type scores listed in Table A4.1 were developed at the University of Wisconsin in the USA and are applicable to all breeds of cattle.

Table A4.1 *Maturity type, and body/frame type scores*

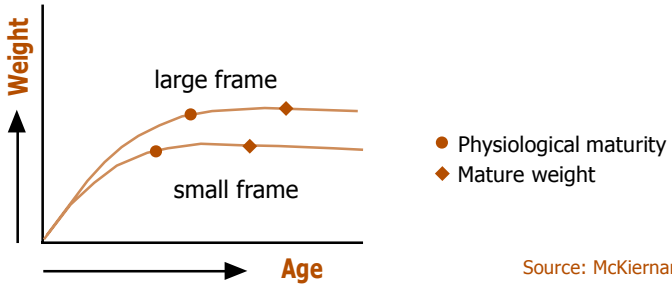
Early maturing — small framed (frame score I and 2): Generally short in every skeletal dimension. Short legged and short bodied. Generally show a tendency towards waste. Lack rapid growth potential. Can still show good muscle expression. Generally reach market potential at low carcase weights, i.e. 150–180 kg carcase weight at 9–12 mm of fat at the P8 site.	
Moderate maturing — average framed (frame score 3, 4 and 5): Average growth potential rising to good growth for frame 5s. Generally good length of body and, particularly in British breeds, can have good muscle development. Generally reach market potential at carcase weights of 200–350 kg with 9–12 mm of fat.	
Late maturing — large framed (frame score 6, 7 and 8): Much larger cattle with high growth potential, and lean. Non-continental breeds of this size generally lack muscle expression. Reach market potential much later at carcase weights of 350–450 kg with 9–12 mm of fat. Suitable for long feedlot feeding if structurally sound, reasonably muscled and with the potential to marble.	
Very late maturing — extreme framed (frame score 9, 10 and 11): Huge cattle with extreme growth potential, and usually extremely lean. It is doubtful if animals of this size will achieve enough fat for any quality market.	

Frame type — growth and fattening relationships

Because height or 'frame' at a given age is closely related to maturity type, live animals can be categorised or classified by their growing and fattening pattern.

All cattle grow quickest until they reach physiological maturity (the stage of growth when fattening begins). Smaller framed cattle reach this point at an earlier age and lighter weight than large-framed cattle. At any given weight, large-framed cattle will be younger and a little leaner than their small-framed counterparts (Figure A4.1).

Frame score is a predictor of maturity type, but it does not predict growth rate, reproductive performance or carcase quality.



Source: McKiernan (2000)

Figure A4.1 *Comparative growth and weight gain of large-framed and small-framed cattle*

Fat cover

There are several parts of the animal where the bones initially have only a covering of skin, cartilage and connective tissue. These are the head, point of the shoulder, point of the elbow, spinal processes of the backbone, hip bones, lower legs, and tail. As the animal grows and develops towards maturity, it builds bone mass, followed by muscle mass, followed by fat (finish), laying down a layer of fat between the connective tissues covering the bones and the skin.

To assess fat cover, visually inspect (and if possible palpate) areas least influenced by muscle, such as the brisket, flank and cod, and over the obvious bony areas such as the ribs, hips and tailhead (Figure A4.2).

As cattle fatten look for

- ribs becoming less visible
- tail head softening, with rolls of fat increasing beside the tail
- muscle seams of the hindquarters becoming covered with fat and appearing less evident when cattle walk
- brisket, flank, cod and twist filling out, giving cattle a square appearance compared with the roundness of leaner, heavier muscled cattle.

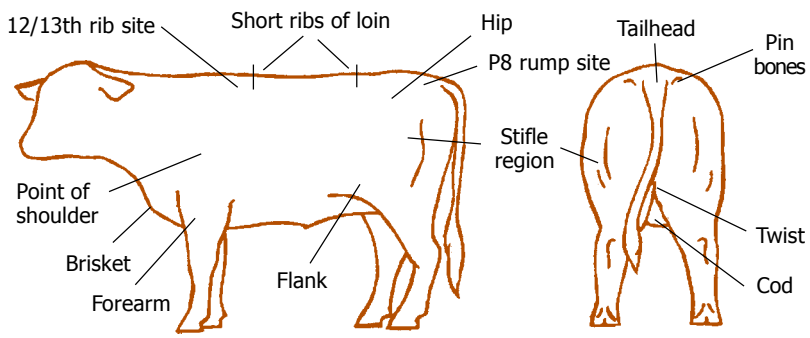
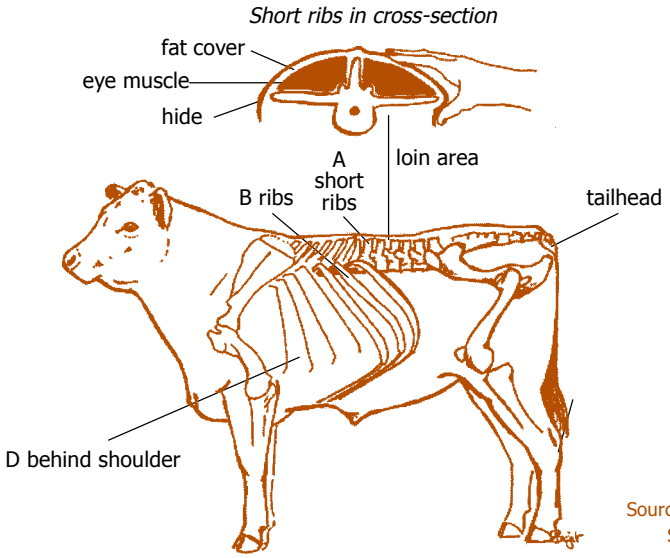


Figure A4.2 *Sites for assessing fatness*

Source: The Australian Feedlot Directory (1994)

Manual appraisal by palpitating can provide a more accurate assessment of fatness than visual inspection alone. Assessments are made on the live animal at positions where fat can be readily differentiated from muscle. From Figure A4.3, it can be seen that these areas include the rib area of the short loin (A), the area over the long ribs (B and D), and the area around the tailhead (C).



Source: McKiernan and Sundstrom (2000)

Figure A4.3 *Sites for manual assessment of fatness*

AUS-MEAT fat scores for various grades of fat developed are listed in Table A4.2

Table A4.2 *Description of AUS-MEAT fat scores as they relate to manual assessment and P8 rump fat thickness*

P8 rump fat thickness	Description	AUS-Meat fat score
Up to 3 mm	No fat beside tail head.	1
Over 3 and up to 6 mm	Short ribs of loin are sharp to the touch and easily distinguished. Hip bone and ribs are hard.	2
Over 6 and up to 12 mm	Short ribs can be felt individually but feel increasingly rounded. Ribs clearly felt. Hip bone still quite hard, and only light deposit of fat at flank and around tail head.	3
Over 12 and up to 22 mm	Short ribs felt only with firm pressure. Moderate fat cover around tail head. Hip bone carrying some fat cover.	4
Over 22 and up to 32 mm	Short ribs cannot be felt or need very firm pressure to be felt. Ribs and hip well covered. Tail head fat as slight mounds, soft to touch.	5
Over 32 mm	Hard to distinguish bone structure. Tail head buried in fatty tissue. All other sites show obvious soft fat deposits. Difficult to detect ribs with a hand placed flat over the ribs behind the shoulder.	6

Source: CALM Services Manual (1994)

Muscling

Muscling is the thickness of muscle in relation to frame size. Muscling is independent of frame size; both large and small-framed cattle can be heavily muscled. Muscling is mainly determined by genetics, but it is also affected by nutrition to some extent.

To evaluate muscle accurately, fatness must be accurately appraised first and allowed for when evaluating the animal's shape.

Lightly muscled cattle will finish earlier and lay down fat quicker than heavily muscled animals. However heavier muscled cattle generally produce a higher percentage yield of saleable meat and higher carcase value. They also tend to have a higher dressing percentage.

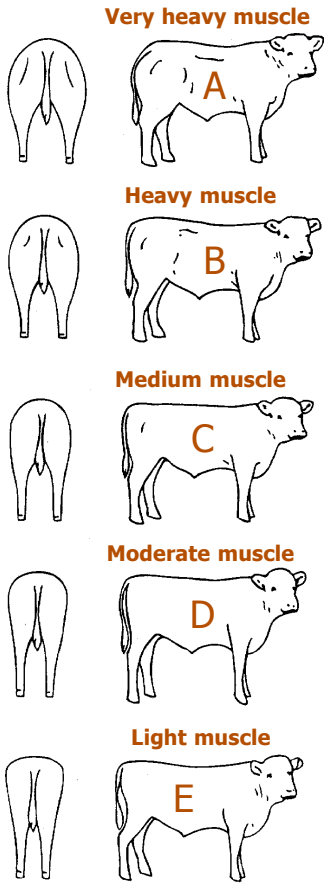
The forearm or 'shin' and the 'shank' on the hind-leg are areas on all animals that have mostly muscle covering the central bone. These areas contain only minimal amounts of fat. A more heavily muscled animal stands with its hind feet wider apart. A convex or bulging hind-quarter muscle is apparent down either side of the flanks when viewed from behind.

Another muscle area sits neatly above the ribs and beside the vertical spinal processes on either side of the backbone. This is known as the eye muscle. As an animal fattens, fat deposits are laid down around this muscle, often giving a false impression of the musculature or muscling of the animal.

To assess muscling

- Consider thickness through the backline, shoulders and the lower hindquarter (stifle area). Heavily muscled stock stand with their hind legs further apart than lightly muscled animals. Figure A4.4 shows some of the indicator sites for muscling.
- Observe cattle from the side for the curvature of the muscles of the thigh.
- Observe cattle as they are walking, because muscle seams are clearly evident in heavily muscled cattle. Muscle will bulge and ripple as an animal walks, whereas fat will wobble and appear smooth.

Muscling is commonly scored in five categories. These are shown in Figure A4.5.



Source: AUS-MEAT (1994)

Figure A4.5 *Muscle scores*

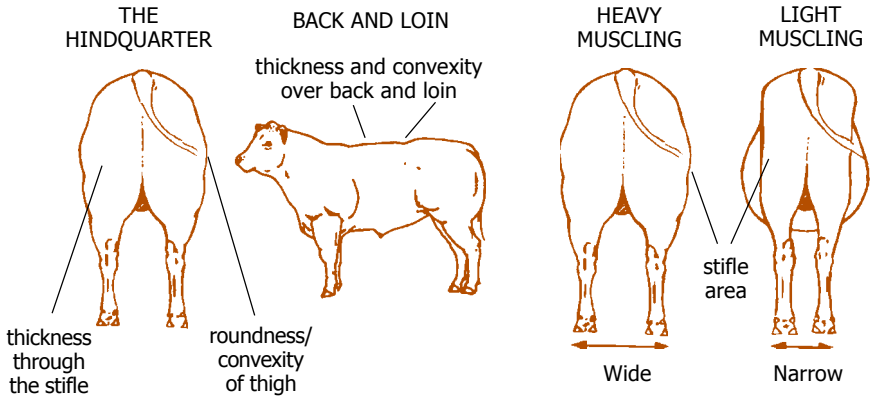


Figure A4.4 *Rear and side view of muscling*

Rigor mortis

Rigor mortis is the process occurring after death during which glycogen in the muscles is converted into lactic acid, lowering the pH and influencing meat quality.

In the living animal, glycogen (a form of energy stored in the muscle) is used in association with oxygen to expand and contract the muscle. Glycogen levels in muscles are reduced by physiological and physical stress, cold weather, disease, and strenuous muscle contraction.

In the absence of oxygen (i.e. after death), calcium is released in the muscle

causing the muscle fibres to contract. These contractions use up glycogen and produce lactic acid. The more glycogen stored in the muscles at the start of this process, the more lactic acid produced and the lower the final pH of the meat. However if glycogen levels are low at death, the onset of rigor mortis will be rapid and the process will complete quickly, resulting in less lactic acid and a slightly higher pH.

Rigor mortis is complete at the point where the muscle has 'set' and is no longer able to contract. Under normal condition, this process takes approximately 20-24 hours to complete to produce tender meat.

Describing carcases

Objective carcase descriptions are used to determine market compliance.

Weights

Hot standard carcase weight

Hot standard carcase weight (HSCW) is the main factor determining a carcase's price.

HSCW, taken within two hours of slaughter, is the weight of the slaughtered animal's body after bleeding and skinning, minimum trimming required for the carcase to be passed as fit for human consumption, removal of all internal and external organs, and removal of the head, feet, tail, thick and thin skirts, kidneys, kidney fat, udder, testes, penis, and excess fat to AUS-MEAT requirements.

Dressing percentage

Dressing percentage is the weight of the dressed carcase as a percentage of the liveweight. Dressing percentages can range between 46 and 58 per cent.

$$\text{Dressing \%} = \frac{\text{HSCW}}{\text{Liveweight}} \times 100$$

Dressing percentage is affected by gut fill, dehydration, carcase fatness, plane of nutrition, breed, and pregnancy status.

Gut fill is the single most important factor affecting dressing percentage. The weight of the gut contents at weighing is influenced by time off feed and water, feed quality and breed (Table A4.3). After twelve hours without feed and water, cattle lose between two and eight per cent (on average, 6 per cent) of their original liveweight.

Table A4.3 *Guide to weight loss after removal from feed and water*

Time off feed and water	Liveweight loss as a % of full liveweight	Dressing % increase
1 hour	1.5	0.75
2 hours	2.5	1.25
4 hours	4	2
12 hours	7	3.5
16 hours	8	Over 4

Source: CALM Services Manual (1994)

Feed quality affects gut fill. Animals on concentrated diets have a lower gut fill than animals on pasture. Breed can also affect gut fill. *Bos indicus*-derived cattle will have lower gut fill than animals of other breeds in the same mob. This often corresponds to a higher dressing percentage (1 to 1.5 per cent) in animals with higher *Bos indicus* content.

Saleable meat yield

Saleable meat yield (SMY) is an important commercial parameter because it is a strong determinant of an abattoir's profitability. Some payment systems offer price premiums and penalties for individual carcase measurements for quality and meat yields that are above or below the average SMY.

SMY is the weight of saleable meat trimmed to retail level, less bone, fat and trimmings (made up of fat and muscle).

$$\text{Saleable meat yield \%} = \frac{\text{Weight of saleable meat}}{\text{HSCW}} \times 100$$

Table A4.4 shows the relative value of SMY to HSCW.

Table A4.4 *Approximate composition of a beast from full liveweight to saleable meat yield*

Action	Subtotal (kg)	Term	Notes	Total (kg)
		Full liveweight		453
Gut fill: less 6%	27	Empty liveweight		426
Dressing: less 46%	196	Hot standard carcase weight (HSCW)	54% of empty liveweight	230
Trimming: less 30%	69	Saleable meat yield (SMY)	70% of HSCW	161

SMY can be estimated using

- subjective assessment based on experience and guess work
- equations that use manual measurements of P8 fat, carcase weight and eye muscle area
- video image analysis (VIA), for example VIAscan®, which consists of two cameras at right angles to one another connected to a computer and measuring dimensions such as fat thickness, eye muscle area, marbling, meat colour and fat colour.

Age

Physiological maturity in carcases is seen in the ageing and consequent toughening in body tissues, and is measured by ossification.

Ossification

Ossification is the calcification of the cartilage tips of the vertebrae. As an animal matures the degree of ossification increases, that is, the soft cartilage becomes more calcified and the vertebrae become fused. During early stages of maturity ossification begins in the hind regions of the backbone (sacral and lumbar vertebrae), progressing with increasing maturity toward the forequarter (thoracic vertebrae).

Carcase assessors refer to three sites along the backbone – the sacral, lumbar and thoracic vertebrae. The sacral vertebrae are the last five vertebrae on an AUS-MEAT standard carcase, taken from the tail end after the tail has been removed at the junction between the sacral and coccygeal vertebrae. The lumbar vertebrae are the six vertebrae in the loin region of the carcase. The thoracic vertebrae are the thirteen vertebrae to which the ribs are attached. Table A4.5 shows the ossification that occurs at the three sites as the animal ages.

The relationship between ossification and actual age can vary widely. Cattle that experience a slow growth rate over their lifetime tend to ossify at an earlier age than cattle that grow more rapidly.

Table A4.5 *Ossification description table*

Months approx.	Sacral vertebrae	Lumbar vertebrae	Thoracic vertebrae
9	No ossification	No ossification	No ossification
10	Capping starts	No ossification	No ossification
15	Advanced capping; separation still visible	No ossification	No ossification
20	Capping completed but some cartilage still visible	No ossification	No ossification
24	Capping completed; sacral closing	Ossification clearly evident	No ossification
30	Completely fused	Nearly completely ossified	Some evidence of ossification; 25% in the first three vertebrae
42	Completely fused	Completely ossified	Partially ossified
72	Completely fused	Completely ossified	Outlines plainly visible
96	Completely fused	Completely ossified	Outlines barely visible

Describing meat

Post slaughter descriptors

The following aspects of meat quality can be measured. The measurements are usually taken after the carcase has chilled for at least 12 hours.

- pH
- meat colour
- wateriness/firmness
- bruising
- marbling
- eye muscle area
- fat colour
- fat distribution.

Some markets will dictate minimum requirements for these characteristics. Actual measures may attract price penalties or premiums.

pH

pH is the measure of the acidity of meat. A neutral pH value is 7 with a pH value below 7 referred to as acid and above 7 as alkaline. The pH of muscle in the living animal is neutral.

The desired pH for tender meat is 5.6. This will produce tender meat of a cherry red colour. The pH of meat affects its juiciness and flavour because it affects its water holding characteristics.

The final acidity of muscle is influenced by the amount of glycogen in the muscle at slaughter. Post slaughter, the muscles continue to contract in the absence of oxygen causing the use of the glycogen and the production of lactic acid. The lactic acid increases the acidity of the muscle. The extent of this fall in pH is determined by the amount of glycogen in the muscle at the time of death. Consequently stressed animals will have used up much of their muscles glycogen reserve through excessive movement such as running or shivering, and the amount of lactic acid produced post slaughter will be decreased.

Meat colour

Meat colour is the colour of the bloomed loin muscle at the quartering point. It is scored on a 9 point scale from 1A (light) to 7 (dark). Older cattle have darker, more red-coloured muscle than young cattle.

Myoglobin, the main contributor to meat colour, is purple in the absence of oxygen. When exposed to air, myoglobin turns into oxymyoglobin which is bright red. After further oxidation it turns into metmyoglobin, which is brown. Age, nutrition, muscle function and exercise affect myoglobin levels.

As well as being affected by myoglobin levels, meat colour is influenced by the rate of the rigour mortis process and the final pH of the meat.

'Dark cutter' is a term used to describe meat that has an unusually dark colour. This will occur when the animal has been stressed prior to slaughter and the muscle glycogen levels are low, causing the meat to obtaining a high final pH (above 6). At this pH, the muscle components bind tightly onto water. This increased water holding capacity reduces the amount of light reflected off the meat, making it appear dark. Such meat tends to be tough and is susceptible to bacterial spoilage because the acid levels in the meat are not adequate to prevent bacterial growth.

Pale meat is caused by a rapid decline in pH, resulting in a too low final pH (below 5.6) which causes subsequent partial breakdown of proteins and myoglobin. The remaining myoglobin is absorbed into other proteins and concealed. Low pH meat reflects more light, appearing a pale, dull colour.

Bruising

Bruising is assessed visually on a score system that reflects the position and extent of the bruise on the carcase. Badly bruised stock will be trimmed heavily, lowering dressing percentage.

Marbling

Marbling fat, or intramuscular fat (IMF), is the fat deposited between the muscle fibres. The amount of marbling varies with an animal's genetic propensity to deposit intramuscular fat, and increases with age after the major stages of muscle growth have stopped. There is a positive correlation between marbling and subcutaneous fat.

Marbling accounts for about 10 per cent of variation in meat tenderness. Marbling is visually assessed at the loin quartering point on a 7-point scale from 0 (devoid) to 6 (excessive).

Eye muscle area

The eye muscle area (EMA) is the cross sectional area of the rib eye muscle taken in carcases quartered at the 10/11th rib. EMA is calculated in square centimetres and can be measured in the carcase using a grid scale and on live animals by scanning.

Eye muscle area and shape is slightly correlated to muscle score (in animals of the same weight), indicating that as muscle score increases so too will eye muscle area.

Fat colour

The colour of the inter-muscular fat of the loin is visually assessed and scored on a 10-point scale from 0 (white) to 9 (yellow). Fat colour varies primarily with nutrition and age, becoming increasingly yellow with age or nutritional stress. Loss of weight causes fat to break down, resulting in an increased intensity of colour in remaining fat. Deposits of yellow fat can be reduced in most cattle by feeding on high grain diets for at least one month before slaughter. Fat colour is also influenced by an animal's genetic ability to convert carotene to Vitamin A.

Fat distribution

Fat distribution is the distribution of fat over the carcase and over certain cuts and is visually assessed.

Appendix 5
Useful calculations and worksheets

Calculating the cost of dry matter and nutrients

The following calculations use cottonseed meal with these parameters as an example:

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

How much dry matter in 1 kilogram of feed?

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

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

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

Cost of 1 tonne of dry matter

$$\frac{(1\ \text{t} \times 100) \times \text{cost of 1 t as purchased}}{(\%\ \text{dry matter})} = \frac{1 \times 100 \times \$350}{90} = 1.1 \times \$350 = \$385/\text{t of dry matter}$$

Dollars per tonne to cents per kilogram

$$\frac{\text{Cost of 1 t in cents}}{1{,}000} = \frac{35{,}000}{1{,}000} = 35\text{c}$$

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

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

Cost of 150 grams of protein

$$\frac{\text{Cost of 1 kg of protein} \times 150}{1{,}000} = \frac{104 \times 150}{1{,}000} = 15.6\text{c}$$

Forage budgeting

Consider doing a Nutrition EDGE or Grazing Land Management Workshop call DPI&F 13 25 23

The steps in working out a dry season forage budget are

- setting a goal (amount of pasture to be left) for the end of the period
- estimating the feed available at the beginning of the period (*the feed)*
- calculating the stock's feed requirements per animal during the period (*the need*)
- determining the appropriate stocking rate to achieve the goal (*divide the need by the feed*)
- monitoring the result.

Setting the goal

A common target for the end of the dry season is 1500 kg/ha of dry matter, which is enough to reduce runoff and allow rainwater to infiltrate the ground and to provide enough fuel for a burn if desired.

Determining the feed

The net amount of feed available per hectare is the gross amount at the beginning of the season adjusted by the quality of the pasture (by discounting for the proportion of unpalatable species) and multiplied by the utilisation rate.

- The DPI&F publication *'Southern Speargrass – a graziers guide'* (Ian Partridge QI93037; ISBN 07242-53890) has photo standards for estimating standing dry matter. Take several estimates around the paddock to account for variation and work out an average.
- Take a walk around the paddock to estimate the percentage of pasture that cattle will not eat, such as wiregrass and blady grass.
- Optimum (sustainable) utilisation rates, or the proportion of pasture that you will allow the livestock to consume, will vary between pasture communities from 40 per cent on fully sown pasture, to 30 per cent on high fertility soils, such as black soils, to 20 per cent on sandy or gravely ridge country.

Net feed available = feed at start x (100% - % unpalatable)% x utilisation rate

For example, say the standing dry matter is estimated at 2500 kg/ha, proportion of unpalatable species is estimated at 15%, utilisation rate is set at 30%, then

Net feed available = 2,500 kg/ha x (100% – 15%) x 30%
= 2,500 x 85% x 30%
= 637.5 kg/ha

Once the net feed available per hectare has been calculated, check that there will be sufficient ground cover left if this amount of feed is eaten. To do this, subtract the net feed available from the feed at the start and compare this with your goal.

Is (Feed at start – Net feed available) > End-of-season target?

In the calculation here, (2,500 – 637.5) kg/ha = 1,862.5 kg/ha remaining, which is more than the goal of 1,500 kg/ha.

If the feed remaining is less than the end-of-season goal, you will need to reduce the utilisation rate (permitting the cattle to eat less of the pasture) and recalculate the feed available. This is usually only a problem in years with low rainfall and when pasture growth has been poor.

Calculating the need per animal

The need per animal for the whole period will be average weight over the period, multiplied by expected daily intake (as a percentage of body weight), multiplied by the length of time in days until you can expect enough rain for the grass to start growing again.

- You may know from experience when you can reasonably expect to receive sufficient rain for grass to start growing again in your district. It is wise to assume rain will be late rather than early.
- Average weight will be starting weight plus half of the amount you expect the cattle to gain over the period. Estimate average daily gain according to the amount of green leaf in the pasture, the amount of legume, and from your experience.
- Daily intake (as a percentage of body weight) will vary considerably, being as high as 3 per cent of body weight (on a dry matter basis) on a high quality feed, such as a feedlot ration, and as low as 1.2 per cent on poor quality pasture or 1.8 per cent on reasonable quality pasture.

Number of days = *finishing date – starting date*

Average weight = *starting weight + (estimated weight gain per day x number of days)/2*

Feed required/head/day for period (i.e. need per animal)
= *daily intake as percentage of body weight x average body weight x days*

For example, say you are working out a forage budget from the beginning of April until mid-November (230 days) for cattle with a starting weight of 250 kg. You estimate they will gain 0.3 kg/day over the period, and that their daily intake will be about 1.8% of body weight.

Number of days = 15 November – 1 April
= 230 days

Average weight = 250 kg/hd + (0.3 kg/hd/day x 230 days)/2
= 250 kg/hd + 34.5 kg/hd
= 284.5 kg/hd

Need per animal = 1.8% x 284.5 kg/hd x 230
= 1,178 kg/hd

Setting the stocking rate

The number of animals the paddock will carry is calculated by dividing the amount available by the amount required by each animal and multiplied by the size of the paddock.

Stocking rate per hectare = Need per animal / Net feed available

Stocking rate per paddock = Size of paddock / Stocking rate per hectare

Completing our example, and calculating the number of stock that can be carried in an 80 ha paddock

Stocking rate per hectare = 1,178 kg/hd / 637.5 kg/ha
= 1.85 ha/hd

Stocking rate per paddock = 80 ha / 1.85 ha/hd
= 43 head.

This approach to setting a stocking rate provides a very good guesstimate. It is subject to several assumptions and inaccuracies that must be taken into account when making decisions:

- You are assuming you won't get any pasture growth over winter, so any growth you do get will be a bonus.
- You are estimating the animals will gain some weight over winter. If it is a hard winter, they may actually lose weight. This makes little difference because you've allowed for the extra feed consumption.
- You may get good rain earlier, say in September. You will then have fuel for a burn in September instead of having to wait until November.
- If cattle start to use more than 30 to 40 per cent of the pasture that was available at the start, they will be eating poorer quality pasture components (e.g. stem) and will not do as well.

To develop your understanding of how a forage budget works on your property, record your estimates and calculations and monitor both animals and pasture as the seasons progress, reassessing stocking rates accordingly.

Feeding costs worksheets

In this section, a number of examples are worked through for assessing the economic benefits of various production feeding options, followed by blank versions of each worksheet for your own calculations.

Grain feeding in the paddock – worked example

PADDOCK GRAIN FEEDING BUDGET WORKSHEET (based on carcase weight)			
Initial (est) carcase weight (CW)	270 kg		
Carcase price ($/kg CW)	$3.35 /kg CW		
Initial value	270 kg x $3.35 /kg CW		$904.50
Average carcase gain per day	0.40 kg/day		
Estimated days to fatten	130 days		
Total carcase gain	52 kg		
Final dressed weight	322 kg		
Average daily feed	6 kg/day		
Total feed consumption	780 kg		
Feed cost a tonne	$300.00/tonne		
Total feed cost			$234.00
Feeding out cost per steer	depreciation, interest and repairs, equipment plus labour, fuel and power		$16.00
Interest on steer and feed	7% for 114 days		$31.44
Costs Growth promotants	$4.00		
Lice treatment	$0.00		
Losses 1%	$9.05		
Vet. costs	$0.00		
Transaction Levy	$3.50	Total	$16.55
Commission	0.00% of est final value		$0.00
Transport			$0.00
TOTAL COSTS			$1,202.49
SUMMARY	Initial value		$904.50
	Feed cost		$234.00
	Feeding out cost		$16.00
	Interest on steer and feed		$31.44
	Treatment cost		$16.55
	Commission		$0.00
	Transport		$0.00
	Total cost		$1,202.49
Break-even price ($/kg CW)			$3.73
Estimated sale price	$/kg CW $3.50	Price per head	$1,127.00
Profit/Loss			$75.49

Grain feeding in the paddock – worksheet

PADDOCK GRAIN FEEDING BUDGET WORKSHEET (based on carcase weight)			
Initial (est) carcase weight (CW)	_____ kg		
Carcase price ($/kg CW)	$ _____ /kg		
Initial value	initial value x $____ /kg		$_____
Average carcase gain per day	_____ kg		
Estimated days to fatten	_____ days		
Total carcase gain	_____ kg		
Final dressed weight	_____ kg		
Average daily feed	_____ kg		
Total feed consumption	_____ kg	(daily intake x no. days)	
Feed cost a tonne	$_____		
Total feed cost	(total fed consumed x $/tonne)		$_____
Feeding out cost per steer	depreciation, interest and repairs, equipment plus labour, fuel and power		$_____
Interest on steer and feed	_____% for _____ days		$_____
Costs Growth promotants	$_____		
Lice treatment	$_____		
Losses 1%	$_____		
Vet. costs	$_____		
Transaction Levy	$_____	Total	$_____
Commission	_____% of est final value		$_____
Transport			$_____
TOTAL COSTS			$_____
SUMMARY	Initial value		$_____
	Feed cost		$_____
	Feeding out cost		$_____
	Interest on steer and feed		$_____
	Treatment cost		$_____
	Commission		$_____
	Transport		$_____
	Total cost		$_____
Break-even price ($/kg carcase weight)	(final CW/total costs)		$_____
Estimated sale price	$/kg CW $_____	Price per head	$_____
Profit/Loss			$_____

Note. Use either live or carcase weight. Carcase weight is approximately 50% for forward store animals and 52% for grass finished animals when weighed full (straight from the paddock). Dressing percentage will increase if animals are fasted.

Feedlot costs – worked example

Group to feed	2-year-old steers		
Initial steer weight	450 kg		
Steer price	$1.50/kg		
Steer value	$1.50/kg x weight 450 kg	=	$ 675.00
Average weight gain	1.8 kg/day		
Estimated days to fatten	100 days		
Total gain	average daily gain 1.8 x 100 days to fatten	=	180 kg
Final weight	gain 180 kg + initial weight 450 kg	=	630 kg
Av. weight in lot	initial weight 450 kg + 90 (½ total gain)	=	540 kg
Av. daily feed intake	average weight x 2.7 / 100	=	14.58 kg
Total feed intake	14.58 av daily feed intake x 100 total days	=	1,458 kg
Total feed cost	$3.00/tonne = $240 feed $/ton x 1.45 tonnes		$437.40
Feeding out cost	depreciation, interest, repairs, labour, fuel and power		$10.00
Interest on steer and feed	7% for 114 days		$24.32
Treatment costs			
Growth promotant	$4.50		
Lice treatment	$0.50		
Deaths — 1%	$6.75		
Veterinary costs	$5.00		
Transaction levy	$3.50		
Total treatment costs			$19.75
Interest on steer/feed/treatment @ 10% pa for 4 mths			$25.10
Commission	5% of final estimated value		$0
Transport			$15.00
TOTAL COSTS			$1181.47
Summary			
Cost of steer	$675.00		
Feed cost	$437.40		
Feeding out cost	$10.00		
Interest on steer and feed	$24.32		
Treatment cost	$19.75		
Commission	$0		
Transport	$15.00		
Transaction levy	$3.50		
TOTAL COST			$1,181.47
Breakeven			
c/kg LW =	$1,181 total cost / 630 final weight		$1.88
c/kg CW =	$1,181 total cost x 100 / 630 final weight x dressing %		$3.47

* Intake is 2.5% of liveweight on a dry matter basis. Most grain rations are about 90% dry matter, so the actual intake is approximately 2.7% of liveweight on an as-fed basis.

Feedlot costs – worksheet

Group to feed 2-year-old steers		
Initial steer weight	_____ kg	
Steer price/kg	$_____/ kg	
Steer value	= $/kg____ x weight ____kg	$_____
Av. weight gain/day	_____kg	
Estimated days to fatten	_____days	
Total gain	= av daily gain ____ x ____ days to fatten _____ kg	
Final weight	= gain ____kg + initial weight _____kg _____ kg	
Av. weight in lot	= _____ initial weight + _____ ½ total gain _____ kg	
Av. daily feed intake	= average weight x 2.7 = 14.5 kg 100	
Total feed intake	= _____ av daily feed x _____ total days _____ kg	
Total feed cost	$_____/tonne = $_____ feed $/tonne x ____ tonnes	$_____
Feeding out cost	depreciation, interest, repairs, labour, fuel and power	$_____
Interest on steer and feed	_____% for _____ days	$_____
Treatment costs		
Growth promotant	$_____	
Lice treatment	$_____	
Deaths — 1%	$_____	
Veterinary costs	$_____	
Transaction levy	$_____	
Total costs		$_____
Interest on steer/feed/treatment @ 10% pa for 4 mths		$_____
Commission	5% of final estimated value	$_____
Transport		$_____
TOTAL COSTS		$_____

Summary		
Cost of steer	$_____	
Feed cost	$_____	
Feeding out cost	$_____	
Interest on steer and feed	$_____	
Treatment cost	$_____	
Commission	$_____	
Transport	$_____	
Transaction levy	$_____	
TOTAL COST		$_____
Breakeven		
c/kg LW = total cost / final weight	$_____	
c/kg DW = total cost x 100 / final weight x dressing %	$_____	
Estimated sale price ($/kg)	$_____	
Final value ($/kg x final weight)	$_____	
Profit/Loss from feedlotting = final value – total costs		$_____

When growing crops, such as oats, to finish cattle there are two areas of oats to take into account:

1. cost associated with producing the crop and
2. cost associated with the animal.

Both have to be taken into account when calculating the likely outcome from finishing on crop.

Costing a grazing crop – worked example

Animal information		Animal costs	
Initial weight	500 kg	Interest on initial value	$20.55
Price $/kg LW	$ 1.50	Growth promotant	$4.00
Initial value	$ 750 (initial weight x initial price)	Parasite control	$1.00
Days on feed	100 days	Deaths 1%	$7.50
Daily gain	0.8 kg/day	Vet costs	$1.00
Total gain	80 kg (days on feed x total gain)	Transaction levy	$3.50
Final live weight	580 kg (initial weight + total gain)	Commission	$0.00
Final dressed weight	307 kg	**Total costs**	$37.55
Sale price $/kg	$ 3.00 DW		
Sale price	$ 921.00		
Return per animal	(sale price - Initial value and other costs)	$133.45	
Stocking rate/ha	4.0 head/ha		
Animal return/ha	(return per animal x stocking rate per ha)	$533.80/ha	

Costing a grazing crop – worksheet

Animal information		Animal costs	
Initial weight	_____kg	Interest on initial value	$_____
Price $/kg LW	$ _____	Growth promotant	$_____
Initial value	$ _____ (initial weight x initial price)	Parasite control	$_____
Days on feed	_____ days	Deaths 1%	$_____
Daily gain	_____ kg	Vet costs	$_____
Total gain	_____ kg (days on feed x total gain)	Transaction levy	$_____
Final dressedweight	LW _____ kg (initial weight + total gain)	Commission	$_____
	CW _____ kg	**Total costs**	$_____
Sale price $/kg	$_____ DW		
Sale price	$_____		
Return per animal	$_____ (sale price - initial value and other costs)		
Stocking rate/ha	_____ head/ha		
Animal return/ha	$_____ (return per animal x stocking rate per ha)		

Calculating cropping costs – worked example

Land preparation

Implement	No. of operations	Cost/operation	Total cost	Total
Chisel	1	$9.80	$9.80	
Scarifier	1	$3.53	$3.53	
Fertiliser spreader	3	$2.50	$7.50	
Planter	1	$6.50	$6.50	
Seed	40 kg/ha	$3.00 /kg	$120.00	$147.33
Fertiliser	**Rate (kg/ ha)**	**Cost ($/tonne)**	**Cost**	**Total**
Planting				
Super	0	200	0.00	
Potash	125	400	50.00	
Urea	125	451	56.38	106.38
Maintenance				
Urea	125	451	56.38	
Irrigation	mega litre	mm/app	Number of app	Total water
	$20.00	25	5	1.25 mega litres ($25)
Interest on crop growing costs			$31.50	
Total crop cost per ha			$388.60	
Return per ha (Animal return per ha-crop costs)			$145.20	

Calculating cropping costs – worksheet

Land preparation

Implement	No. of operations	Cost/operation	Total cost	Total
Chisel	_____	_____	_____	
Scarifier	_____	_____	_____	
Fertiliser spreader	_____	_____	_____	
Planter	_____	_____	_____	
Seed	_____ kg/ha	_____ /kg	_____	_____
Fertiliser	**Rate (kg/ ha)**	**Cost ($/tonne)**	**Cost**	**Total**
Planting				
Super	_____	_____	_____	
Potash	_____	_____	_____	
Urea	_____	_____	_____	
Maintenance				
Urea	_____	_____	_____	
Irrigation	mega litre	mm/app	Number of app	Total water
	_____	_____	_____	_____ mega litres
Interest on crop growing costs			_____	
Total crop cost per ha			_____	
Return per ha (Animal return per ha-crop costs)			_____	

Appendix 6
Useful contacts

Agforce Queensland
Street address:
First floor, Primary Producers House
183 North Quay
Brisbane QLD 4000
Postal address:
PO Box 13186
George Street
Post Shop Brisbane QLD 4003
Phone (07) 3236 3100
Fax (07) 3236 3077
Email agforce@agforceqld.org.au
Web www.agforceqld.org.au

Animal and Plant Health Service (APHS)
Phone DPI&F Call Centre on 13 25 23
Web www.dpi.qld.gov.au/health

Animal Health Australia
Suite 15, 26-28 Napier Close
Deakin ACT 2600
Phone (02) 6232 5522
Fax (02) 6232 5511
Email aahc@aahc.com.au
Web www.aahc.com.au

AuctionPlus Pty Ltd
Street address:
Level 6, 64 Clarence Street
Sydney NSW 2001
Postal address:
GPO Box 2671
Sydney NSW 2001
Phone (02) 9262 4222
Fax (02) 9262 2244
Web www.auctionplus.com.au

AUS–MEAT Limited (Queensland office)
Street address:
9 Buchanan Street
South Brisbane QLD 4101
Postal address:
PO Box 3175
South Brisbane QLD 4101
Phone (07) 3247 7200
Freecall 1800 621 903
Fax (07) 3247 7222
Email ausmeat@ausmeat.com.au
Web www.ausmeat.com.au

Australian Fodder Industry Association Inc.
PO Box 4022
Balwyn VIC 3103
Phone (03) 9890 6855
Fax (03) 9890 2353
Web www.afia.org.au

Australian Pesticides and Veterinary Medicines Authority (APVMA) (previously the National Registration Authority)
Street address:
John Curtin House
22 Brisbane Avenue
Barton ACT 2600
Postal address:
PO Box E240
Kingston ACT 2604
Phone (02) 6272 5852
Fax (02) 6272 4753
Email contact@apvma.gov.au
Web www.apvma.gov.au

Australian Quarantine and Inspection Service (AQIS)
(National office)
GPO Box 858
Canberra ACT 2601
Phone (02) 6272 3933
Freecall 1800 020 504
Web www.aqis.gov.au

AQIS Queensland
Street address:
42-44 Qantas Drive
Eagle Farm QLD 4009
Postal address:
PO Box 222
Hamilton QLD 4007
Phone (07) 3246 8755
Fax (07) 3246 8639

Biodynamic Research Institute (BDRI) also known as ***DEMETER***
Main Road
Powelltown VIC 3797
Phone (03) 5966 7333
Fax (03) 5966 7433

Biological Farmers of Australia (BFA) (Head office)
Level 1/766 Gympie Road
PO Box 530
Chermside QLD 4032
Phone (07) 3350 5716
Fax (07) 3350 5996
Email info@bfa.com.au
Web www.bfa.com.au

Breeds and Breed Societies
C/- Animal Genetics and Breeding Unit
The University of New England
Armidale NSW 2351
Phone (02) 6773 2055
Fax (02) 6773 3266
Email AGBU@mendel.une.edu.au
Web http://abri.une.edu.au and go to the International Livestock Register

BREEDPLAN (also GROUP BREEDPLAN and BreedObject)
Agricultural Business Research Institute (ABRI)
University of New England
Armidale NSW 2351
Phone (02) 6773 3555
Fax (02) 6772 5376
Email breedplan@abri.une.edu.au
Web www.breedplan.une.edu.au

ChemCert Training Queensland Inc.
Plant Protection Building
University of Queensland, Gatton Campus
Gatton QLD 4343
Phone (07) 5460 1295
Email chemcertqld@bigpond.com.au
Web www.chemcert.org.au

ChemClear ®
Level 4 AMP Tower 1 Hobart Place
GPO Box 816
Canberra City ACT 2601
Phone (02) 6230 4799
Freecall 1800 008 182
Fax (02) 6230 6710
Email info@chemclear.com.au
Web www.chemclear.com.au

Cooperative Research Centre for Cattle and Beef Quality
CJ Hawkins Homestead
University of New England
Armidale NSW 2351
Phone (02) 6773 3501
Fax (02) 6773 3500
Email beefcrc@metz.une.edu.au
Web www.beef.crc.org.au

CSIRO Publishing
PO Box 1139
150 Oxford Street
Collingwood VIC 3066
Phone (03) 9662 7666 (order enquiries)
(03) 9662 7500 (general enquiries)
Email publishing@csiro.au
Web www.publish.csiro.au

District Veterinary Officers
Phone DPI&F Call Centre on 13 25 23

DPI&F Bookshop
All DPI&F books can be bought from the DPI&F Bookshop, and selected titles are available at some DPI&F regional centres.
Ground Floor, Primary Industries Building
80 Ann St
Brisbane QLD 4000
Phone (07) 3239 3100
Email books@dpi.qld.gov.au
Web www.dpi.qld.gov.au/shop

DPI&F Call Centre
Phone 13 25 23
Email callweb@dpi.qld.gov.au
Web www.dpi.qld.gov.au
8 am to 6 pm Monday to Friday (excluding public holidays) for the cost of a local call from anywhere in Queensland for everything you need to know about DPI&F products, services and contacts.

Flockcare
Contact AUS–MEAT (Queensland office).

Fodder Vendor Declaration Forms
Contact Australian Fodder Industry Association Inc.

Grains Council of Australia
Street address:
Level 2, NFF House
14-16 Brisbane Avenue
Barton ACT 2600
Postal address:
PO Box E10
Kingston ACT 2604
Phone (02) 6273 3000
Fax (02) 6273 3756
Email gca@grainscouncil.com
Web www.grainscouncil.com

LiveCorp
Suite 601, Currency House
23 Hunter Street
Sydney NSW 2000
Phone (02) 9223 7655
Fax (02) 9223 7650
Email livecorp@livecorp.com.au
Web www.livecorp.com.au

Livestock Transaction Levy
Levies and Revenue Service Office
(Queensland)
Freecall 1800 647 801

Meat and Livestock Australia (MLA)
Street address:
Level 1, 165 Walker Street
North Sydney NSW 2060
Postal address:
Locked Bag 991
North Sydney NSW 2059
Phone (02) 9463 9333
Freecall 1800 023 100
Fax (02) 9463 9393
Email info@mla.com.au
Web www.mla.com.au

Meat and Stock Inspectors
Phone DPI&F Call Centre on 13 25 23

National Association for Sustainable Agriculture Australia Ltd (NASAA)
PO Box 768
Stirling SA 5152
Phone (08) 8370 8455
Fax (08) 8370 8381
Email enquiries@nasaa.com.au
Web www.nasaa.com.au

National Livestock Identification Scheme
See Meat and Livestock Australia

National Organochlorine Residue Management (NORM) Program
Phone DPI&F Call Centre on 13 25 23
Web www.dpi.qld.gov.au and go to the Animal and Plant Health section

Natural Resources, Mines and Energy
(Central office)
Level 8, 144 Edward Street
GPO Box 1401
Brisbane QLD 4001
Phone (07) 3227 6626
Fax (07) 3227 8758
Web www.nrm.qld.gov.au

National Residue Survey (NRS)
Department of Agriculture, Fisheries & Forestry
Phone (02) 6272 3446
Fax (02) 6272 4023
Web www.daff.gov.au/nrs

National Vendor Declaration (Cattle) forms
See Meat and Livestock Australia

NSW Agriculture Bookshop
Orange Agricultural Institute
Locked Bag 21
Orange NSW 2800
Phone 1800 028 374
Fax 1800 642 065
Email bookshop@agric.nsw.gov.au
Web www.agric.nsw.gov.au

Organic Food Chain (OFC)
PO Box 2390
Toowoomba QLD 4350
Phone (07) 4637 2600
Fax (07) 4696 7689
Email ofc@organicfoodchain.com.au
Web www.organicfoodchain .com.au

Queensland Herbarium
Brisbane Botanic Gardens Mt Coot-tha
Mt Coot-tha Road
TOOWONG QLD 4066
Phone (07) 3896 9326
Fax (07) 3896 9624
Email
Queensland.Herbarium@epa.qld.gov.au
Web www.epa.qld.gov.au

Registrar of Brands
Phone DPI&F Call Centre on 13 25 23
Web www.dpi.qld.gov.au
(search for *brands* – for owning and selling livestock application forms)

Safe Food Queensland
Street address:
12 Helen Street
Newstead QLD 4006
Postal address:
PO Box 440
Spring Hill QLD 4004
Phone 1800 300 815
Fax (07) 3253 9824
Email info@safefood.qld.gov.au
Web www.safefood.qld.gov.au

SAFEMEAT
C/- Meat and Livestock Australia
Phone (02) 9463 9333 or 1800 023 100
Web www.safemeat.org

Tick Fever Centre
Phone (07) 3898 9655
Fax (07) 3898 9685
Email tfc@dpi.qld.gov.au
Web www.dpi.qld.gov.au/tickfever

Appendix 7
Recommended reading

Prime Notes CD (2004). Department of Primary Industries & Fisheries, Brisbane. *Available from the DPI&F bookshop*. The PrimeNotes CD delivers over 5,000 advisory fact sheets (equivalent to over 24,000 pages of print) from the research of numerous respected government agencies and non-profit information organisations.

Rural business management

Breedcow and Dynama. (2000). B.Holmes. Department of Primary Industries and Fisheries, Queensland. Available from the DPI&F Bookshop.

Financing your farm - A practical guide to farm financial planning and management. (1995). 3rd Edition. A. Blackburn and R. Ashby on behalf of the Australian Banker's Association. *Available on-screen at* www.bankers.asn.au. *Thorough overview of the issues facing rural managers, financial management and planning.*

Holistic management: A new framework for decision making. (1999). 2nd Edition. A. Savory and J. Butterfield. Washington D.C. Island Press. ISBN 1-5596-3488-X.

Beef markets

Beef market specifications. (1999). D. Allteron. New South Wales Department of Agriculture. ISBN 0-7347-1037-2. *Available through NSW Department of Agriculture, 72 page softcover. Assists producers with identifying market specifications within target markets. Reviews current specification requirements of cattle for major slaughter, feeder and backgrounding markets, and highlights areas of non-compliance that can threaten Australia's reputation as a quality beef producer. Provides a planning focus for a range of production-based opportunities.*

Handling and transport

Australian model code of practice for the welfare of animals — cattle. (1992). Standing Committee on Agriculture, Animal Health Committee. CSIRO Publications, Australia. ISBN 0-643-05377-8.

Cattle yards: design, materials and construction. (2003). 2nd Edition. E. Powell and J.W. Lapworth. Department of Primary Industries and Fisheries, Queensland. ISBN 0-7242-2259-6. *Available from DPI&F Bookshop, 65 pages, illustrated. A how-to guide to locating, planning and building yards for cattle, including more than 80 diagrams explaining construction and 21 plans of cattle yards.*

Handling the herd. (1998). M. Evans. Kondinin Group. ISBN 1-8760-6806-6. QX98001. *Available from DPI&F Bookshop, 300 pages, illustrated. Covers all aspects of cattle yard design and construction.*

The stockman's handbook. (1997). 6th Edition. R. Kaus, J.W. Lapworth and P. Carroll. Department of Primary Industries and Fisheries, Queensland. ISBN 0-7242-6701-8. *Available from DPI&F Bookshop, 196 pages, softcover, illustrated. Provides beef property managers with practical information about animal health and husbandry practices affecting stock across northern Australia, including weaner management, livestock health and regulations, tick control and marketing best practice.*

Ruminant nutrition

Nutrient requirements of beef cattle. (1996). 7th revised edition. National Academy Press, Washington DC. ISBN 0-2090-5426-5. *242 pages, illustrated.*

Pasture Management and Weeds

GRASS Check – A Grazier Rangeland Assessment. (1994). K. Forge. Department of Natural Resources, Mines and Energy, Brisbane. ISBN 0 7242 5408 0. *Available from the DPI&F bookshop*. This package has been developed to help graziers look more closely at the changes taking place in their pastures, and to help understand how those changes affect production. It provides early warning of feed shortages, weed invasions, loss of palatable grasses, bare areas and compacted soils that no longer take in water. The methods used have been tested in the field by graziers, extension officers and pasture agronomists.

Grazing the north: creating wealth and sustaining the land. (1993). D. Gramshaw. Department of Primary Industries and Fisheries, Queensland, Brisbane. ISBN 0 7242 3911 1. *Available from the DPI&F bookshop*. This book is a full-colour, informative, and easy-to-read text. Discussed are pasture and livestock resources; advances in technology; beef, wool, and dairy production systems; and future challenges and opportunities for sustaining livestock and pastures.

Leucaena – The Shrub Legume for Cattle Feed. (1991). Tropical Grassland Society, Brisbane. ISBN 0 9590 9483 0. *Available from the DPI&F bookshop*. Leucaena is a thornless, productive, persistent and palatable legume shrub or tree. Like other legumes, it can provide a protein-rich diet to cattle and fix nitrogen to improve soil fertility. Farm livestock have been fed on leucaena for centuries in central America, the Philippines, and Indonesia while ranchers have grown it in Hawaii since the 1930's. This booklet has been published by the Tropical Grassland Society of Australia to help graziers make money out of leucaena by learning how and where it can fit into property and management systems, and how to minimise the risk of failures.

Managing native pastures: a grazier's guide. (1992). I.J. Partridge. Department of Primary Industries and Fisheries, Queensland. ISBN 0-7242-3909-X. *Available from DPI&F Bookshop, 33 pages, softcover, illustrated. Sets out the basic principles of native pasture management, effects of grazing on plants, and effects of stocking on animals and pastures. Also addresses integration of other feed supplies, property planning, signs and causes of poor pasture condition, pasture monitoring, and computer decision support.*

Managing native pastures in Queensland: The resources and their management. (1987). W.H. Burrows, J.C. Scanlan and M.T. Rutherford. Department of Primary Industries, Queensland, Brisbane. ISBN 0 7242 2443 2. *Available from the DPI&F bookshop, soft cover, 284 pages.* The book describes Queensland's many native pastures, their management and integration with other feed sources, and the problems caused by woody weeds and land degradation. Useful appendices on plant identification and soil sampling are included and the bibliography contains more than 500 references.

Managing southern speargrass: a grazier's guide. (1993). I.J. Partridge. Department of Primary Industries and Fisheries, Queensland. ISBN 0-7242-5389-0. *Available from DPI Bookshop, 42 pages, softcover, illustrated. Provides specific guidelines for managing the speargrass native pasture community stretching from north of Bowen to south of Boonah for sustainable production, i.e. clearing or thinning trees, altering stocking rates, moving stock, burning and improving the pasture.*

Pasture photo-standards CD. (2003). Department of Primary Industries and Fisheries Queensland, Brisbane. *Available from the DPI&F bookshop*. This pasture photo-standard CD will assist in developing pasture budgets and dry season business management plans. The CD contains photo-standards and corresponding pasture yields for many of Queensland's common pasture communities. Users will be able to search for standards according to region or by pasture type. Also included is an order form to obtain durable, full colour, laminated copies of each of the pasture photo-standards for use in the field.

Pasture plants of southern inland Queensland. (1995). D.R. Henry, T.J. Hall, D.J. Jordan, J.N. Milson, C.M. Schefe and R.G. Silcock. Department of Primary Industries and Fisheries, Queensland. ISBN 0-7242-5940-6. *Available from DPI&F Bookshop, 261 pages, colour illustrations. Covers pasture management, poisonous plants, and the land types of the area as well as a plant identification key and extensive index. A valuable resource for landholders, conservationists and anyone with an interest in native pasture plants.*

Plants of central Queensland. (2003). E.R. Anderson. Department of Primary Industries and Fisheries, Queensland. ISBN 0-7242-3990-1. *Available from DPI&F Bookshop, 272 pages, illustrations and maps. Describes and illustrates plants and vegetation of central Queensland, facilitating easy identification.*

Savanna Burning: Understanding and using fire in Northern Australia. (2002). Tropical Savannas, Darwin. ISBN 0 9578489 8 6. *Available from the Tropical Savannas CRC, 144 pages.* A practical guide and information resource for managing fire in Australia's tropical savannas.

Stylos for better beef. *(1996).* I.J. Partridge, C. Middleton and K. Shaw. Department of Primary Industries and Fisheries, Queensland. ISBN 0-7242-5977-5. Available from DPI&F Bookshop, 32 pages, illustrated. Describes using these well-adapted legumes to help meet beef market specifications; provides detailed background and management information on various stylos.

Weed Pocket Guide. (1997). Department of Natural Resources, Queensland, in conjunction with Brisbane City Council. ISBN 0-7242-7259-3. *Available from DPI&F Bookshop, pocket format of up to 52 colour-illustrated cards, describing the weed, weed habitat and declaration status. Can also be obtained from local shire Weed Officers, Department of Natural Resources, Mines and Energy, Rural Land Protection Officers, Catchment and Landcare groups with species selected for local areas.*

Managing for growth

Crops, carcass, cash. (1993). J. Cavaye. Department of Primary Industries and Fisheries, Queensland. ISBN 0-7242-3215-X. *Available from DPI&F Bookshop, 46 pages softcover. Guide to efficient and profitable production using forage crops, covering the place of forage crops in whole-production systems, summer forage crops, winter forage crops, grazing management economics, and maintaining animal health.*

Nutritional and managerial opportunities for meeting beef markets. (1996). R. Cheffins. Department of Primary Industries and Fisheries, Queensland. ISBN 0-7242-6690-9. QI 96112. *Available from DPI&F Bookshop, 64 pages softcover. Identifying preferred markets and evaluating nutritional and managerial options to meet market specifications, with examples of various market specifications.*

Dry Season, Drought and Supplementary Feeding

Dry season management of a beef business. *(2001). R. Tyler. Department of Primary Industries and Fisheries, Queensland. ISBN 0-7345-0161-7. QI01069.* Available from DPI&F Bookshop, small format, 52 pages, illustrated. Successful drought management and feeding depends on early planning, taking account of the long term effect of the drought on the land, finances, cattle and people. This books sets out steps for decision making with information on insurance supplementation, crisis supplementation, roughages, feeding, chemical residues, regulating intake, analysis of protein meals, digestion in the ruminant and fermentation of feedstuffs.

Phosphorus nutrition of beef cattle in northern Australia. (1994). T. McCosker and L. Winks. Department of Primary Industries and Fisheries, Queensland. ISBN 0-7242-5417-X. *Available from DPI&F Bookshop, 86 pages, colour photos. Provides a total supplementation and management program for treating phosphorous-deficient beef cattle in northern Australia, including appropriate supplements, methods of feeding and likely economic results.*

Health and Diseases

Animal health and disease investigation. (1998). B. Cottam and J. Berry. Department of Primary Industries and Fisheries Queensland. ISBN 0-7345-0013-0. *Available from DPI&F Bookshop, 276 pages, softcover, illustrated. Establishes the factors that maintain animals in health and indicates how environment, circumstance and infectious disease can compromise health. Other topics include exotic disease preparedness, animal welfare, and market protection.*

Diseases of livestock. (1990). 9th Edition. T.G. Hungerford. McGraw-Hill. ISBN 0-0745-2563-8. *Available from commercial bookstores, 1942 pages, hardcover, illustrated. A comprehensive reference covering all livestock diseases and veterinary medicine.*

Poisonous plants

Poisonous plants: a field guide. (1993). R.M. Dowling and R.A. McKenzie. Department of Primary Industries and Fisheries, Queensland. ISBN 0-7242-3982-0. *Available from DPI&F Bookshop, 164 pages, colour illustrations, maps. Describes and illustrates, in full colour, plants affecting cattle, sheep, goats, horses and pigs in Queensland and adjoining areas. Provides plant descriptions and information on toxins, animals affected, conditions under which poisoning is likely to occur, clinical signs of poisoning, post-mortem changes and management.*

Refer also to recommended texts under Pasture Management and Weeds.

Breeding and genetics

Artificial breeding of cattle. (1995). D. Boothby and G. Fahey. AGMedia Melbourne. ISBN 0-7306-6427-9. *Available from DPI&F Bookshop, 127 pages, illustrated. Describes the reproductive systems of cows and bulls and the mechanics of artificial insemination. Covers all aspects of a successful breeding program, including bull selection, oestrus detection and synchronisation, record keeping, reproductive disorders, avoiding problems and economic factors.*

Beef cattle recording and selection. (2000). Agency for Food and Fibre Sciences, Beef, Department of Primary Industries and Fisheries, Queensland. ISBN 0-7345-0071-8. *Available from DPI&F Bookshop, 51 page softcover.*

Provides an overview of basic beef cattle genetics and the basic principles of planned breeding and selection in practice. Includes producers' experiences using BREEDPLAN EBVs.

Breeding for profit. (2002). J. Bertram, M. Carrick, R. Holroyd, M. Lake, W. Lehman, K. Taylor, R. Thompson, M. Tierney, R. Tyler, M. Sullivan and R. Whittle. Department of Primary Industries and Fisheries, Queensland. ISBN 0-7242-5400-5. *Available from DPI&F Bookshop, 44 page softcover. Written for tropical beef producers, this book assists with defining target markets, determining breeding goals to serve those markets and planning breeding programs to meet the breeding goals. Covers achievable gains, analysing performance, breeding methods, and managing a crossbred herd.*

Bull selection. (2003). J. Bertram, V. Edmonston, R. Farrell, G. Fordyce, R. Holroyd, K. Taylor, and R. Whittle. Department of Primary Industries and Fisheries, Queensland. ISBN 0-7242-5435-8. *Available from DPI&F Bookshop, 44 pages softcover. Covers a bull's worth, basis of genetic selection, beef genetic improvement, selecting for fertility, structural soundness, growth, carcase attributes, temperament and bull management.*

Bull selection and use in northern Australia. *(Final Report, Bull Power). Holroyd et al. Available from DPI&F, Rockhampton. Result of a major project conducted on three research stations and eight cooperator properties. Over 1000 bull were subjected to physical and reproductive examinations prior to mating.*

Evaluating and reporting bull fertility. (2003) K Entwistle and G Fordyce, Australian Association of Catle Veterinarians. ISBN 0-9585654-4-9. *Available from AACV (phone Anne Cover on 07 3378 7944) – $55 plus $7 p&h.*

Female selection in beef cattle. (2000). G. Fahey, D. Boothby, G. Fordyce and M. Sullivan. Department of Primary Industries and Fisheries, Queensland. ISBN 0-7345-0094-7. *Available from DPI&F Bookshop, 46 pages softcover. Practical overview of the principles of female cattle selection and management skills.*

Producing and processing quality beef from Australian cattle berds. (2000). P. Dundon et al. Available from the Beef CRC. *Documents industry outcomes from the Beef CRC.* ISBN 1-86378-677-5.

Abbreviations

ADG	average daily gain
ADI	Acceptable Daily Intake
AUS-MEAT	Oversees standards in meat processing and terminology
BDRI	Biodynamic Research Institute
BFA	Biological Farmers of Australia Cooperative Ltd
BVD	bovine viral diarrhoea
DEMETER	Biodynamic Research Institute
EMS	Environmental Management Systems
ESI	Export Slaughter Interval
EU	European Union
EUVD	EU Vendor Declarations
FVD	Fodder Vendor Declaration form
HACCP	Hazard Analysis Critical Control Point
HGP	Hormone growth promotant
ISO	International Organization for Standardization
LEAP	Livestock Export Accreditation Programme
MLA	Meat and Livestock Australia
MRL	Maximum Residue Limit
MSA	Meat Standards Australia
NASAA	National Association for Sustainable Agriculture (Australia) Ltd
NFAS	National Feedlot Accreditation Scheme
NLIS	National Livestock Identification Scheme
NORM	National Organochlorine Residue Management program
NRA	National Registration Authority
NSQA	National Saleyards Quality Assurance program
NVD	National Vendor Declaration (Cattle) form (see *Glossary*)
OC	organochlorine chemical
OCP	organochlorine pesticide
OFC	Organic Food Chain
OTH	over the hooks
PIC	Property Identification Code (on NVD)
PTIC	Pregnancy Tested in Calf
TTL	Targeted Testing List (for OCPs)
WHP	withholding period

Units

AE	adult equivalent – a 450 kg dry animal (see *Glossary)*
DM	dry matter
h	hour
ha	hectare
hd	head
kg	kilogram
L	litre
m	metre
ME	metabolisable energy (see *Glossary)*
mg	milligram
MJ	megajoule
ml	millilitre
mth	month
°C	degree Celsius
t	tonne
yr	year

Glossary

acaricide. Kills ticks.

AuctionPlus. Computer-aided cattle auction system.

ad lib. Feeding without restricting intake; providing enough for animals to eat as much as they want.

adult equivalent (AE). Measure used to relate all animals irrespective of size to a standard animal. One adult equivalent is a 450 kg non-lactating beast. AE provides a relative measure of the feed intake of different classes of cattle.

afterbirth. See *placenta*.

agistment. Paying for stock to use feed on another property. Prices are usually expressed in dollars per head per week.

artificial insemination (AI). Introducing semen collected from a bull into a cow's uterus with the intention of impregnating her.

backcrossing. Mating a crossbred animal with an animal from one of its parent breeds.

backward store condition. Animal in Condition Score 2.

barren. Female animal that cannot become pregnant.

beast area. Area of country required to run one adult equivalent for a year.

bentonite. Feed additive that can be added to a grain-based ration to reduce the incidence of acidosis. A clay.

bivalent vaccine. Vaccine that immunises for two diseases.

break of season. Time of year when winter dry period ends with rain.

breeder. A female used to breed calves. Includes pregnant and lactating heifers, first-calf cows and cows.

breeder area. Area of country required to run a breeder for a year.

bloat. Swelling of the first and second stomachs of cattle by the formation of a stable foam. Occurs mainly in cattle grazing on temperate legumes, particularly lucerne and clover.

bobby calf. Small calf used for slaughter. Usually 18 to 36 kg dressed weight, and for the purposes of the Cattle Transaction Levy, less than 80 kg.

body condition. State of fatness of an animal.

bolus. See *rumen bolus*.

Bos indicus. Breeds of cattle referred to as tropical or humped breeds, for example, Zebu breeds and crossbreeds including Brahman and Sahiwal.

Bos taurus. Temperate, British and European breeds and crossbreeds of cattle, for example, Hereford, Angus, Murray Grey and Charolais.

bovine. Cattle species.

branding. Permanent marking (by fire or freezing) to identify the current owner of particular stock.

branding percentage. Number of calves branded expressed as a percentage of the number of cows mated to produce those calves.

BREEDPLAN. Performance recording system, operated by the National Beef Recording Scheme, which uses an animal's own performance plus the performance of all known relatives in the herd and all genetically correlated (or related) traits to estimate breeding values.

bullock. Castrated male bovine over 30 months of age.

bypass protein. Protein in the feed which is not digested or broken down in the rumen, but which flows through the rumen to the abomasum where it is digested.

CALM. Computer Aided Livestock Marketing. Now known as AuctionPlus.

calving date. Date on which a cow calves/calf is born.

calving percentage. Number of calves born expressed as a percentage of the number of cows mated to produce those calves.

cast for age. Animal (usually female) removed from the herd because of age.

castrate. Remove the testes.

compensatory growth. Greater than expected weight gain sometimes occurring after an extended period of slow growth or weight loss due to restricted nutrition or disease.

composite breed. A stabilised crossbred line. Also called a synthetic breed.

condition score. Assessment of an animal's condition based on a visual estimate of the amount of fatty tissue under the skin on certain body parts. Condition scores are

1 – poor
2 – backward store
3 – store
4 – forward store
5 – fat.

conformation. Characteristic traits of an animal that combine to describe its shape or frame.

coronet. Area where the hair joins the hoof, that is, the lowest part of the pastern.

cow. Female after her first calf or over 2½ to 3 years of age.

creep feeding. System of supplementary feeding where only calves have access to the supplement.

crossbreeding. Mating system in which two or more straight breeds are mated.

crude protein. Measure of the total protein in a feed, calculated as the nitrogen content (as a percentage) multiplied by 6.25.

crush. Structure for confining cattle for inspection or veterinary treatment.

culling. Removing animals from the herd that are no longer economically productive or valuable as breeding stock, for sale or slaughter.

dam. (a) Female parent. (b) Structure for storing water.

declared plant. Pest plant recognised by state or local government as having, or having the potential to have, significant impacts on agricultural production or the environment. Landholders have certain responsibilities under the *Land Protection (Pest and Stock Route Management) Act* to manage declared plants.

dehorning. Removing the horns.

***del credere* insurance**. Insurance where agents guarantee to the vendor that payment will be made, even if the agents themselves are not paid.

dewlap. Fold of loose skin which hangs from the throat of cattle.

drenching. Administering treatment directly into the mouth of an animal.

dressing percentage. Carcase weight as a percentage of the liveweight.

dry matter. Amount of a substance remaining after the removal of all moisture.

dry season. In south east Queensland, usually starts in April-May and ends as early as September or as late as November.

dystocia. Calving difficulty. Abnormal labour or birth.

earmark. Registered mark cut into the ear of an animal used for quick identification.

ear tag. Plastic or metal tag (usually numbered) applied permanently to the ear of an animal for on-property identification purposes.

ear tattoo. Indelible mark (usually a number) in the ear for identification purposes.

El Niño. Weather condition indicating the probability of many regions of eastern Australia receiving above average rainfall in the following 3 to 6 months is low. Exists when the SOI is consistently negative.

embryo transfer (ET). Transferring a fertilised embryo from one cow to the uterus of another cow.

empty. Female animal that is not pregnant.

entire. Male animal that has not been castrated. Capable of breeding.

ephemeral fever or **three day sickness.** Bovine sickness (fever) caused by a virus. Usually lasts only three days.

escutcheon. Rear of the animal immediately above the point of the udder attachment in the female or scrotal attachment in the male.

Estimated Breeding Value (EBV). Estimate of an animal's breeding value as a parent for a particular production trait (see *BREEDPLAN*).

export ox. An animal suitable for the US manufacturing market.

Export Slaughter Interval (ESI). Minimum time that should elapse between the last application or administration of a product to an animal and the slaughter of that animal for export (for human consumption).

eye muscle area (EMA). Surface area of the rib eye muscle, calculated in square centimetres.

F1. First generation of progeny in a crossbreeding program.

F2. Second generation of progeny, resulting from mating two F1 animals.

fat condition. Animal in prime condition. Condition Score 5.

fat colour. Colour of subcutaneous fat.

fat score. Depth of fat cover. Measure of fatness of an animal.

feed budget. See *forage budget*.

Feed Conversion Ratio (FCR). Ratio between feed intake and weight gain.

finished. Animal with the required proportions of bone, muscle and fat ready for sale to a particular market.

first-calf cow. Heifer after having borne her first calf.

flushing. (1) Increasing the level of feeding for heifers or cows to encourage ovulation. (2) Process for gathering a large number of fertile eggs from a cow for embryo transfer.

foetus. Developing offspring before birth.

forage. Pasture or crop either grazed by an animal, or mechanically harvested and fed fresh, or harvested and preserved as hay or silage and fed to an animal.

forage budget. Budget to set a stocking rate to ensure sufficient feed is available for livestock over a particular period, usually the dry season.

forbs. Non-woody broad-leaf plants, including most legumes and weeds but excluding grasses (narrow-leaved) and trees (woody).

forward condition. Animal approaching market condition and with a fat score of 4.

forward store condition. Animal in Condition Score 4.

full mouth. Animal that has 8 permanent incisor teeth.

full set. A set or group of meat cuts sold on an export market. The number and type of cuts will vary between markets.

genes. Basic units of hereditary material that govern the characteristics of individuals.

genotype. Genetic makeup of an individual, determined by the genes present. Inherited characteristics.

gestation period. Duration of pregnancy: averages 283 days (9 months) in cattle, 5 months in sheep, 11 months in horses, and 4 months in pigs.

Gran-am. A fertiliser added to cattle feeds to supply sulphur.

GRASS Check. Practical hands-on training package related to pasture identification, assessment, monitoring and management.

GROUP BREEDPLAN. Similar to BREEDPLAN but allows animals of the same breed to be compared across different participating herds.

glycogen. A form of energy stored in muscles, used in association with oxygen to expand and contract the muscles.

heifer. Female before her first calf or less than 2½ to 3 years of age. See also *first-calf cow*.

heritability. Proportion of the measured variation between animals that is due to genetic difference between the animals.

heterosis. Differences (usually improvements) in performance of crossbred progeny from the average of the parent breeds.

hot standard carcase weight (HSCW). Weight of a carcase measured within two hours of slaughter after allowable trim.

hormonal growth promotant (HGP). Chemical implants that promote growth and may alter carcase composition (leaner and heavier carcases).

hybrid vigour. See *heterosis*.

inbreeding. Mating of closely related animals.

in calf. Female animal that is pregnant.

incisors. Front cutting teeth.

intercalving interval. Time between successive calvings in a cow.

Japanese ox. An animal suitable for the Japanese market.

joining. Mating male animals with female animals.

LD50. Measure of toxicity of a chemical.

legume. Plant that is able to fix (capture) nitrogen from the air by means of nodules on its roots. See also *nitrogen fixation*.

ley pastures. Pastures used in rotation with cropping usually only for 2 to 5 years.

line breeding. Breeding from the same bloodline or within the same family.

liveweight (LW). Total weight of live animal.

lot-fed. Finished in feedlot. For the Japanese market, over 360 days on feed.

maintenance. Maintaining liveweight.

marbling. Fat deposited between individual muscle fibres.

mastitis. Inflammatory disease of the udder.

mating age. Age animals are first mated.

Maximum Residue Level (MRL). Permissible level of a chemical in meat.

meat colour. Colour of the rib eye muscle assessed on the chilled carcase and scored against reference standards in accordance with the Chiller Assessment Standards.

medium-fed. Fed in feedlot for 'medium' time period, i.e. 180 days.

metabolisable energy (ME). Energy content of a food or diet available for use by the animals expressed as megajoules of metabolisable energy per kilogram of dry matter (MJ/kg DM).

milk replacer. Milk substitute in powdered form.

mouthing. Determining the approximate age of an animal by looking at its teeth.

muscling. Thickness of muscle in relation to frame size.

National Vendor Declaration (Cattle) (NVD). Form providing details of the management history of an animal relating to chemical use, vaccination and feeding.

nitrogen fixation. Converting atmospheric nitrogen into nitrogenous compounds by various bacteria in the soil or associated with the roots of legumes.

oestrus. Period during the reproductive cycle of a cow or heifer when she is willing to mate with a bull. Also known as heat or bulling.

organochlorine pesticides (OCPs). Insecticidal products using organic forms of chlorine, which persist in the environment and accumulate in the food chain.

ovulation. Shedding of an egg or eggs from the ovary.

parturition. Giving birth.

P8 fat. Measurement of fat taken at the P8 site on the rump. Indicator of yield.

pastern. Lower part of the leg between the top of the hoof and the fetlock joint.

Pasture Watch. Environmental action research program that promotes community awareness and education about the health of our native pasture ecosystems.

pH. Potential Hydrogen. Measure of acidity.

phenotype. Observable characteristics of an individual determined by genotype and environment.

photosensitisation. Sensitivity of the skin to sunlight.

pizzle. Penile sheath in male animals.

placenta. Sack-like membrane that holds the foetus in the uterus and is delivered with or soon after the calf. Also called afterbirth.

poddy. Young calf that has lost its mother. Artificially reared calf, bucket- or nipple-fed on milk or milk replacer.

polled. Animals that are naturally without horns.

prime cattle. Cattle with carcase types that satisfy specified market requirements for slaughter.

production target. Animal weight, age and fatness criteria that a producer strives to achieve in animals in order to meet a predetermined goal such as a particular market specification.

progeny. Offspring of the sire and dam.

progeny testing. Measuring the performance of an animal's progeny to assess the animal's value as a parent (its breeding value).

PTIC (Pregnancy Tested in Calf). Used to describe the pregnancy status of females at sale.

poor condition. Animal in Condition Score 1.

puberty. Time when animals become sexually mature.

pure breeding. Mating males and females of the same breed (also called straightbreeding).

residue status. Status of chemical residue on a property or in an animal.

rib fat measurement. Thickness of subcutaneous fat in millimetres (mm) measured at the $12^{th}/13^{th}$ rib.

rigor mortis. Process occurring after death in muscles which affects final meat quality.

roughage. Feed that is high in fibre.

rumen. First stomach of ruminants.

rumen bolus. Object designed to remain in the rumen (one of the stomachs) of cattle. May be indigestible, such as an identification marker, or slowly digestible, such as a bolus of a mineral administered with a grinder.

rumen modifiers. Substances which, when fed to cattle, affect the digestive processes by altering the balance of microorganisms in the rumen.

ruminant. Animal that has four stomachs and chews its cud by regurgitating stomach contents.

scours. Diseases causing diarrhoea.

second cross. Progeny resulting from the mating of a first cross (see *F2*).

selection. Choosing stock to keep for breeding or growing. The opposite of culling.

selection differential. Advantage of the selected group over the group as a whole.

service. Inseminating a cow, either by joining with a bull or by artificial insemination.

set stocking. Continuous grazing of an area for long periods by the same number of stock.

short-fed. Finished in a feedlot for a 'short' time period. For the Japanese market, 100 to 120 days on approved grain rations.

silage. Forage crops or pasture harvested and preserved at about 20 to 40 per cent dry matter (60 to 80 per cent water content) by fermentation in the absence of air.

sire. Male parent.

sodic soil. Soil with a relatively high proportion of exchangeable sodium.

Southern Oscillation Index (SOI). Difference in atmospheric pressure between Tahiti and Darwin. Useful for predicting probability of rain in eastern Australia in the following 3 to 6 months.

spike feeding. Feeding heifers or cows before calving to improve fertility in the subsequent mating season.

spring break. See *break of season* and *dry season*.

steer. Castrated male bovine.

stocking rate. Number (per hectare) of stock being run on a property or in a paddock.

store. Cattle traded for growing on to a target market specification.

store condition. Animal in Condition Score 3.

straightbreeding. Mating of animals of the same breed (also called purebreeding).

superphosphate. Phosphorus fertiliser. Also called 'super'.

supplementary feed. Feed given to animals to supplement pasture.

tail tag. Tag applied to the tail of an animal destined for sale, identifying the property of origin by the registered property number.

temperament. Individual character of an animal, shown by the way it behaves.

temperate plant. Plant species that grow best in cool climates, or during the cooler months of the year.

three day sickness. See *ephemeral fever*.

tillering. In pasture plants, suckering or shooting from the base.

turn-off. Animals sold from the property. Annual turn-off is the total number of animals sold in a year.

utilisation rate. Amount of pasture used compared to the total amount available, usually expressed as a percentage.

vaccinate. Injecting an animal with a preparation containing a dead pathogen or antigens so that the animal produces antibodies for protection against the pathogen.

vealer. Calf 100 to 160 kg carcase weight, 6 to 10 months old, sold off the dam in good condition.

vendor. Seller of goods, land, animals or other articles.

virus. Infectious, sub-microscopic particle. Causes plant and animal disease.

visual assessment or **appraisal.** Judging the merit of animals by looking at them.

weaner. Young animal that has been removed from its mother, usually at 6 to 9 months of age.

weedy. Small, under-nourished, scruffy appearance.

withholding period (WHP). Statutory minimum interval of time that must elapse between the last application or administration of a drug or chemical product to an animal and slaughter of that animal for human consumption within Australia.

yearling. Cattle up to 12 to 24 months of age.

yearling mating. Mating heifers at about 15 months of age rather than the more traditional 27 months.

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Managing a beef business in the subtropics provides information and tools to help you develop the skills to produce an environmentally friendly, market driven beef product. It will assist you to proactively manage your business in an ever-changing industry.

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