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MEAT & LIVESTOCK AUSTRALIA





Manual for South-East Asian cattle feedlots

Module 1

The Australian production system for live cattle exports

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The harsh and monsoonal climates of northern Australia, allied to poor soils, mean that most grasslands are suitable for breeding cattle but not for fattening them.

South-East Asia has a large population demanding more meat in their diet. From demand has risen the export of live cattle from Australia to be fattened in feedlots in South-East Asia.

This module describes the systems for producing well-adapted and healthy cattle in northern Australia, and how these cattle are prepared for export.

Contents

Introduction

The livestock export trade to South-East Asia is critically important to northern Australian producers. Australia's northern cattle industry has grown and developed due to the strong demand for beef from South-East Asia. For its ever-increasing population and a middle class that can afford to purchase good quality beef, importing and fattening live cattle provides a source of fresh beef for the local population. It also removes pressure to slaughter local female cattle thus supporting a more secure local beef industry.

"Australian cattle are well known for being of high quality, healthy and disease-free. They are well suited to the South-East Asian climate and the livestock industries in our key markets are investing in animal welfare programs and infrastructure to support this trade."

Animal requirements for SE Asian markets

Table 1 South-East Asian beef cattle status

Country	Human population	Domestic herd slaughtered	**Imported cattle slaughtered**	Consumption (kg per head of population)
Indonesia	250,000,000	1,700,000	750,000	2.4
Malaysia	25,000,000			4.7
Philippines	80,000,000			5.1
Brunei	370,000			8.4

The northern Australian beef industry

The environment

The climate across the top half of Australia varies from the tropical zones in the north with a wet season from October to April to the arid environments of central Australia. Annual rainfall ranges from as high as 2000mm in the north to 200mm in the arid centre and west.

The monsoonal climate of northern Australia and relatively poor soils mean that the grasslands of much of the region are suitable for breeding beef cattle but not for finishing them. As a result of the Australian conditions and SE Asian demand, growing cattle are exported to the region to be fattened in local feedlots.

Soil types are equally variable: from the fertile marine plains of the north coast and the black clays of the Barkly Tableland to the lighter soils of the semi-arid centre of the continent.

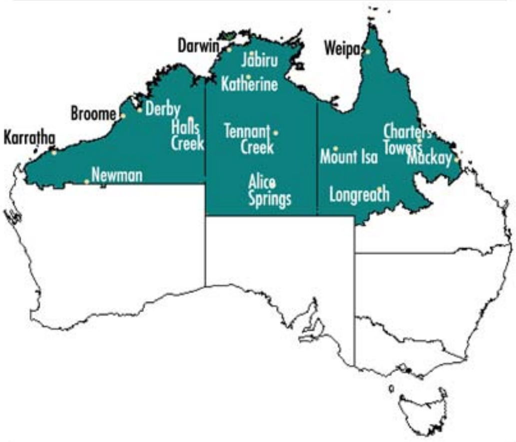
Water supplies for cattle include limited natural water in the wetter northern areas and the more common bore water supplies on the majority of properties across northern and western Australia.

Cattle suitable for live export are sourced from across the top of the Australian continent and down the west coast of Western Australia. Most live cattle are exported from Darwin in the Northern Territory (NT) because of its proximity to SE Asia.

The second largest source of live cattle is Queensland from where animals are exported from the ports of Townsville, Karumba and Mourilyan. Those from Queensland can come from areas north of about Emerald up into the Gulf of Carpentaria. Queensland exports tend to be more opportunistic and are often shipped during the wet monsoonal months when transport in the NT can be unreliable because of wide-spread flooding.

Cattle in these northern areas have been selected and bred for tropical and subtropical conditions and are well suited to the hot and humid environment found in SE Asian feedlots.

map 1 **northern Australia live export zone**



Well-grown commercial cattle from northern Australia.

Brahman and cross-bred cattle.

Property and herd size

Property sizes are similar across the north and west of Australia despite the large variation in carrying capacity. The overall size of cattle properties in the Northern Territory (NT), North Queensland (NQ) and Western Australia (WA) averages just over 3000 square kilometres.

The total cattle herd in the area from which cattle are sourced for live export comprises about 5 million head in North Queensland, 1.7 million head in the Northern Territory and 500,000 head in Western Australia. Individual herd size varies greatly because of the very different carrying capacities of the various environments across the regions. Herd sizes in the NT range from 80,000 head on a single property to fewer than 1000 head in some far northern areas. The most common breeder herd across the north is 2000–5000 head. Large property sizes and small labour forces mean that cattle are handled only infrequently.

Big properties, open spaces.

Well-adapted Brahman-cross cattle.

Breeding and exporting

The main cattle breeds across the northern half of Australia are *Bos indicus,* being pure Brahman and Brahman cross. These animals are ideally suited to this harsh environment and equally suited to the environment found in SE Asia.

The main production system in all these areas is breeding, with a small proportion of properties able to fatten cattle. The animals most commonly sold are 18–24-month-old feeder steers, followed by cull cows and heifers; all these are generally turned off in the dry season between April and September. Most are sent to live export, the rest to abattoirs or for fattening in other parts of Australia.

In the wet season, stock often come from Queensland where they can be transported over the more reliable all-weather road system. However, in high rainfall years, fewer cattle may be available from there as producers have ample grass for more profitable fattening of their steers.

Mustering cattle on extensive properties with helicopters means that many northern cattle have little contact with humans.

Herd management

Most producers undertake two rounds of mustering each year during the dry season using helicopters, horses, motorbikes and trap yards. Most northern beef herds do not restrict mating and so calve year-round, with young stock weaned from their mothers at each round of mustering.

Breeders in Queensland tend to be mated seasonally with mustering and weaning from April to June.

Most animal receive some nutritional supplement—phosphorus in the wet season and nitrogen (as urea) in the dry season. The main animal health concern is botulism; virtually all herds on very phosphorus-deficient country are vaccinated against botulism if there is any history of it in the region.

Mustered cattle being drafted in the yards.

Labour

It is often difficult to source labour to work in these remote areas. The average property across the regions has about five permanent staff but employs an additional seven seasonal workers for the mustering season. Thus very large numbers of cattle spread over vast areas are managed by very small work forces. As a result, cattle in these areas do not have a great deal of contact with humans.

Australia's livestock disease status

Australia's unique disease status is a result of the history of early settlement by Europeans. The first domesticated livestock brought to Australia in the late 1790s and early 1800s travelled from England on sailing ships on a voyage that took about 9 months. During this enforced quarantine, a wide range of diseases were either eliminated naturally or died out with the animals. Thus, the more serious diseases of livestock did not come onto Australian soil, creating an extremely disease-free base herd. Once the early settlers understood this process and its value to the future of livestock production, they introduced strict quarantine measures for all future introductions, resulting in one of the most disease-free animal populations in the world.

Travellers to Australia will have encountered the very strict quarantine arrangements at all points of entry.

Australia is free from Foot and Mouth Disease (FMD), rabies, rinderpest and Haemorrhagic Septicaemia. Pleuropneumonia was eradicated from the national cattle herd in the 1960s, and bovine brucellosis and tuberculosis between the early 1970s and 2000. The strict quarantine measures and early ban on feeding meat meal to livestock has ensured that BSE (Mad Cow Disease) is also absent from our national herds.

NLIS electronic ear tag.

National Livestock Identification System (NLIS)

The disease-free status of the Australian cattle herd needs to be carefully monitored to ensure our access to foreign markets. NLIS is Australia's system of livestock identification and traceability for disease, food safety, product integrity and market access purposes. It is a permanent whole-of-life system that allows individual animals to be identified electronically and tracked from the property of birth to slaughter or live export.

Automatic NLIS tag reader on loading ramp.

NLIS uses machine-readable Radio Frequency Identification (RFID) devices as either ear tags or rumen boluses to identify cattle. Each animal has a unique number which is recorded when the animal is first tagged and then recorded again if the animal leaves the property, and this information is downloaded to a national database. NLIS has created a centrally-stored electronic history of all recorded individuals which enables rapid and accurate traceability.

Livestock Production Assurance (LPA)

LPA is an on-farm food safety program that ensures that livestock producers can support their claims that the meat from their animals is fit for human consumption. Producers complete a statutory declaration called the National Vendor Declaration (NVD) Waybill when animals are dispatched from their properties. The NVD describes the stock and any treatments or procedures that they have experienced to demonstrate that the meat from the animals is safe for human consumption.

Hand-held NLIS tag reader.

Australian Standards for the Export of Livestock (ASEL)

Australian guide to fitness of animals for export.

The general public in Australia takes great interest in animal health and welfare. The Australian Government recognises this concern and the country's international obligations to animal health and welfare. Accordingly, the Government has developed a set of standards to help the export industry ensure that the outcomes of the live export process meet the expectations of the Australian and international communities. The export trade will depend on the industry continuing to meet these expectations.

The standard developed by the Australian government and industry provides:

- an Australian government statement of guiding principles and minimum recommended animal health and welfare outcomes for animals in the livestock export industry
- an approach consistent with that taken by international bodies such as the World Organisation for Animal Health (OIE)

These standards are under constant review.


Trucking cattle to port quarantine yards.

Australian Quarantine Inspection Service (AQIS)

The livestock export industry is regulated by the Australian Commonwealth Government through the Australian Quarantine and Inspection Service (AQIS). Only livestock exporters licensed by AQIS can export livestock from Australia.

The standards take a whole-of-chain approach to minimise the chance of an adverse animal health and welfare outcome. They aim to identify critical risks and to develop and implement risk management measures. The key elements in the chain are:

- planning the consignment
- sourcing and on-farm preparation of livestock
- land transport
- pre-embarkation assembly at AQIS registered premises
- vessel preparation and loading
- sea voyage
- discharge
- post-embarkation

Quarantine yards at port.

A licensed livestock exporter must apply to AQIS for each export consignment, and provide information on all aspects listed above to satisfy AQIS that the ASEL are complied with and the risks of the consignment are minimised.

The export supply chain

The licensed exporter negotiates a commercial transaction with a SE Asian importer. The importer provides the exporter with an import permit and health protocol.

The exporter presents these documents to AQIS along with a Notice of Intent to Export (NOI) and a Consignment Risk Management Plan (CRMP). If all documentation is in order and the export process will meet the ASEL, the exporter is given approval to proceed. This includes specific requirements for the shipment.

Producers are contacted and suitable livestock are selected and purchased.

Issues that are considered in the selection process include:

- Breed factors – most low-land SE Asian feedlots must use only Brahman and Brahman-cross cattle for the hot and humid local conditions. Feedlots at elevated locations may be fatten cattle with a higher British or European breed content.
- Importing feedlot requirements – the type of animal that the feedlot requires, the period of feeding, the most suitable weight range, sex and class.
- Seasonal factors – the difficulties of sourcing stock during the monsoon season in northern Australia, and associated higher prices.

South-East Asian health protocols require properties of origin to be free from certain diseases, and cattle can be sourced only from properties that meet the protocol requirements.

Some importers send a selector to personally choose appropriate stock; others rely on the experience of the exporter. Livestock agents are frequently used to source stock for exporters.

Road transport companies are contracted to deliver the selected stock to registered assembly depots for preparation of the consignment. These transport companies are required to comply with ASEL.

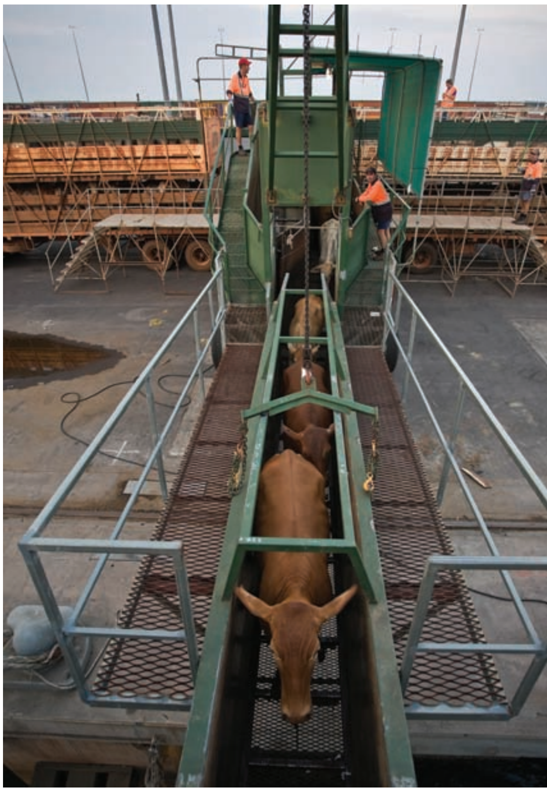
Feed manufacturers are contacted to source fodder for both the time spent in the registered premises and the voyage. This fodder is generally pellets or cubes of compressed hay and must be of a minimum standard as per the ASEL.

Assembly depots for processing of export livestock must be accredited by AQIS to ensure that they meet the ASEL.

Only veterinarians accredited by AQIS are permitted to complete the tests, treatments and inspections required for export. They have to provide appropriate documentation to AQIS as proof of completion of treatments and inspections.

Any female feeder cattle must be certified to be either spayed (surgically desexed) or pregnancy-tested to ensure that no pregnant feeder cattle animals are sent for live export.

Export cattle being fed a pelletted maintenance ration.



Loading cattle in an Australian port.

Cruising 'cattle class' on an ocean liner.

At all stages of the export process, animals are constantly inspected for health and welfare, and any ill, injured or unsuitable animals are rejected from the consignment.

Stevedoring companies are engaged to facilitate the loading of the vessel. The livestock export industry provides training for stevedores to ensure that they are able to load the cattle onto ships in a manner that maintains the health and welfare of the cattle and minimises stress.

Accredited stockmen must accompany every voyage. These stockmen are trained and accredited by LiveCorp to ensure they are familiar with the management of livestock onboard vessels at sea.

ASEL requires the master of the vessel and the stockmen to report on the outcomes of each live export voyage. In the event of mortalities—or other unfavourable events such as vessel problems or delays to discharge—AQIS will investigate the incident so as to minimise the chances of a repeat of this event.

Accredited stockmen (and veterinarians when they are required to travel with the shipment) have to remain with the vessel until all cattle are unloaded.

Australian livestock producers and exporters, through levies on every exported animal, have invested in projects in South-East Asia to promote the health and welfare of the livestock after arrival and to assist with the sustainable development of local feedlot industries.

Under supervision on board.

Finishing unloading cattle in Indonesian port.

Module 2
Feedlot design

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Good design will result in a feedlot that ensures good animal welfare, efficient weight gains and effective feeding and waste management with minimal management concerns. Poor design can hinder the operation and management of a feedlot for its entire life.

This module provides design information on the components of a feedlot, and also looks at poor designs that should be avoided.

Contents

Introduction

The operating conditions of a feedlot are based on the local climate, the environmental sensitivity of the area, the type of cattle being fed, the nature and availability of commodities and the social structure of local communities.

The climate in South-East Asia is probably the single most important factor influencing feedlot design. It is characterised by:

- frequent, high-volume and high-intensity rainfall
- high temperatures
- high humidity.

These aspects influence feedlot design, particularly from the perspectives of animal welfare and waste management. For example, large quantities of rainfall run-off could contaminate areas of high environmental value.

Most cattle in SE Asian feedlots are *Bos indicus*—generally large-framed animals with high tolerances to heat and humidity.

Although local feedlots often have access to large workforces, some mechanisation may improve the efficiency of their operations.

Heavy rainfall governs much of the design of feedlots in SE Asia.

1. Feedlot pens

Function

Feedlot pens hold cattle; provide access to feed and water; provide conditions which allow cattle to maximise their weight gain; allow easy removal of manure; and provide free drainage.

Design features

Pen size

The dimensions of a feedlot pen depend on pen capacity, the stocking density and the amount of feed trough required. Figure 1 shows how stocking density (SD), trough length (TL) and pen capacity relate to the dimensions of a typical feedlot pen. Where shed structures require columns within the pen area, pen dimensions may also be determined by the spacing of the shed frames to ensure that fences are aligned with columns.

Pen capacity

Pen capacity is best matched with the expected numbers of cattle entering or leaving the feedlot in each consignment—for example, a standard truck load.

Stocking density

The stocking density describes how much area is allowed for each animal, and is based on the size of animals with larger heavier cattle needing more space than smaller lighter one. It is also based on the type of housing intended. Fully covered pens can be stocked more densely (2.5–4 m^2 per head) than partially covered pens (5–9 m^2 per head).

Feed and water

Cattle must always have free access to both feed and water. The feed trough should run along the full length of the front of the pen, while the water trough should be located towards the rear of the pen (see Figure 2). Each animal must have at least 200 mm of feed trough space. See Sections 4 and 5 for further detail on feed and water troughs.

Cattle movement

Cattle must be able to be easily moved into and out of the pens. The gate should be located in one of the back corners of the pen, and should swing across the cattle lane.

Sample plans

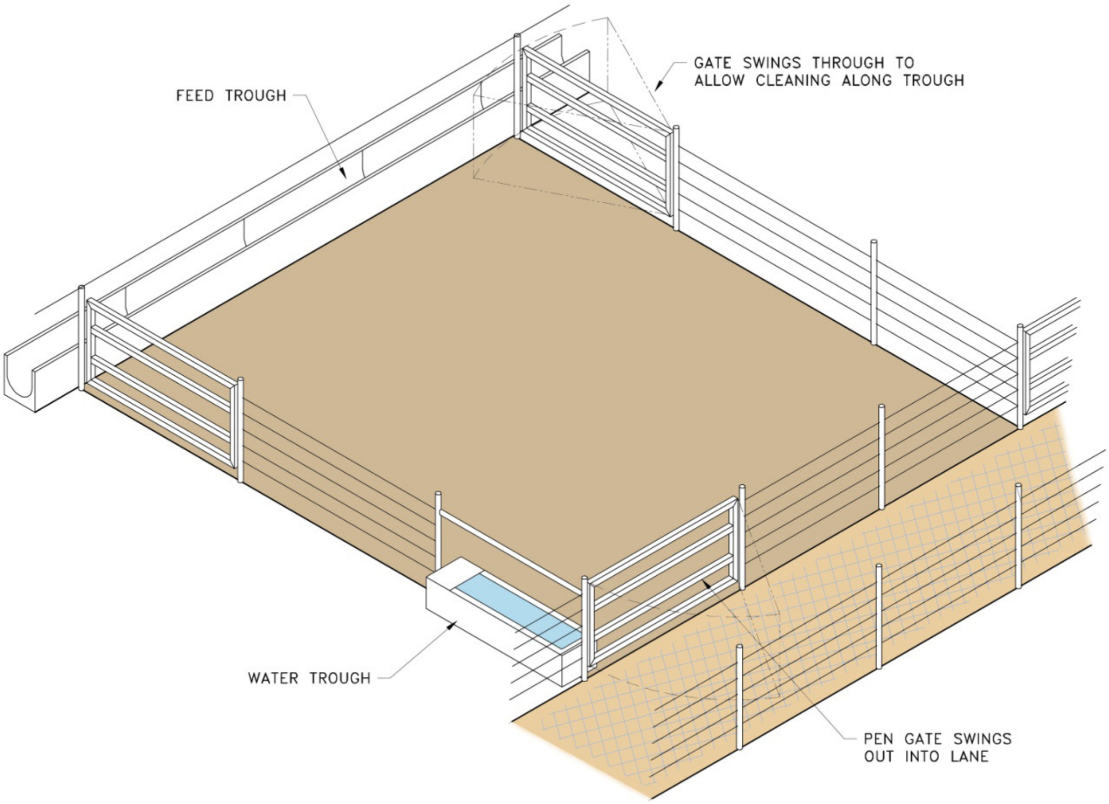
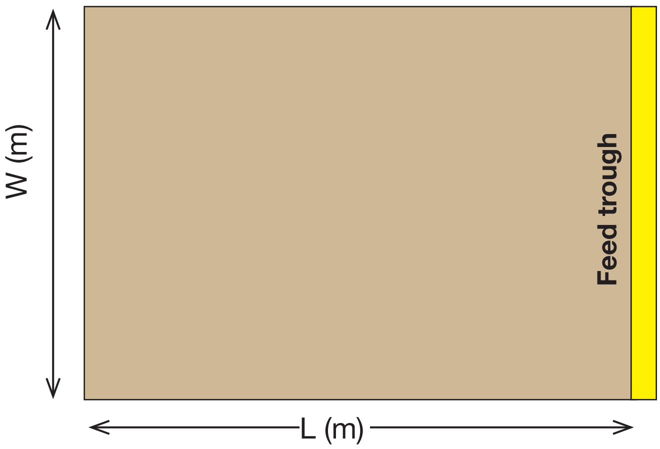


Figure 1 – Typical layout of a feedlot pen



Stocking Density (m^2/head):

SD = (L x W) / No. of head

Trough Length (mm/head):

TL = (W x 1000) / No. of head

Figure 2 – Dimensions of a single pen

2. Housing systems

Function

Housing provides a suitable environment for cattle through shade and protects feed from rain without causing waste management problems.

Design features

Configuration

Feed troughs (bunks) must be covered under South-east Asian climatic conditions. Pens can be fully or partially covered (over the feed trough only). Fully covered pens cost more but reduce effluent control requirements as there is no pen run-off. Partially covered pens cost less, but require more complex systems for effluent control.

Orientation

Open-sided feedlot sheds should be orientated east–west to reduce direct sunlight penetrating underneath the roof during the day. However, north–south orientation can allow early morning and late afternoon sunlight into the pens to promote drying of bedding material.

Shed design

Sheds should have high eaves, open sides and open ridge caps to promote natural ventilation. Ridge caps must allow sufficient overhang to prevent wind-driven rain passing through the gap. Sheds must allow easy access for machinery to deliver feed and clean pens.

Support columns

Clear-span structures are preferred. No columns should be placed inside pens other than in line with fences or on the alley side of feed troughs. Steel columns should be encased in concrete to prevent corrosion around their bases.

Roofing

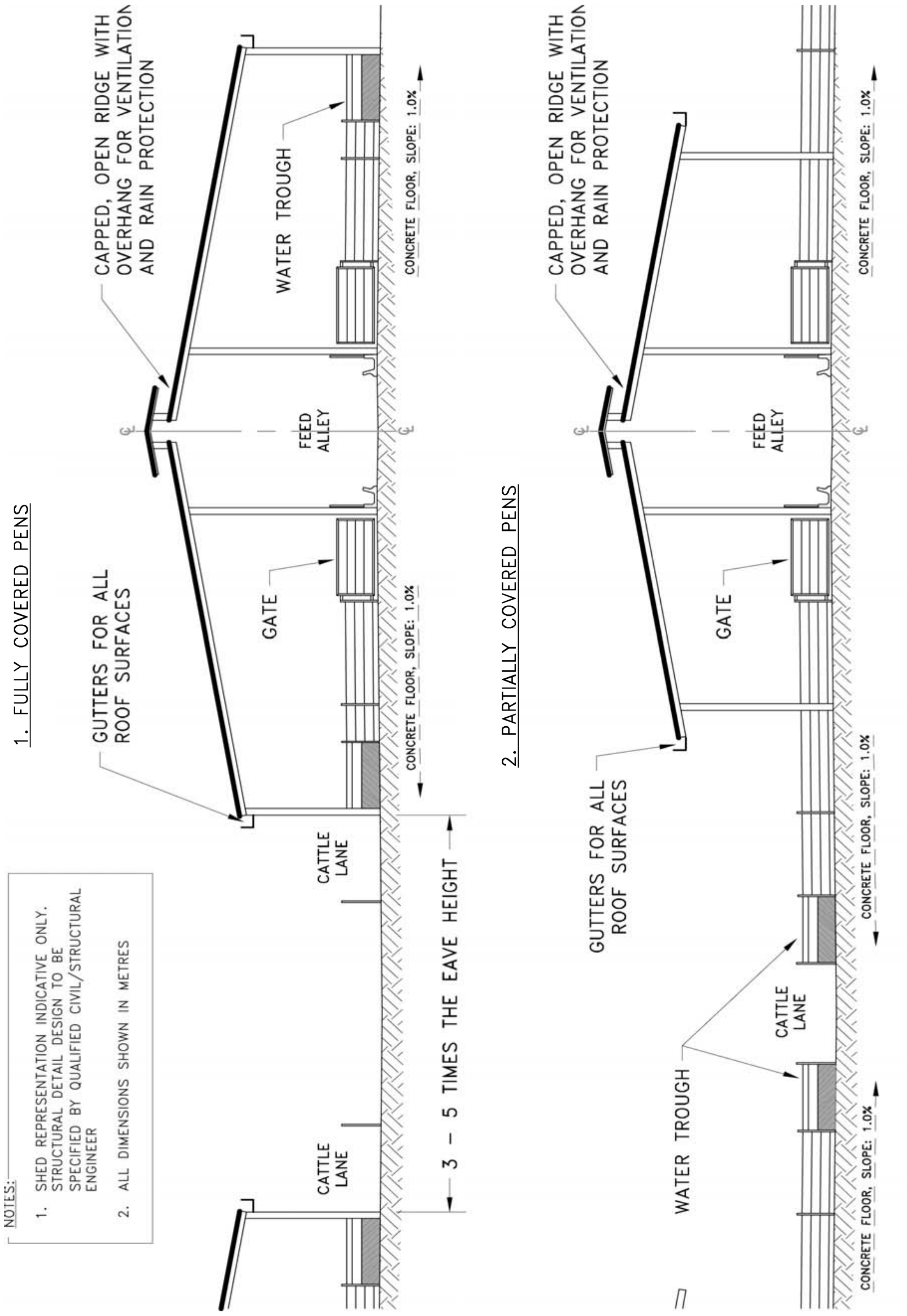
Roof pitches should be steep enough (between 1:2 and 1:3 slope) to promote good natural ventilation. All roof run-off should be collected in gutters and diverted away from any effluent management systems.

Shed spacing

Sheds should be spaced apart a distance of 3–5 times the eave height to promote natural ventilation.

Sample plans

Figure 3 – Typical feedlot shed end elevations.



Practical examples

Good features | **Poor features**

High eaves, good roof pitch and raised open ridge vent.

Sheds too close, and no ridge vents; poor natural ventilation.

Clear-span structure, with good pen slope.

Insufficient cover for both cattle and feed.

Sufficient cover for cattle and feed, and concrete encased columns.

Insufficient cover to prevent rain entering shed and spoiling feed.

3. Flooring and bedding

Function

Cattle must have a safe and comfortable surface to move and rest on. The surface must allow good drainage and easy pen cleaning.

Design features

Base surface

Concrete surfaces are best for all feedlot pens, but these should be stamped with a grooved pattern to prevent cattle slipping.

Slope

The surface should slope from the feed trough end of the pen to drain any moisture. Slopes should be 0.5–1.5% for covered pens and 1–2% for uncovered pens.

Pen cleaning

Pens need to be cleaned regularly. Spent bedding material, manure and other solid wastes must be able to be removed by hand or mechanically from covered pens. Uncovered pens will generally be washed clean by rainfall—with hosing when necessary.

Bedding material

Bedding is required only in covered sections of the pen. It should provide a comfortable surface for cattle to move and rest on while absorbing moisture and manure. A good supply of dry straw, sawdust or compost is needed to provide a depth of approximately 200mm. When the bedding cannot absorb any further moisture or manure it should be removed, and taken to a covered manure handling area or directly off the feedlot premises.

Practical examples

Dry compost and sawdust being laid as fresh bedding.

Straw used as bedding material.

Stockpile of fresh bedding material.

Fresh bedding being spread in a pen.

Stamped concrete to prevent cattle slipping in uncovered pen.

Pen overdue for cleaning and fresh bedding.

4. Feed delivery systems

Function

Cattle must have easy and comfortable access to fresh feed, which can be delivered by hand or by machine.

Design features

Construction materials

Concrete or rendered brickwork is the most durable material for feed troughs, and can be formed to desired shapes. Feed delivery roads can be made with compacted gravel provided they are well maintained and kept free of potholes.

Trough length

Each animal should have 200–300mm length of accessible feed trough. For the most efficient delivery of feed, troughs should be continuous along each row of pens (see Figure 2).

Weather protection

Feed troughs must be protected from rain to prevent feed being spoiled by excess moisture. See Section 3 for further detail.

Cattle access

Cattle should be able to access all of the feed in the trough with comfort. A single overhead cable or rail will prevent cattle climbing into the trough and escaping.

Feed delivery access

Delivery of feed and roughages to the troughs should not be obstructed by overhead cables or rails. Feed delivery roads should be wide enough for two feed delivery vehicles.

Shape

The configuration of the trough and cables/rails should allow cattle to reach all of the feed. The pen side of the trough should be rounded and lower to allow better access to feed while the road side of the trough should be higher to minimise the spilling of feed during delivery. Both external faces of the trough should be vertical to prevent build-up of spilt feed and manure, and to help pen cleaning. Pens must slope away from the feed trough.

Cleaning

Feed troughs need to be cleaned to ensure feed is fresh and free of contamination. All corners on the inside of the trough should be rounded to prevent stale feed from collecting, and to help cleaning operations with no obstruction from the overhead cable.

Sample plan

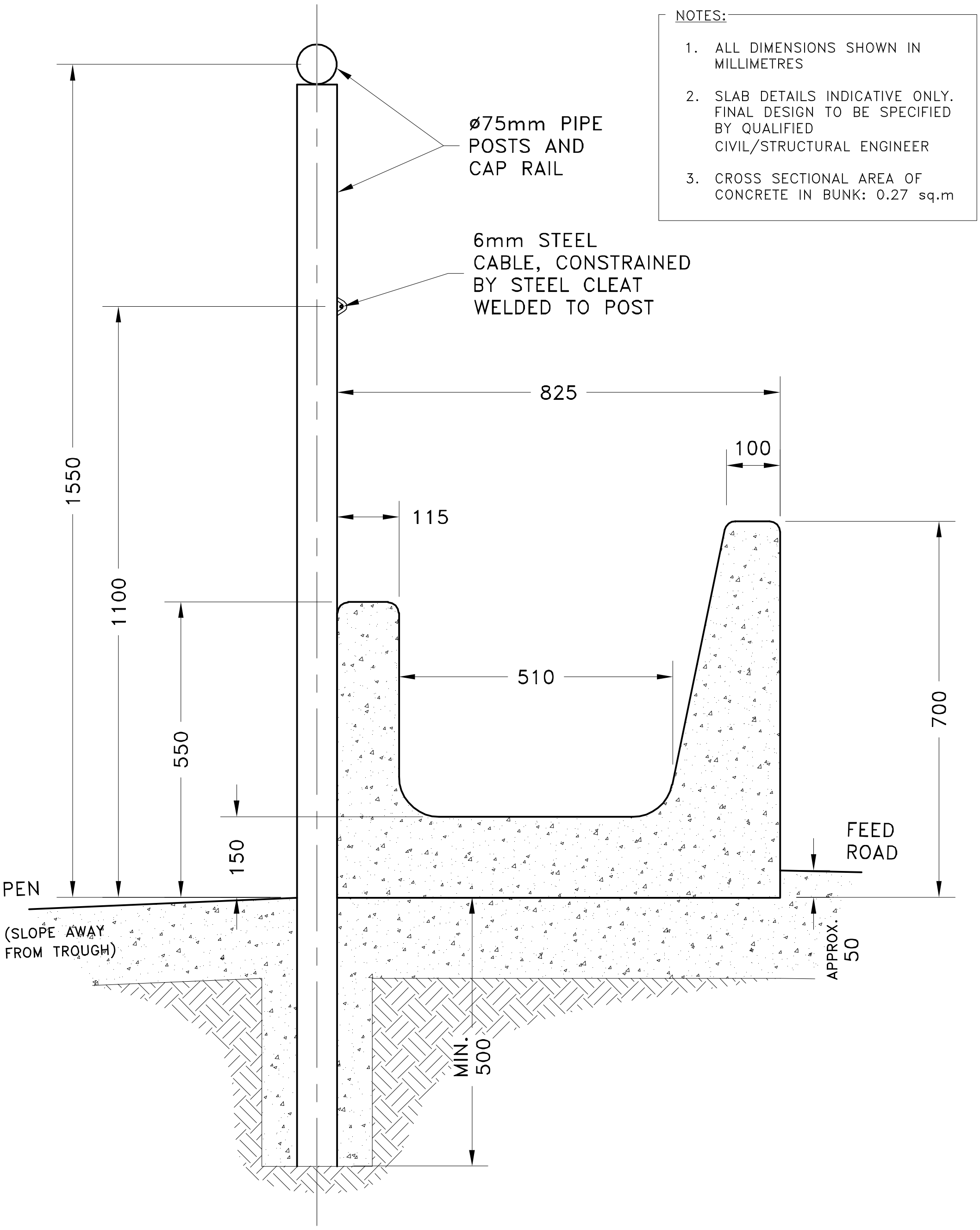


Figure 4 – Typical feed trough

Practical examples

Good features

Feed delivered with minimal spillage.

Good width—cattle can reach right across trough to feed.

Wide feed alley gives clear access to troughs for feed delivery vehicles.

Poor features

Too low restraint cable restricts cattle access.

Feed trough is too wide; cattle stretching to reach feed.

Narrow feed alley prevents delivery of feed by vehicle.

5. Water troughs and water supply

Function

Cattle need a constant supply of good-quality, clean and cool drinking water.

Design features

Construction materials

Concrete is strongest and most durable. Steel can rust and plastic can be damaged by cattle and machinery.

Trough length

Provide 50cm of accessible trough length per animal.

Water supply pipes

Reticulation systems should be able to deliver 5–6 litres/head/hour with pipes shielded from direct sunlight to keep water cool. Pipes should be protected from damage by cattle and machinery, particularly if vulnerable materials such as PVC are used.

Water level control in troughs

Troughs should have some form of water level control to minimise water waste through overflow. Float valves are recommended but must be protected from damage by cattle and machinery.

Location in pen and cattle access

Troughs should be in-line with the side fences (positions A or C in Figure 6). Troughs on the back fence (D) can block drainage and cause manure to build up. A trough positioned within the pen (B) will allow access from both sides, provided it does not hinder cleaning of the pen. All troughs should be easy to clean around and should not have any areas where manure can collect. A neck rail above the centre will prevent cattle climbing into the water.

Cleaning

Water troughs need to be cleaned regularly with any dirty water discharged from the pens. Troughs should have a flushing outlet with a plug that can be removed to drain the water rapidly. Access should be allowed for brush cleaning.

External shape

Troughs should been enclosed underneath with vertical sides to prevent manure building up underneath.

Emergency supply

Cattle must have constant access to water. An on-site gravity-fed emergency supply (usually a large elevated tank) should be provided in case a pump or pipeline breaks down.

Sample plans

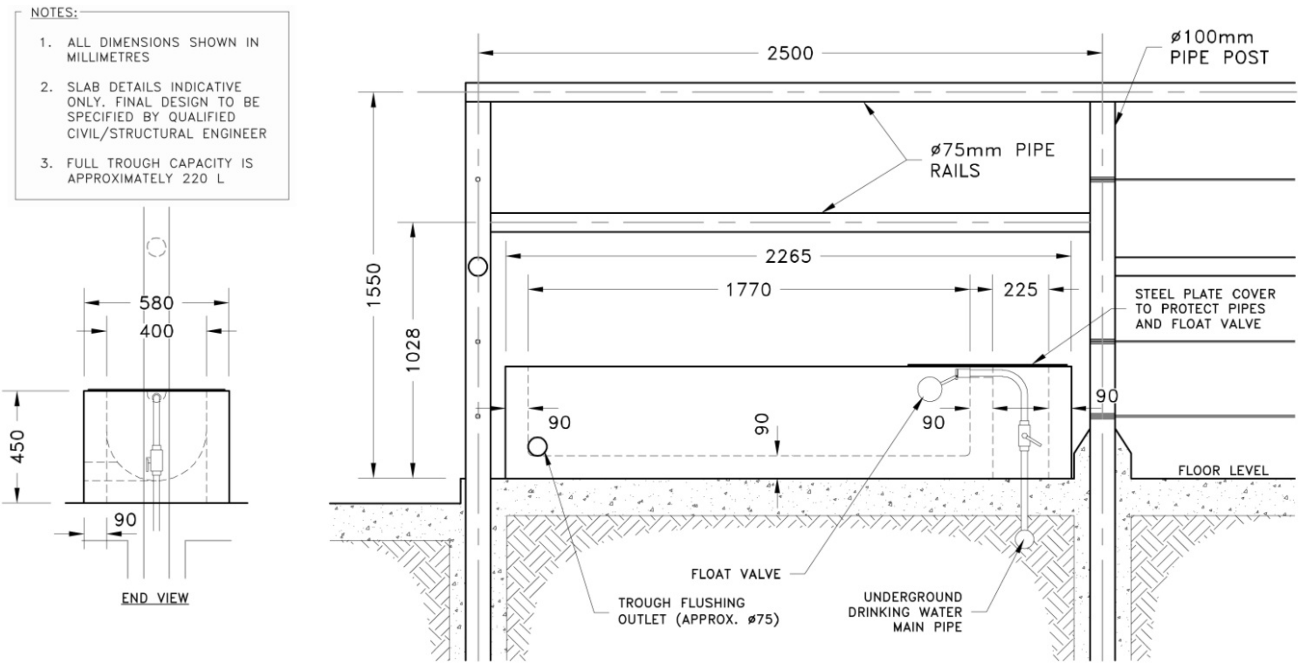


Figure 5 – Typical water trough details

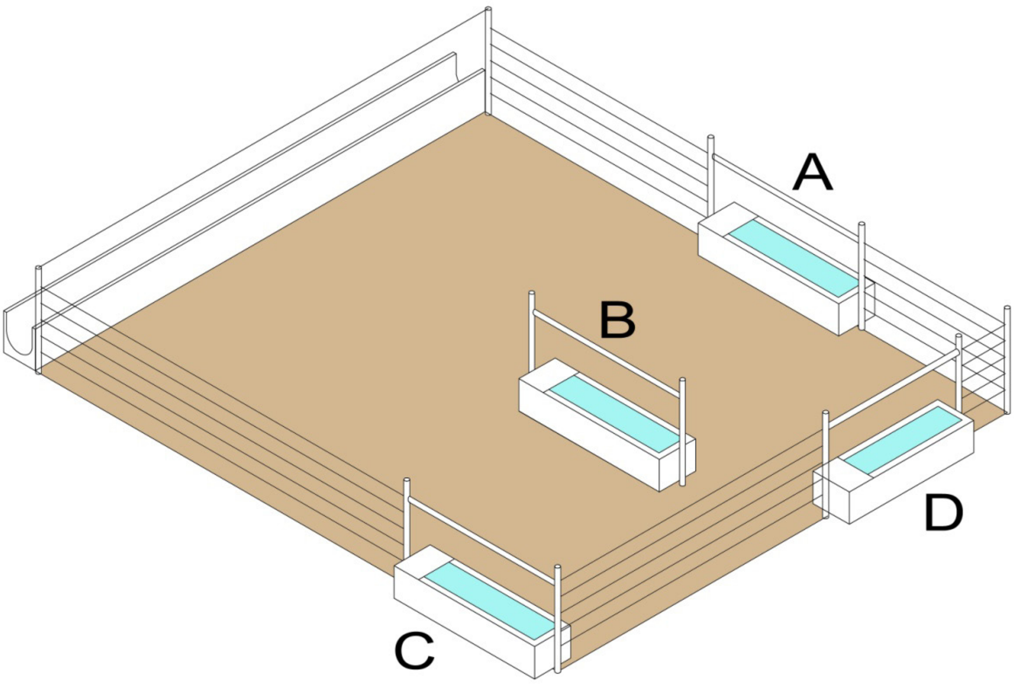


Figure 6 – Optional locations for water troughs.

Practical examples

Good features | **Poor features**

A well-protected float valve.

An exposed float valve can be easily damaged.

Water trough located in dividing fence allows manure to be washed from pens.

A water trough across the bottom fence holds manure in the pen.

Good float protection, enclosed sides, overflow pipe and brush for cleaning.

Manure can accumulate under an open water trough support.

6. Cattle lanes and fencing

Function

Fenced lanes allow cattle to be moved safely around the feedlot in all weather conditions, and with minimal disruption to other feedlot operations.

Design features

Location

Cattle lanes should run along the bottom end of feedlot pens. These lanes allow cattle to be moved into pens through gates which open into the laneway. Cattle lanes should not cross any roads since moving cattle could disrupt feeding and cleaning operations. If the spacing of the sheds allows, cattle lanes can be shared by a row of pens on either side (Figure 7).

Width

Lanes should be 4–5m wide to allow free movement of cattle herds and machinery.

Surface

Concreting the lanes allows cattle to be moved around the feedlot in any weather conditions. A grooved pattern on the surface will prevent cattle slipping.

Slope

Cattle lanes should have a slope of 0.5–1% to help drainage.

Intersections and corners

Changes of direction should be as open and smooth as possible to help cattle flow but cattle should move in straight lines as much as possible.

Fencing

Fences should include a large-diameter steel top rail and a steel belly rail with pipe or steel cable for intermediate horizontal restraints. The overall height of fences should have a determined by the types of cattle being fed. Fences should have a minimum overall height of 1.5m high while 1.8m for large *Bos indicus* breeds.

Posts

Posts can be made from wood or steel tube set into concrete at least 900mm below ground level and spaced no more than 2.5 m apart. The tops of steel posts should sealed to prevent rain water entering while the bottoms should be encased in concrete to prevent corrosion.

Gates

Gates must be at least as long as the lane is wide, and must be able to be latched open as well as latched closed.

Sample plans

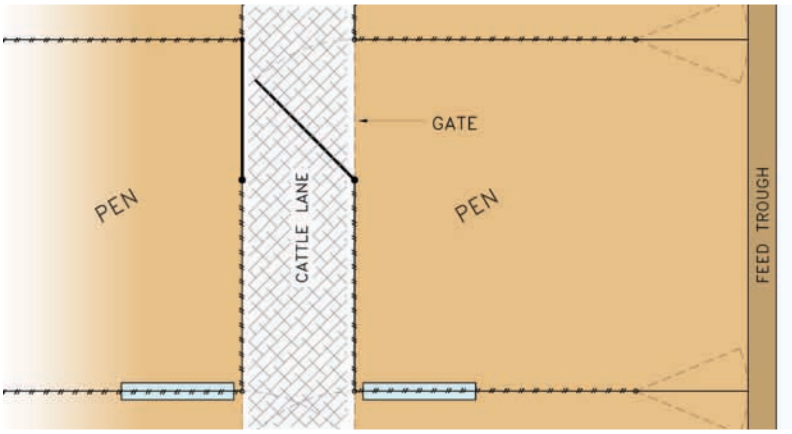


Figure 7 – Typical plan view of feedlot pen.

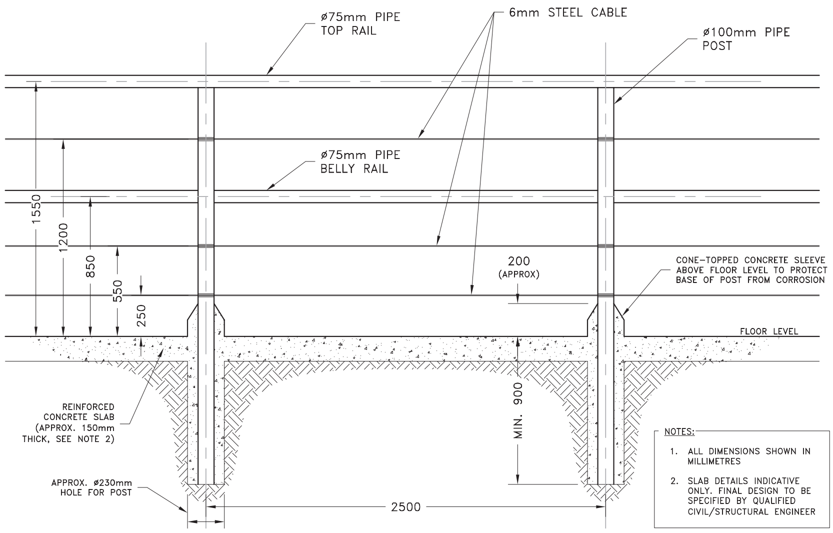


Figure 8 – Typical fencing for feedlot pens and cattle lanes

Practical examples

Good features

Sturdy fencing, concrete protection for post bases and concreted cattle lane (which could be grooved to reduce slipping).

Poor features

Flimsy, poorly maintained fencing, and bogging due to poor lane drainage. Cattle would baulk at using this.

7. Bio-security and quarantine

Function

The risk of cattle in the feedlot contracting or transmitting disease or sickness must be minimised.

Design features

Isolation

Animal receival and dispatch facilities, feed receival areas and hospital pens should be separated from the main feedlot complex to prevent any potential infections spreading through the larger herd. Sick cattle should be isolated from the main feeding complex as much as practically possible.

Public access restrictions

Only feedlot vehicles and staff should be allowed in the feedlot. External traffic and people should be restricted to office facilities, feed receival areas and cattle dispatch and receival facilities.

Feedlot hygiene

Good hygiene is important to preventing disease spreading around a feedlot. Machinery should be kept clean and free of dust, mud and manure. Feeding equipment must be kept separate from that used to handle waste products. Drainage around the feedlot must be carefully maintained to prevent water lying in puddles for extended periods and causing bogging.

Quarantine/hospital pens

Specific pens should be provided near the cattle receival and dispatch facilities to temporarily quarantine cattle before introduction to the feedlot. These pens can also be used as hospital pens to separate sick animals from the main herd in the feedlot. The pens must be at least partially covered to provide protection for cattle from rain and sun, and feed and water troughs should be larger than in normal feedlot pens to reduce stress on animals.

Practical examples

Perimeter fence prevents unauthorised access to the feedlot and keeps straying stock in.

Security checkpoint allows control of vehicle and visitor entry to the feedlot.

8. Cattle handling facilities

Function

Handling facilities provide a safe, hygienic and low-stress way of inducting cattle into the feedlot, performing treatments on the cattle, and dispatching finished cattle from the feedlot.

Design features

Location

Cattle handling facilities should be separated by a short distance from the main feedlot complex for bio-security reasons (see Section 7). There must be adequate room for trucks to turn and to access the unloading/loading ramp.

Pens

Holding pens allow cattle to be held after receival and before being inducted, and also allow finished cattle to be held before dispatch. Drafting and working pens allow cattle to be grouped, re-grouped and held before further treatment or transfer to the feedlot pens. Quarantine or hospital pens allow sick cattle to be isolated from the main herd to prevent spread of sickness and provide conditions that will help them to recover.

Crush

A sturdy steel cattle crush is essential to for safe handling of cattle. It must be able to restrain animals at the head while a squeeze mechanism will help immobilise the animal for handling and treatment. Crushes should allow veterinarian access to the rear of the animal. Weighing scales can be installed onto the crush or in a dedicated weighing box.

Unloading/loading ramp

Loading ramps should have a level section at least 1.5m long at the top for cattle to step onto and off trucks. The ramp should be approximately 760mm wide and be no steeper than 3h:1v (<20%); the floor can be made from concrete or hardwood, but concrete floors must be grooved to prevent cattle slipping. Sides of the ramp should be fully enclosed. Trucks must be able to pull up to the ramp in a way that leaves minimal gaps between the truck and ramp on the floor and sides. No part of the animal may be allowed to fit through any gaps.

Drafting

The ability to separate and divide cattle is essential to good management of a herd. Drafting from a lane generally causes less stress on animals than drafting from a confined round yard. A draft should be able to be directed into one of at least three pens.

Cattle flow

Cattle naturally flow better around curves than around sharp angles or tight corners; thus races and lanes should be curved wherever possible. As cattle will baulk if they see handlers ahead of them, sheeting on lane fences will assist cattle flow. Lanes or races must not appear to come to a dead end, and should have as few shadows as possible crossing them.

Roofing and flooring

The crush and main working area must be covered to protect equipment and handlers from rain and sun. The whole handling facility, and at least the main working area, may be covered by roofing and on a concrete floor. Paved surfaces in working pens can help to reduce bogging under heavy rainfall.

Sample plan

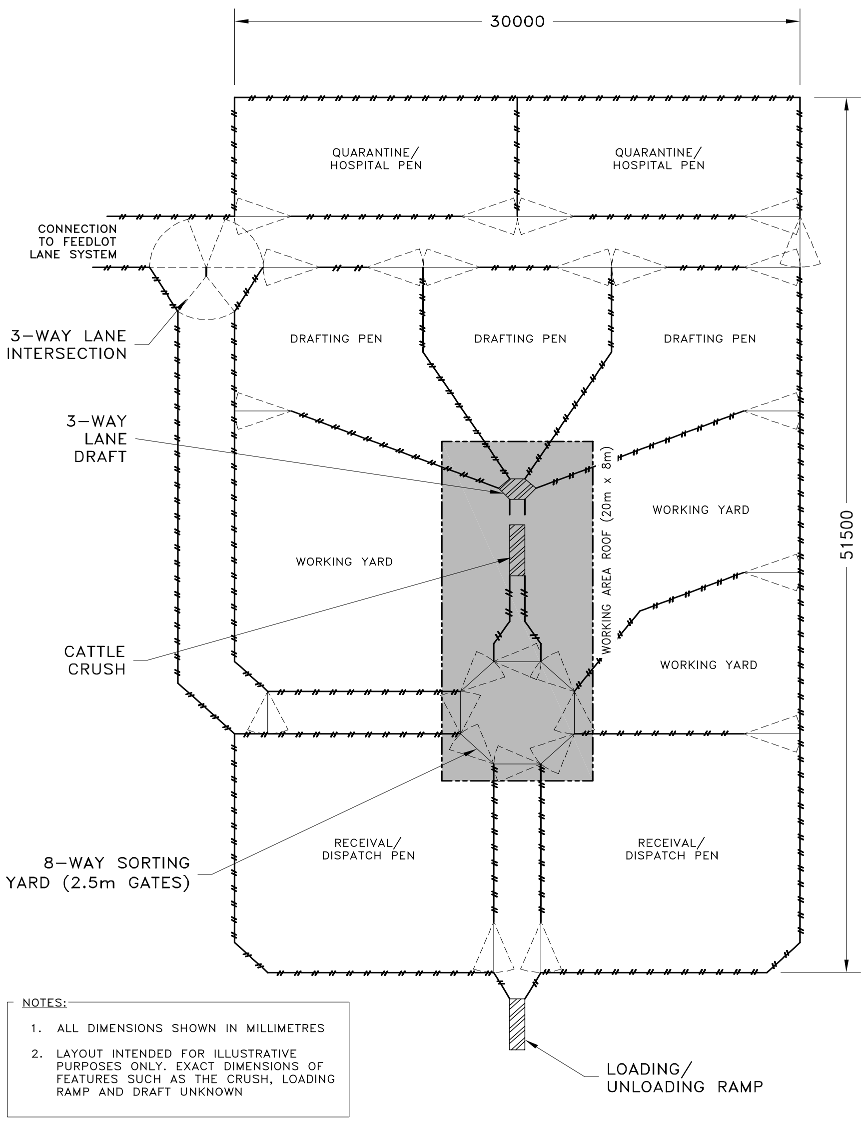


Figure 9 – Sample layout of a simple cattle handling facility.

Practical examples

Covered working area protecting weighing box, crush and drafting gates.

Sturdy fences in working pens but poor drainage in uncovered areas causing bogging.

Clear access for trucks to loading/unloading ramp. Working area fully covered.

Grooved pattern on concrete ramp floor prevents cattle from slipping.

9. Solids management systems

Function

Solid wastes from the feedlot (manure, spent bedding material, spoiled feed and carcasses) must be contained and then allowed to dry to become beneficial, with minimal harm or nuisance to the environment and surrounding residences.

Design features

Storage capacity

Solids are cleaned out of pens and sedimentation structures (see Section 10) and transferred to storage areas. Solid waste management systems must have enough capacity to store solids produced from the feedlot as they dry and are processed for reuse. Reuse or sale of stockpiled solid wastes will reduce the required capacity of storage systems.

Storage design

Stockpiles must be contained in some form to minimise exposure to rainfall or surface water. Simple bunk-style storage areas can offer adequate protection and containment for minimal cost.

Cover

All solid waste storage areas must be covered to stop rainfall wetting the stockpiled solids which must be kept as dry as possible to stop it smelling excessively. Cover can be provided by a roof or by a tarpaulin sheet spread over the top of the stockpile (see Figure 10). Any covers must be well maintained to ensure that they are water-tight.

Drainage

All storage areas must provide adequate drainage to allow stockpiled solids to drain and dry. Drainage from the storage area must be directed into the effluent management system (see Section 10).

Handling

Solid wastes are most easily handled when they are dry. Skid-steer loaders are suitable for cleaning pens or sedimentation structures, and can load solids into the back of trucks for transporting and dumping into storage areas. Solids cleaned from pens can be moved to draining pads to allow them to partially dry before being transferred to stockpile areas.

Reuse

Solid wastes from feedlots can make highly effective fertilisers. Further value can be added by composting solids, which may be offered for sale (often in bags) as soil additives or fertiliser products.

Composting

Composting is a natural process involving the breakdown of organic matter by microorganisms into a humus-like material with a relatively inoffensive odour. Composting material must be kept moist and aerated, so piles should be turned every one to two weeks. Front-end loaders are suitable for turning compost piles, although specialist equipment is available.

Sample plans

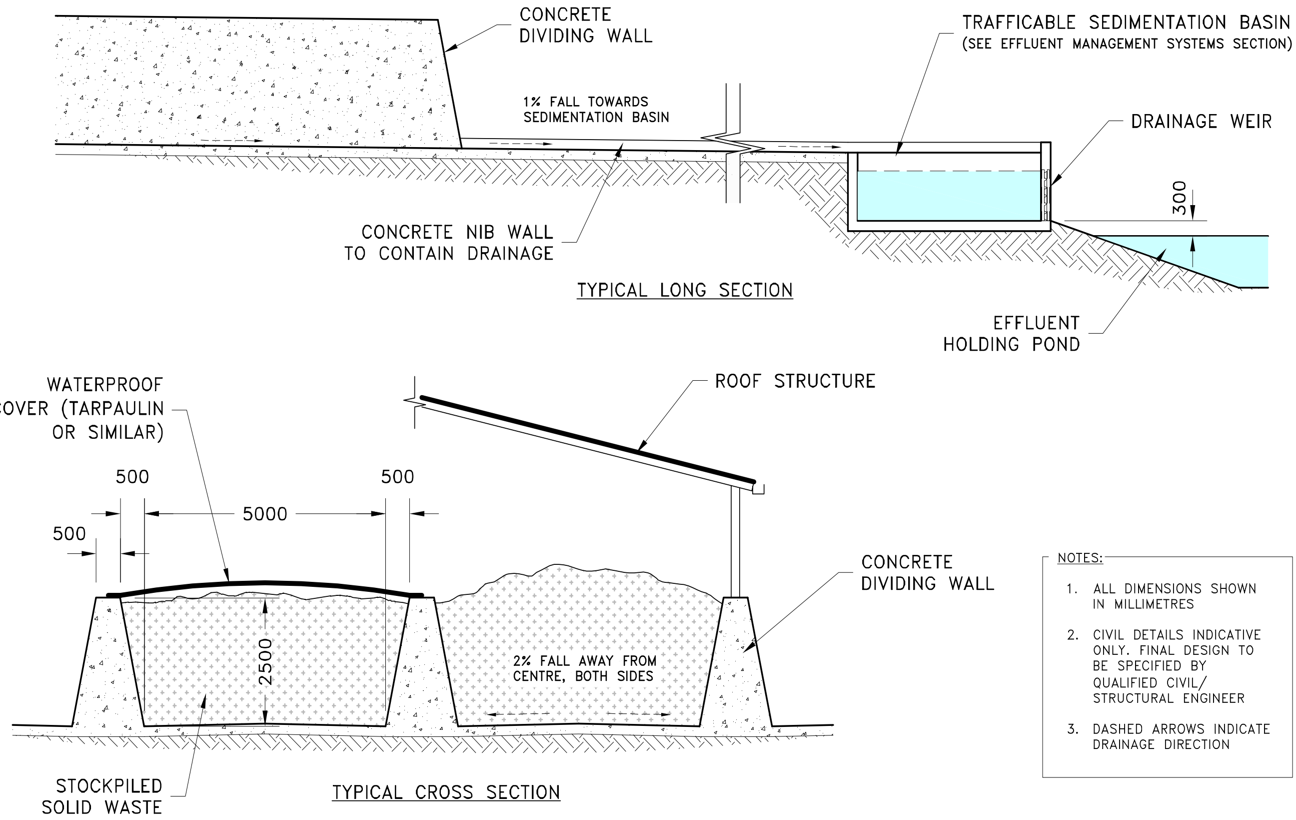


Figure 10 –Example solid waste storage area.

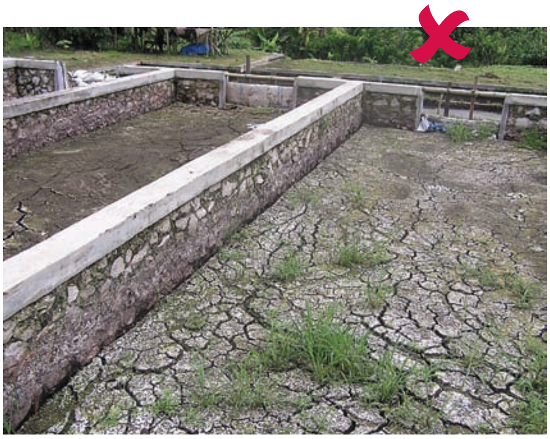
Practical examples

Good Features | **Poor Features**

Fully covered bunk stockpile provides good protection from moisture.

Uncovered stockpile causes bogging and creates contaminated runoff.

Bagged compost waiting for sale.



Sedimentation structure overdue for solids removal and stockpiling.

Solids cleaned from pens being loaded into a truck for transfer to stockpiles.

No cover and poor drainage create surface water contamination risk.

10. Effluent management systems

Function

To contain, treat and dispose of contaminated water from the feedlot pens and manure storage area to prevent pollution of surrounding water resources.

Design features

System Capacity

Effluent systems must be designed to have sufficient capacity such that effluent does not overflow from any structures more frequently than once in every 20 years on average, and they should also be able to contain large rainfall events without overflowing. System capacity should be determined by run-off modelling using long-term daily rainfall records. Effluent management systems consist of drainage networks, sedimentation structures and effluent storage ponds.

Catchments

Run-off from contaminated areas must be directed to the effluent management system. Contaminated areas include all open feedlot pens, cattle lanes, manure stockpile areas and cattle handling yards. Clean run-off (from roofs and grassed areas) should be excluded from the effluent management systems to minimise the required system capacity.

Drainage

Drainage structures should direct all contaminated run-off to a sedimentation structure, and should exclude any clean run-off. A properly designed drainage system should also reduce bogging around the feedlot complex.

Sedimentation

Contaminated water should enter a sedimentation structure to remove solids from the effluent stream. Sedimentation structures must be trafficable so that solids can be cleaned out easily by machinery. They must be able to drain completely to ensure that solids can dry sufficiently. Drainage from the sedimentation structure should be controlled by a board-type weir.

Storage

Effluent should be captured in a holding pond to prevent contamination of surrounding water resources. The pond must be constructed so that effluent cannot seep through the walls or base and contaminate surrounding water resources.

System Maintenance

Effluent drains, sedimentation structures and holding ponds must be kept as clean as possible. Blockages to any flows must be removed immediately. Solid wastes should be removed frequently.

Disposal or reuse of effluent

Effluent can be disposed of by evaporation or may be reused for other purposes. Possible uses can include the irrigation of fodder crops for cattle feed, wetting of compost, or cleaning of the feedlot complex. If effluent is irrigated onto surrounding crop land, drainage structures must be provided to prevent run-off entering local waterways.

Sample plans

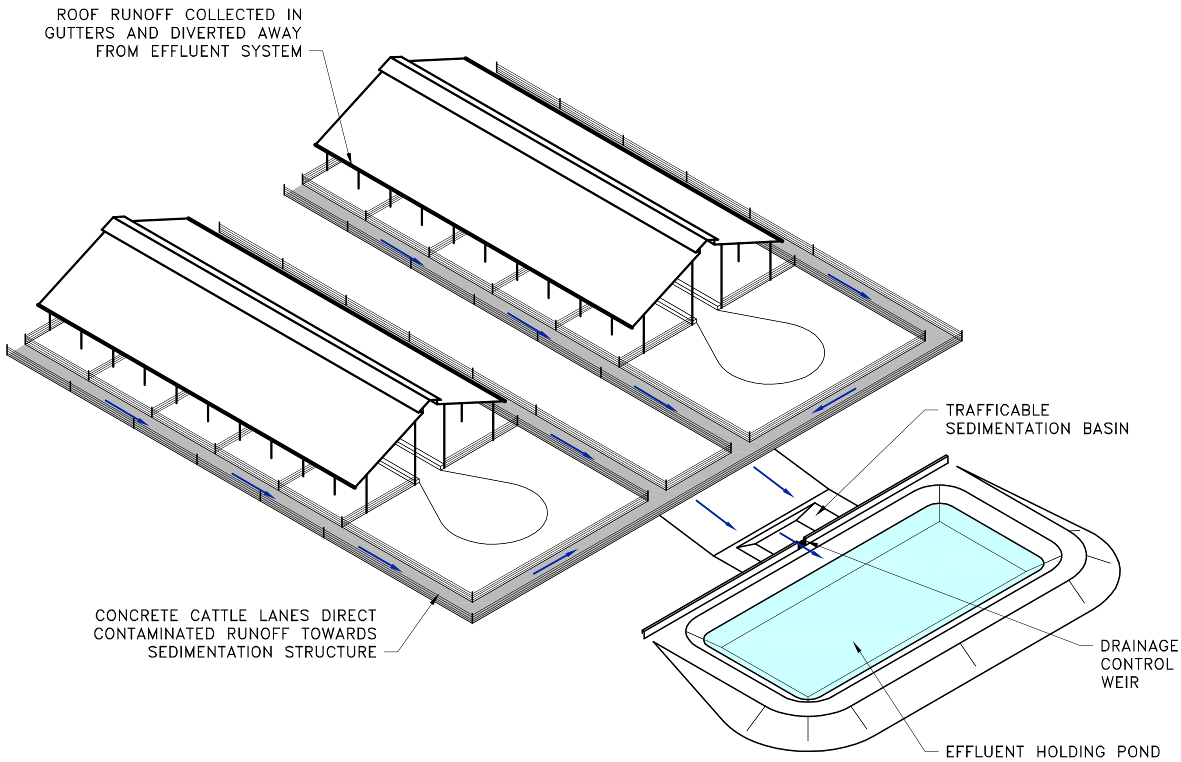


Figure 11 – Typical effluent system

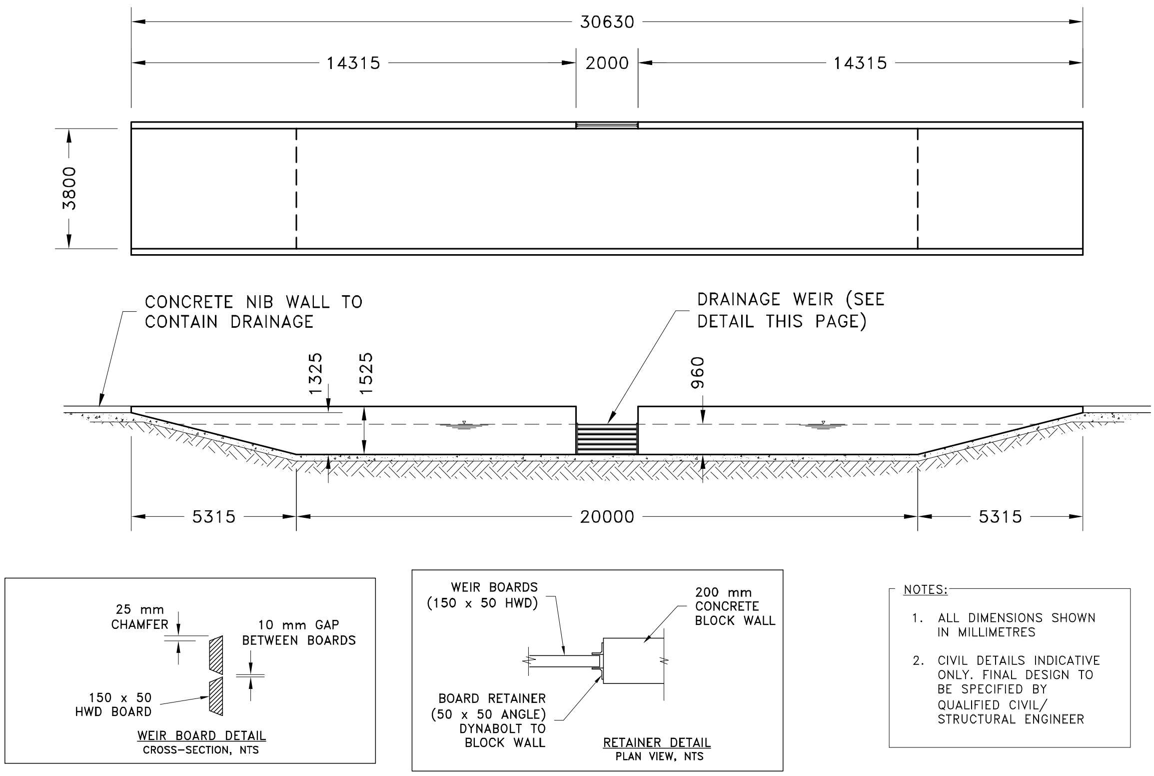


Figure 12 – Typical sedimentation structure

Practical examples

Good features

Raised edges on drains exclude clean water runoff from effluent system.

Well-maintained trafficable sedimentation structure effectively removes solids.

Effluent used to irrigate forage crops to supplement feed supplies.

Poor features

Poor sedimentation performance overloads pond with solids.

Unlined effluent storage ponds can cause pollution of groundwater.

Poorly maintained sedimentation structures and choked overflows prevent good drainage.

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Module 3

Transport and induction at the feedlot

Module 3
Transport and induction at the feedlot

This module describes the stages and procedures from the time cattle leave Australia and arrive at the South-East Asian port through to initial arrival at the feedlot, entry into quarantine and subsequent release into the fattening pens.

Contents

Before loading onto the ship


Loading at Australian port.

All importing country protocols are determined by negotiations between the Australian Quarantine Inspection Service (AQIS) and the importing country's government authorities. Before leaving Australia, all animals are inspected by AQIS and, if the protocols have been met, they are passed fit for loading. They are then moved to the port and start being loaded onto the ship (see Module 1. The Australian Production System).

On the ship

On the ship, cattle are penned at the density specified for their weight, age and condition. They are fed a pelleted total-mix ration—generally of compressed feed products including hay, grain, legume and mineral components—which is typically formulated for maintenance. Waterers must be frequently monitored for contamination given the stocking density on board. This shipping period helps the cattle to become accustomed to noise and movement and helps them adjust to the feedlot when they arrive.


Cattle are fed a pelleted maintenance ration before and during shipment.

Arrival at port of disembarkation

Customs and quarantine clearance

Once the ship is alongside the wharf, authorities from local customs, immigration and quarantine board the ship to check all documentation relating to the vessel, its cargo and the health of the livestock. Cattle cannot be unloaded until all these aspects are accepted.

Unloading from the ship

Once the unloading platforms and gateways are secured, unloading can start. The importer of the cattle has to ensure that there are suitable trucks to deliver the animals from the wharf to the feedlot. Trucks must have a suitable rear gate system for safe loading and to hold the cattle; truck floors must be checked for holes and for suitable bedding so that cattle do not injure themselves if they fall during the road journey.


Unloading from ship into local trucks at night in an Indonesian port.

The speed of unloading depends on the number of cattle, the skill of the handlers, the quality of the unloading equipment and the number of trucks available. Cattle are counted off the ship by the crew and onto trucks by a representative of the importer. Trucks should be weighed at the wharf and when they arrive at the feedlot.

At the feedlot, cattle are unloaded into receiving yards and all documentation should be checked again to match the truck information with number and type of cattle delivered.

Induction at the feedlot

Quarantine

Depending on requirements of the importing country, quarantine regulations may apply to cattle arriving at the feedlot. Most quarantine regulations require that the cattle are kept separate from other cattle at the feedlot for a minimum of two weeks during which they are inspected by quarantine veterinarians.

For the first three days, new arrivals should be given complete rest in pens with soft bedding and plenty of room to allow them to lie down, and should be fed and watered as described in the nutrition section (see page 5). Cattle should remain in their original groups, based on age and sex, during quarantine (and preferably for their whole time in the feedlot).

After the three days of rest and rehydration, normal induction activities such as vaccinations, ear-tagging and blood testing are performed. In Indonesia, cattle are vaccinated for Haemorrhagic Septicaemia and blood-tested for Brucellosis.

If animals are in good health at the end of the quarantine period, the quarantine veterinarians permit their release to the commercial feedlot.

Animal management and observation

As cattle will usually have travelled for at least four hours in a truck from the ship to the feedlot, they should be unloaded to the quarantine pens as calmly as possible to reduce further stress. Any sick or injured animals should be placed in a hospital pen and decisions made about their treatment or salvage for slaughter (see below).

Recognising sick animals

It is unlikely that all sick animals will be identified when they are being unloaded from trucks at the feedlot. Newly-arrived cattle must be observed carefully in their quarantine pens to identify any serious health problems. Sick or injured cattle are removed to the hospital pen using experienced staff so as to minimise disturbance to both the main group of cattle and the sick animal.

Feedlot staff must be well trained to recognise injured or sick animals at induction and during the first week at the feedlot.

Check for signs of injury— Can all cattle rise and walk?

Sick cattle often:

- are depressed and hold their heads lower than normal
- have a ‘distant’ or disinterested attitude
- tend to hide behind other cattle or stand alone
- have a dry, dull hair coat
- have soft, repetitive coughing and an increased breathing rate
- have watery, dull eyes and a clear nasal discharge
- have stiff movements or shortened stride and drag their toes
- tuck their tails tightly between their hocks

Slippery truck floors should be covered with bedding.

Unloading from trucks at feedlot.

Sore or lame animals should be allowed to recover by resting in the quarantine pens.

Common problems seen at induction

Do cattle come to the feed trough more slowly than normal?

Do they eat when at the trough?

Are they generally resting comfortably and ruminating (chewing cud)?

Sick cattle with infectious disease have a rectal temperature at or over 39-40˚C.

General signs to look for each day include: appetite; depression; lameness; stiff movements; nasal and eye discharge; coughing; increased breathing rate; panting; mouth breathing; crusted muzzles; sunken eyes; rough hair coat; loose or extra firm faeces; poor abdominal fill; straining to defaecate or urinate; swollen legs.

When sick animals are put in the hospital pen, the pens they came from should be checked extra carefully.

Loner animal off its feed.

The main problems and their treatment

When new animals arrive and are inducted into the feedlot, 1–2% often require attention. The main problems and their treatment are summarised in Table 1.

Table 1 Treatments for common problems encountered at induction.

Symptom	Treatment
Non-eater	Sulphadiazine and Trimethoprim, Dexamethasone and multi-vitamin injections. Give daily for at least 3 days
Diarrhoea	As for non-eater
Fever	Long-acting Oxytetracycline, Tolfidine and vitamin injection. Repeat every 3 days if necessary
Transit tetany	Calcigol Plus and Dexamethasone
Lameness	Long-acting Penicillin and Tolfidine. Repeat every 3 days as necessary
Abscess / swelling	Long-acting Penicillin, pain relief if required and fly control
Dead tails	Amputate tail, long-acting Penicillin, Tolfidine and fly control
Prolapse	Replace prolapse, long-acting Oxytetracycline and Tolfidine
Nervous signs	Calcigol Plus, Dexamethasone and vitamin B
Downers	Calcigol Plus and Dexapent. Reassess after 24 hours and salvage if not substantially recovered

Injured tail, often seen on animals that want to stay lying down.

Injuries to legs.

Treat or salvage sick cattle?

The economics of treating sick animals vary between feedlots, types of cattle and the problem encountered.

The most critical decision is whether to treat the problem or sell for salvage, and this should be made by an experienced staff member or veterinarian. If the animal is to be kept, the treatment must have a good chance of success, and should start immediately to allow a rapid recovery.

However, treatment may continue the suffering of the animal, with the cost impacting of profitability, especially if it does not recover.

If the decision is to sell the animal for salvage, it should be sold without delay.

Sick or injured animals should be placed in a clean, dry hospital pen with access to clean water and food. Treatment protocols should be followed and with no short cuts in the use of veterinary drugs. Never leave a sick animal by itself; if there are no other animals in the hospital pen, introduce a few healthy animals for company.

Nutrition

When cattle are starting onto a feedlot ration, their diet must be changed slowly. The cattle arriving from Australia will have been fed on a pelleted maintenance ration while in the assembly depot and on board the ship. They should start on roughage and water to allow rehydration, and then go on a starter diet for a minimum of ten days.

Once they have adjusted, their ration can be changed to the finisher diet gradually over the next week or so.

Watch for cattle that are not eating, have runny dung, look 'hollow' or are suffering from ill thrift. If any of these symptoms are seen, the animals must be pulled out and put in a separate pen for closer management.

Transition to production pens

After the quarantine period has finished and rumen function has stabilised on the medium-energy starter rations, cattle can progress to high-energy rations under a normal production feeding system (refer to Module 6 Ruminant Nutrition). By this time, rumen microbial composition has transformed and there will be minimal disruption to the digestive system.

Formal induction programs vary depending on the individual feedlot operation, but cattle are typically:

- ear-tagged with new identification and the Australian NLIS tag recorded
- individually weighed
- vaccinated and treated for fly control
- allocated to new pens for the finishing stage

The process of induction should be done with minimal stress to the animals (refer to Module 4 Animal handling).

Starting on higher-energy concentrate ration during induction.

Resting contentedly.

Formal induction through the crush – identification, weighing and vaccination.

Module 4
Animal handling

Module 4
Animal handling

Good handling of livestock will result in higher productivity and good animal welfare. This module highlights the importance of understanding and communicating effectively with animals.

The principles can be applied by all those working on board ships, unloading and loading, truck drivers, feedlot workers and workers in slaughter houses.

Contents

OIE Animal Welfare Standards

International standards for working with animals have been set by the World Organisation for Animal Health (OIE). Some key issues of the OIE Animal Welfare Standards are described throughout this guide.

Under the standards, an animal handler needs to understand the following key points:

- Domestic livestock live in herds and follow a leader by instinct.
- Animals have natural flight-zones.
- The animal's senses (mainly sight and sound) and how these affect direction by the handler.
- Animals need to be handled in a balanced way to avoid harm, distress or injury.
- Aids such as the 'cattle talker' that can be used to encourage movement and direction of animals.
- Unacceptable practices include creating noise that will agitate the animals, using implements that may cause pain or stress, hitting animals, walking animals over the top of other animals.

New cattle at the feedlot – Good handling will save time, money and tempers.

Commercial benefits of better animal welfare

Understanding cattle and how they react to each other and also to a handler increases efficiency and production. It makes the handler's job easier and saves time, tempers and money.

As the handler – Knowledge of animals and their environment will reduce stress to the animal. The commercial benefits of this include:

- reduced weight loss during handling
- fewer deaths
- faster completion of the job — quicker vessel discharge
- better resistance to disease — high stress levels lower the animal's immune system

As the employer, your understanding of animal welfare can also save time and money by:

- Reducing time and thus cost of unloading from the ship and loading trucks at the port.
- Fewer injuries or deaths mean more animals for the importer.
- Good animal welfare standards reduce criticism from animal rights groups — keep the live export industry (and your business) open.

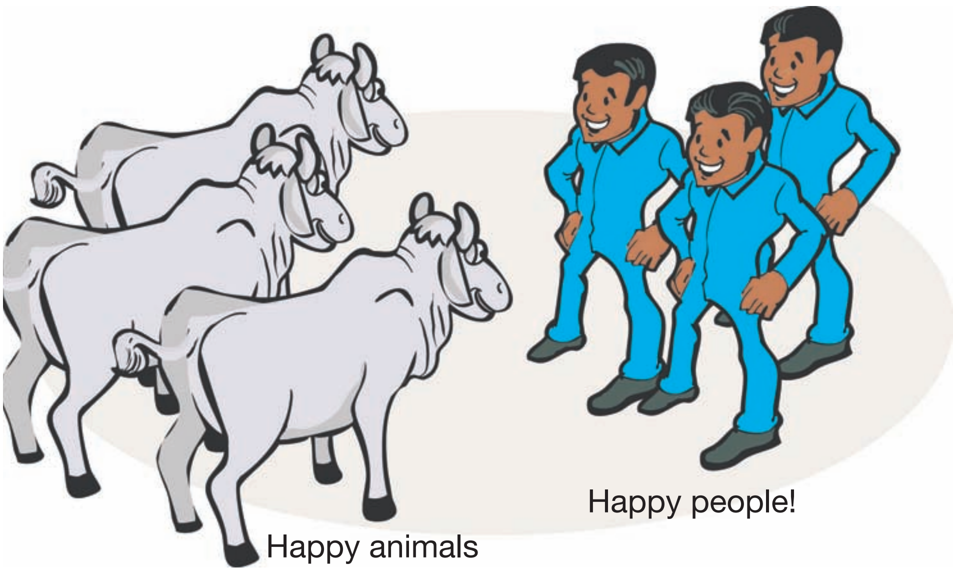


Figure 1. Happy animals and happy people.

The flight-zone of livestock

Cattle like to keep their distance from humans and will try to escape if humans get too close to them too quickly. This critical distance is called the FLIGHT-ZONE.

The flight-zone varies among species and individuals of the same species, but greatly depends upon previous contact with humans.

Animals reared near humans and regularly handled have a small flight-zone, and can often be touched without moving away. Animals reared under extensive grazing systems generally have larger flight-zones and move away as they are approached.

Australian cattle reared in extensive systems usually have larger flight-zones than cattle raised in SE Asia.

Humans exert pressure on cattle just by being there. Animal handlers should avoid suddenly penetrating the flight-zone as this may cause a panic reaction which could lead to aggression or escape.

New induction cattle are wary of the worker in the yard and keep their distance – their flight-zone.

The distance between the handler and the animal (the flight-zone) and where he is in respect to this will determine the animal's response — 'Flight or fight'.

Herd behaviour

Livestock are herding animals that like to be with, and follow, similar animals. They naturally group together in a mob* in which there are leaders and followers (Figure 2).

*Australian stockmen name a group of animals out of the larger herd a 'mob'.

Herd instinct

Cattle from pre-historic times have grazed on open grass plains. In the food chain of the animal world, livestock are regarded as prey animals hunted by the big cats (lions, tigers), wild dogs—and humans.

Cattle are relatively defenceless to predators; to survive, they react naturally by moving away.

It is important to understand the predator–prey relationship as it causes the 'flight or fight' response. Even though cattle have been domesticated, they may still see humans as a 'predator'.

Herd or mob structure

In each mob, there is a structure which is always maintained. It may not always be the same animal, but the mob is classified into:

- **Leader –** the leader is out in front, giving direction and setting the pace. They are called No.1s.
- **Potential leaders –** these are just behind the leaders in the mob. They are called No. 2s.
- **Most insecure –** these animals are in the centre of the mob and have a very large flight-zone.
- **Followers –** most of the animals in the mob. They look to the leaders for stability and direction.

For handling, the most important animal is the leader. Finding the leader and giving it direction may be difficult but, once this is achieved, the mob structure will develop and movement will be much easier.

Mob structure

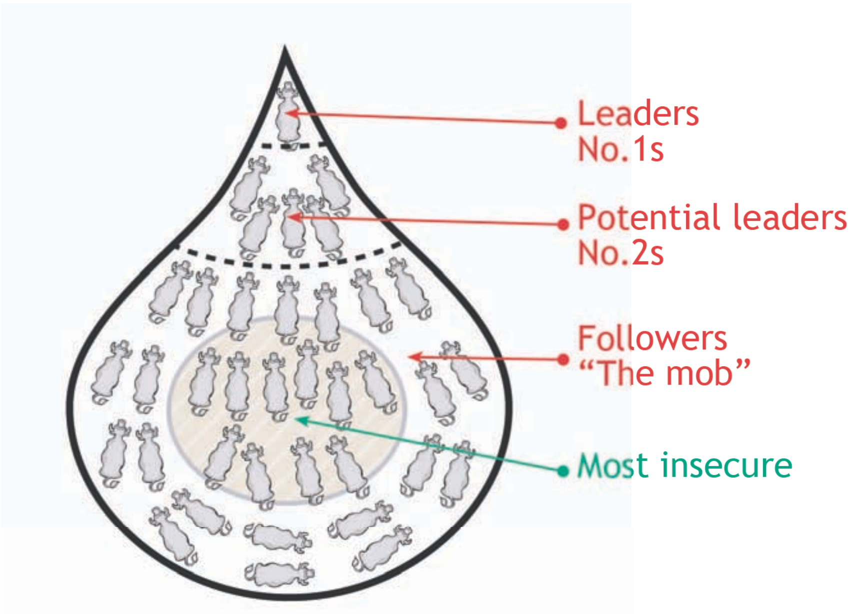


Figure 2. The structure of a mob.

Animal senses

Cattle use many of their senses to communicate, but sight is the most important.

Cattle have panoramic vision as shown in Figure 3 below, but they cannot see behind—the blind spot.

The handler should never position himself in the blind spot directly behind the animal. It wants to see the handler and to follow other animals.

Features of sight

- **Depth perception** – some animals find it difficult to determine distance from a stationary object. To overcome this, create slight movement.
- **Illumination** – stock like to move from dark to light areas. It is difficult to move cattle into dark places.
- **Colour** – cattle can distinguish some colour such as the difference between red and blue or green.

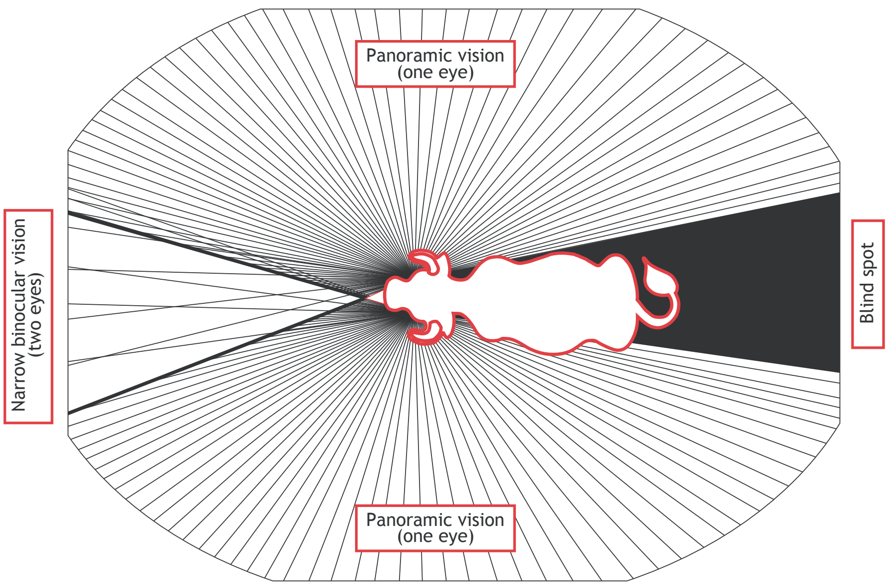


Figure 3. The panoramic field of vision of cattle.

Other senses that need to be considered when working with animals are:

- **Sound** – noise causes stress and so is better avoided. Animals can be moved without noise.
- **Smell** – for example, cattle become upset by strange smells or the smell of blood.

Communicating with cattle

The most important aspects of communicating with cattle are related to flight-zones, mob structure and understanding their reaction to the handler's position and movement.

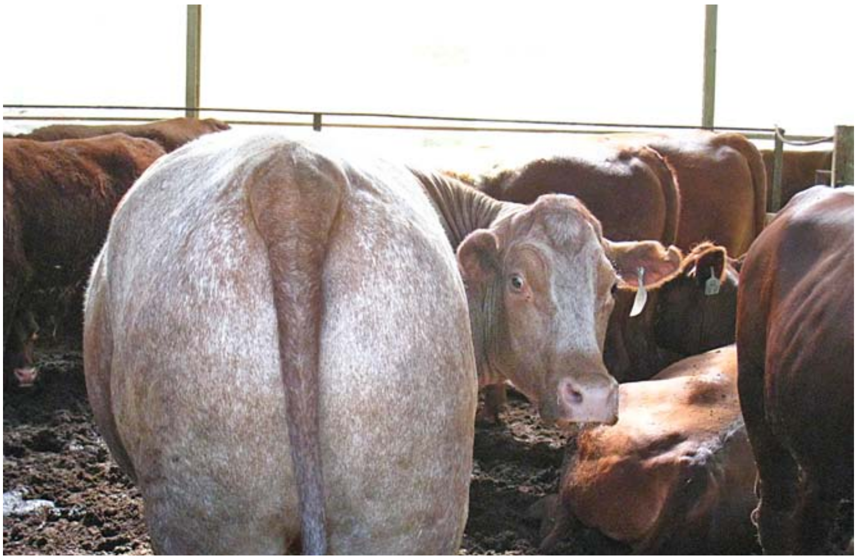
Cattle want to:

- move quietly without being abused
- follow other cattle
- be part of a mob — and not to be isolated
- see what (or who) is pressuring them

Cattle in a mob are always looking for a leader — which may be another animal or a person.

The way the handler positions his body in relation to the animal's eye will influence how it moves.

Vision is the most important animal sense when communicating with livestock.



What do you want? Can I see you?

Four principles of cattle communication

The four top principles of livestock communication are:

1. **Position –** where are you in relation to the animal's eye?

2. **Pressure –** apply pressure to get the animals to move but then release it.

3. **Movement –** move your body position so that the animal sees you.

4. **Communicating –** let the animal communicate with other members of the mob while you communicate with your fellow workers.

Four principles of cattle communication

1. Position

Cattle use sight as the main way they communicate.

Where are you in relation to the animal's eye?

In front – this is very confrontational and can be very dangerous with some cattle.

Behind the animal – they like to see what is pressuring them. If they cannot see you, they will become nervous and turn around to watch you.

The side – you can only influence an animal and create efficient movement and direction when you are at the *side* of the animal.

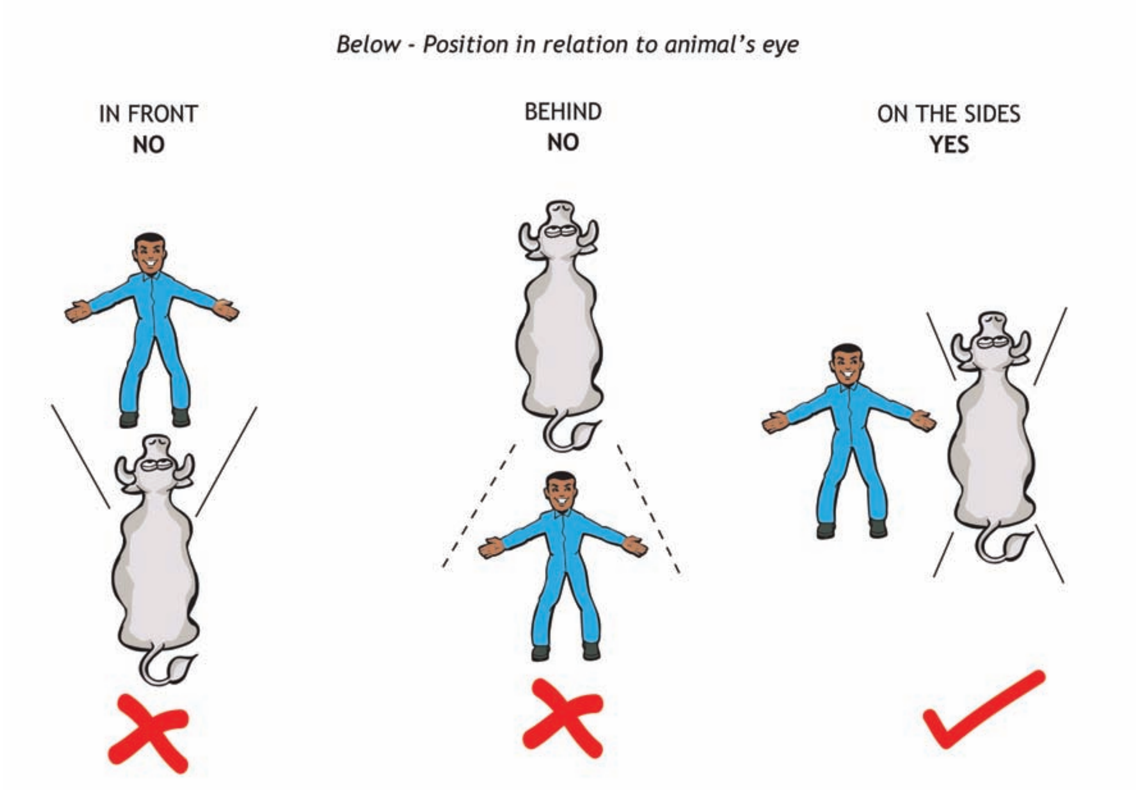


Figure 4. Always work on the side of the animals

2. Pressure

Pressure is whatever is forcing the animal to move away.

Too many people or too much activity can cause too much pressure.

Whatever pressure is applied, it must not be constant. Once it has caused the animal to move, it should then be released.

For example:

- If using a 'cattle talker' or goad with a flap, stop waving the flapper after the animal responds.
- If you created movement by positioning your body, release this pressure by moving back.

The most effective way to create pressure is to move towards the animal (into its flight-zone) and then to move back away to reward the correct response.

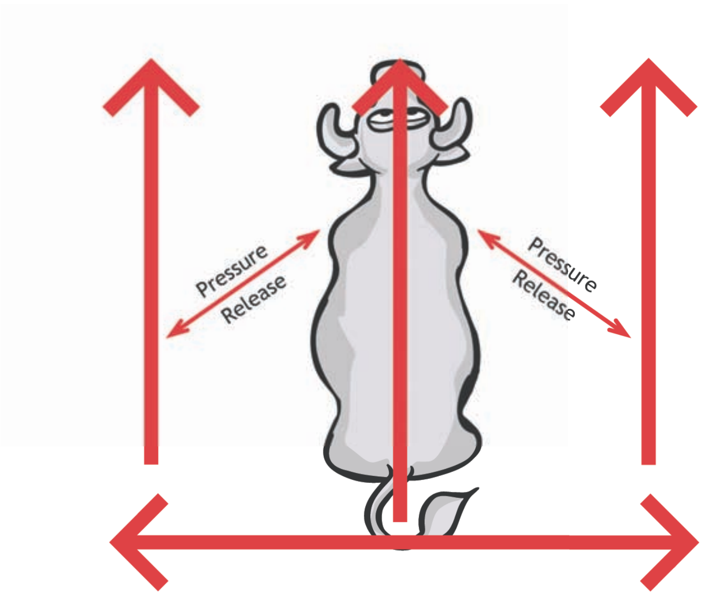


Figure 5. Pressure and release

- There is no point applying consistent pressure when animals are already moving in the correct direction.
- Do not penetrate the animal's flight-zone and apply pressure when the animal has nowhere to go.

3. Movement

Moving your body is an effective way to create pressure and influence the direction of an animal.

Tools that can be used to create movement are:

- **Human body** – move your body by either walking towards an animal (in a zig-zag position) or jumping up and down (without noise) in the same position.
- **Goads** –the 'cattle talker' is a stick with a flapper on the end. Goads are an extension of your body—they are *not* a tool to *hit* animals.

Goads – a 'cattle talker' is an extension of the arm—not a tool to hit the animal.

Once the cattle are moving, discontinue the action.

To move cattle in a race forward:

- move your body over the top of the race
- put the 'cattle talker' in the race and move back in the opposite direction of the cattle

Some basic rules to move cattle:

- You cannot make an animal move if it has nowhere to go.
- Never hit an animal that is already moving in the right direction.
- Never hit or pressure an animal that has nowhere to go.
- To make an animal go where it does not want to go, apply pressure to increase movement in the desired direction.

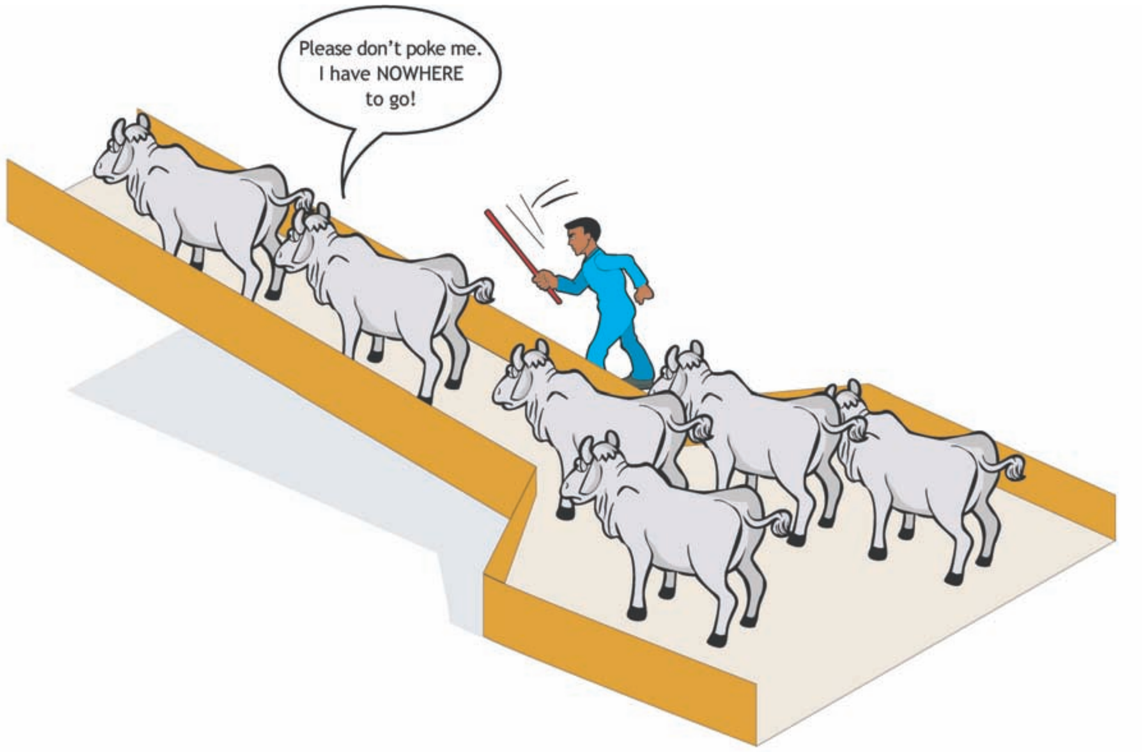


Figure 6. Never hit or pressure an animal if it has nowhere to go.

- Livestock always move in a curve when going in and out of gateways and pens.
- Position yourself so the animal curves around you, rather than blocking them.

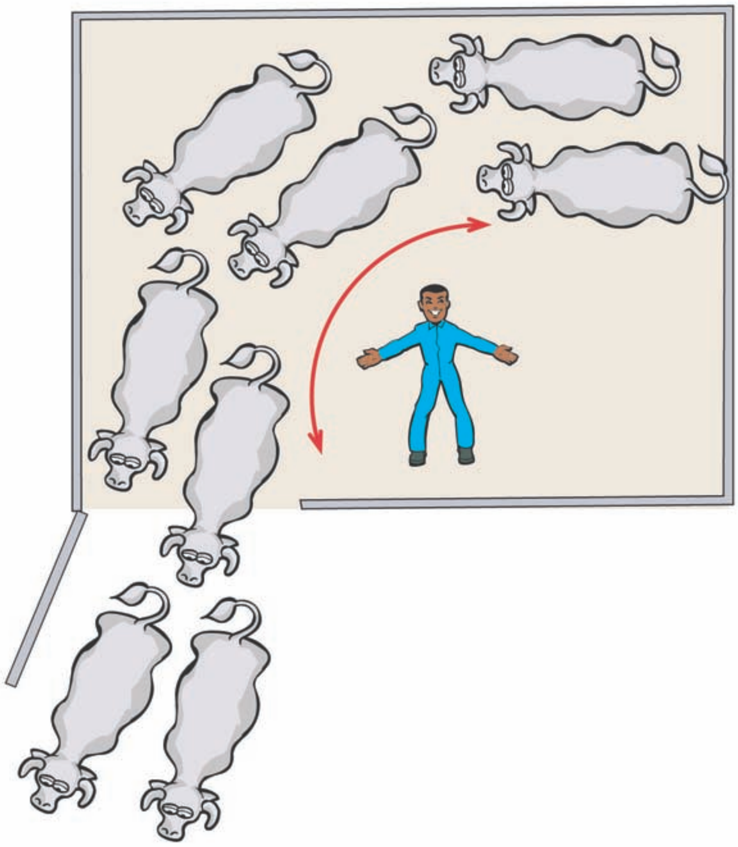


Figure 7. Using body position to move animals from a yard.

4. Communication with the animal and your fellow workers

Make sure that what you are asking livestock to do is made very clear to them.

Are you sending the animals the right message?

It is difficult to communicate with an animal that is frightened of you.

Do not penetrate the flight-zone too deeply or too quickly when trying to create movement with frightened animals.

Do your fellow workers understand what you are trying to achieve? Working together as a team will create more effective movement and livestock handling.

Never hit an animal that is already moving in the right direction.

Never hit or pressure an animal that has nowhere to go.

Do not stand behind the animal. It cannot see you.

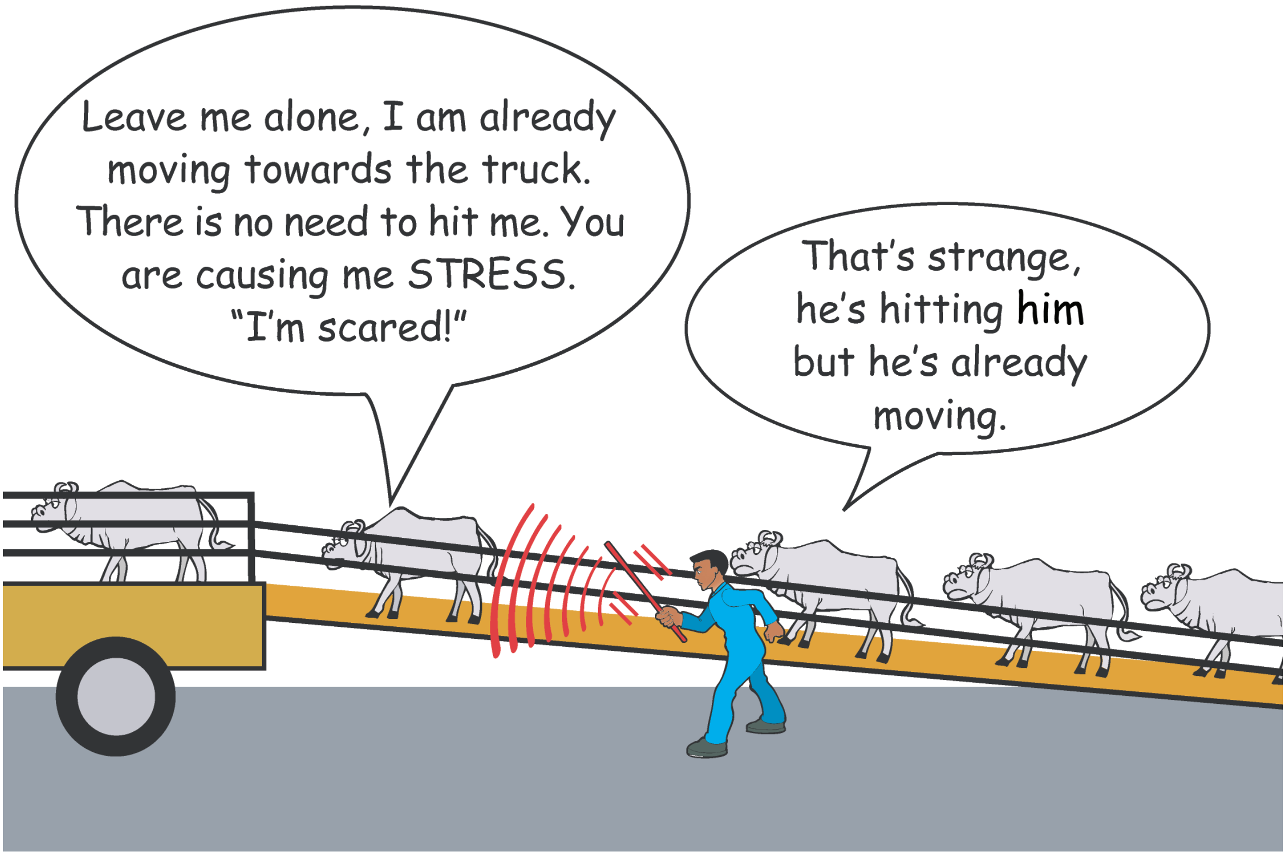


Figure 8. Never hit an animal that is already moving in the right direction.

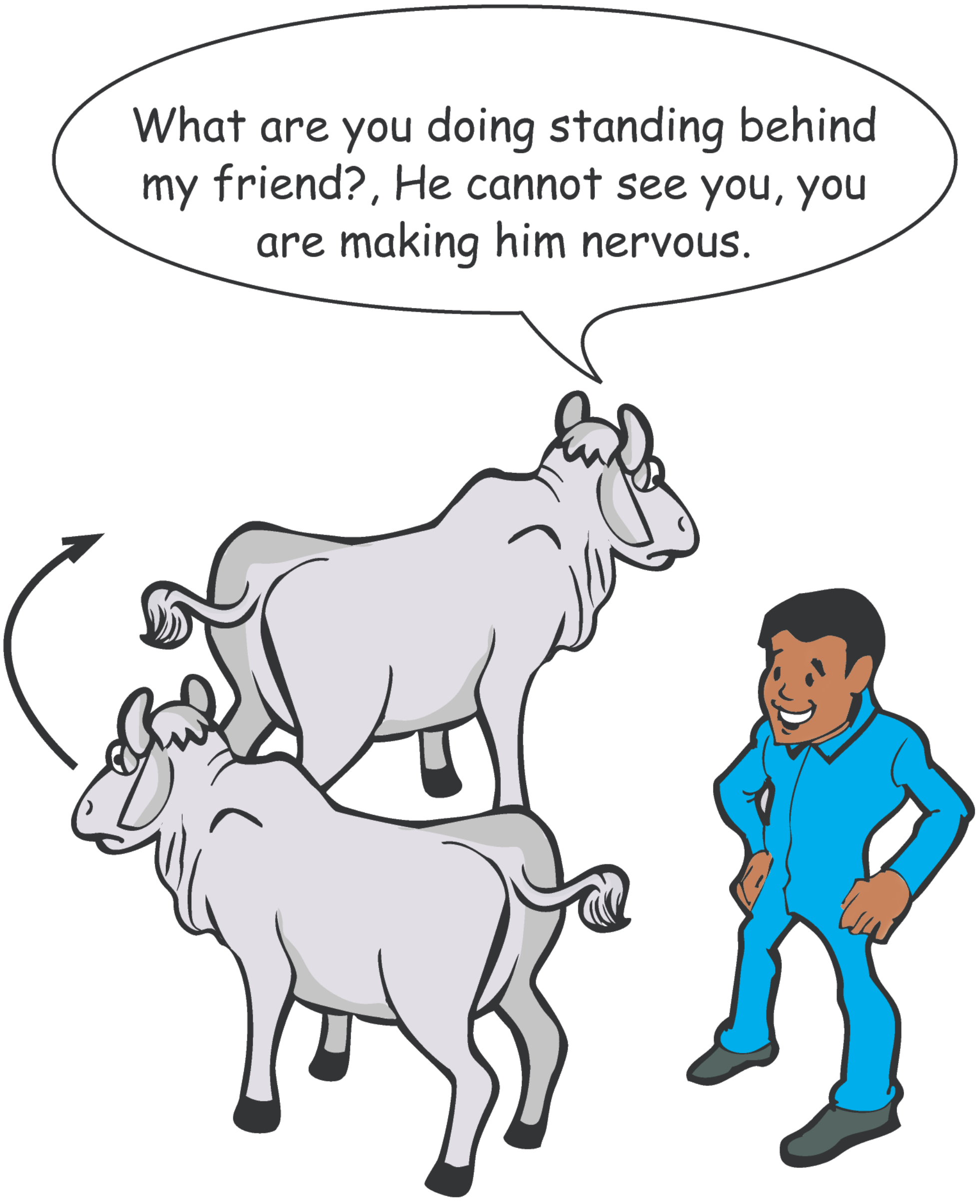


Figure 9. Do not stand behind the animal as it cannot see you.

Do not isolate an animal from the mob. Cattle on their own are generally dangerous. They become frightened and can get aggressive.

Always be wary of Brahman cows with calves; they are very protective.

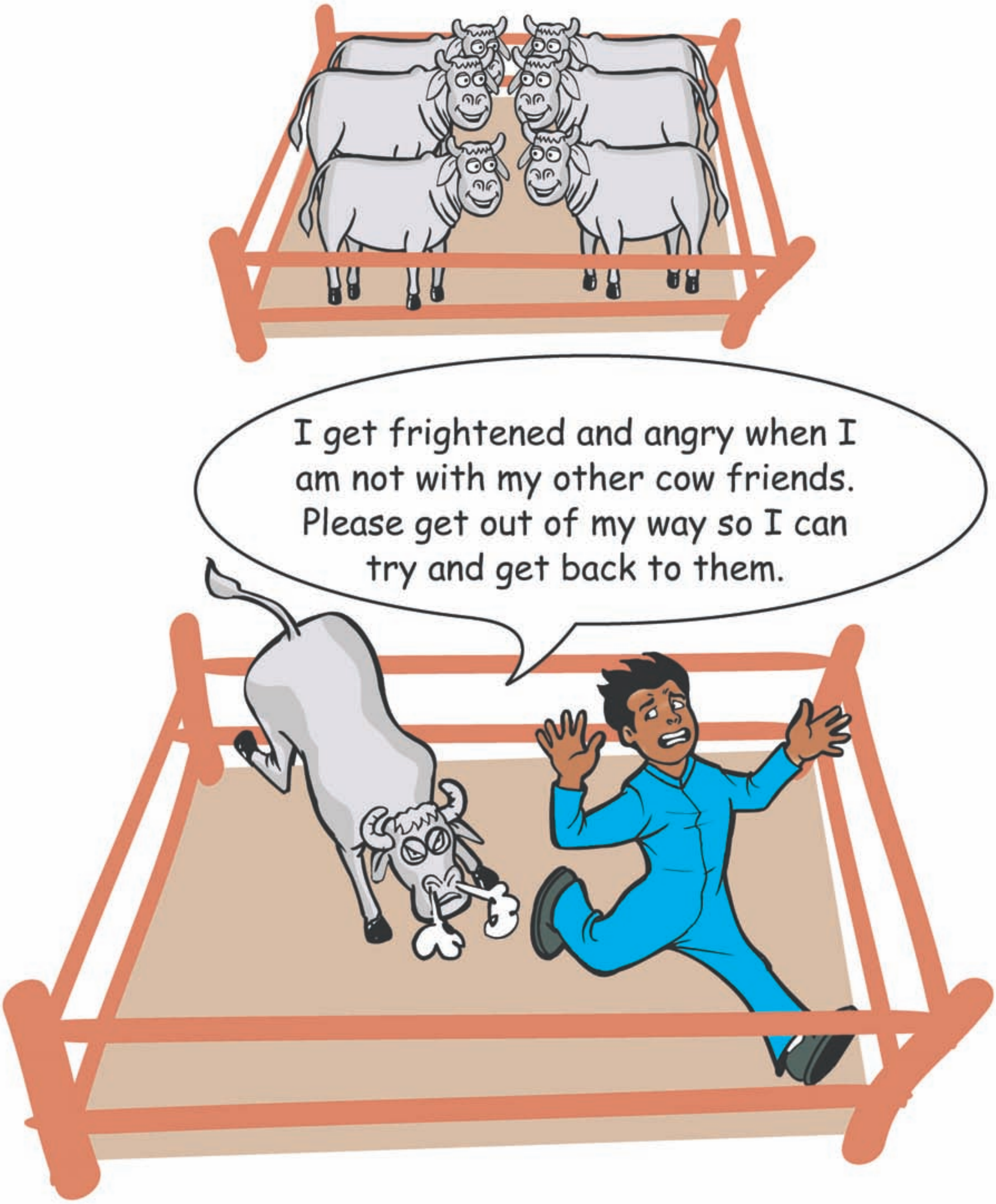


Figure 10. Do not isolate an animal from the mob.

Do's and don'ts of ship unloading

These figures are schematic. We know that cattle cannot be regimented to stand in lines and that generally they align across the truck.

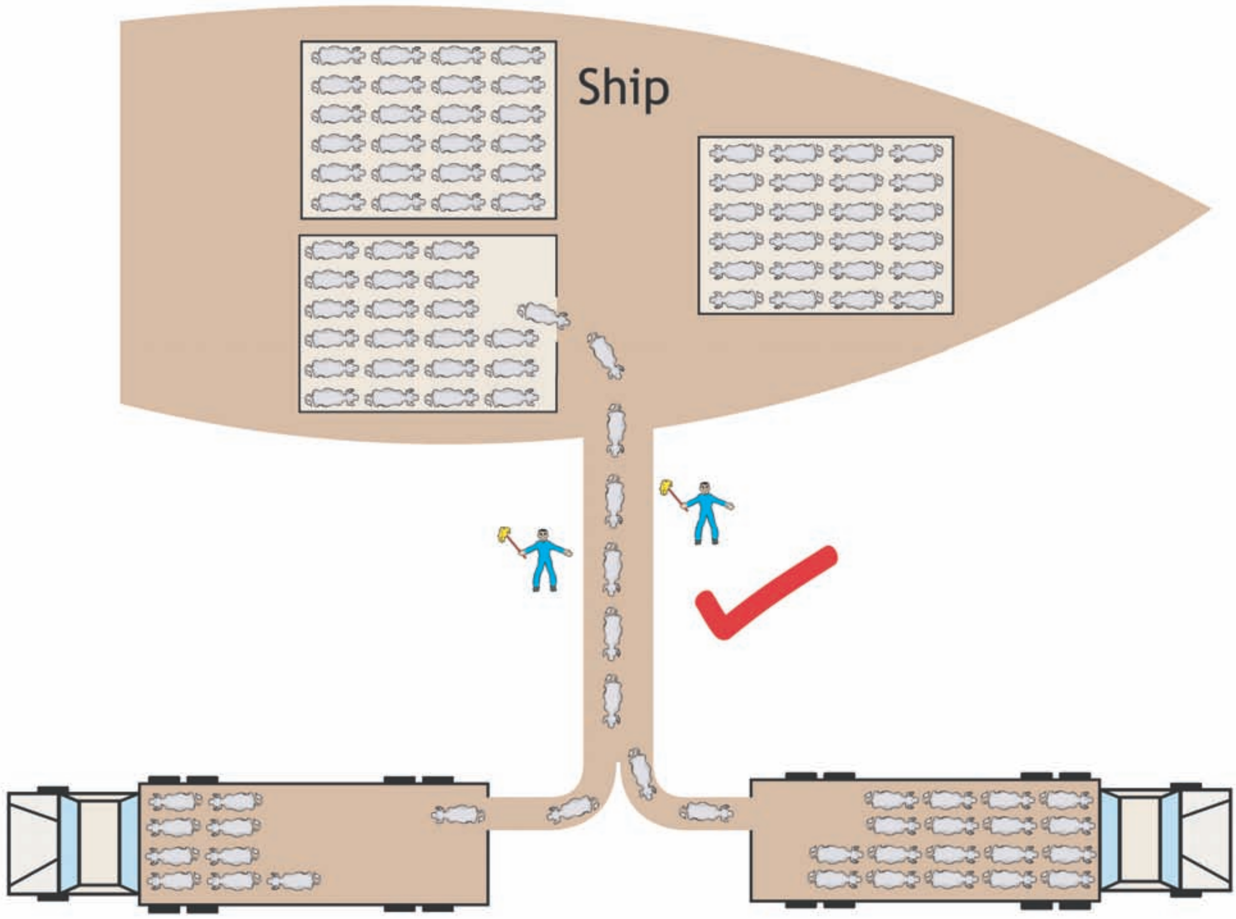


Figure 11. Stand back and make less noise!

Do's and don'ts of ship unloading

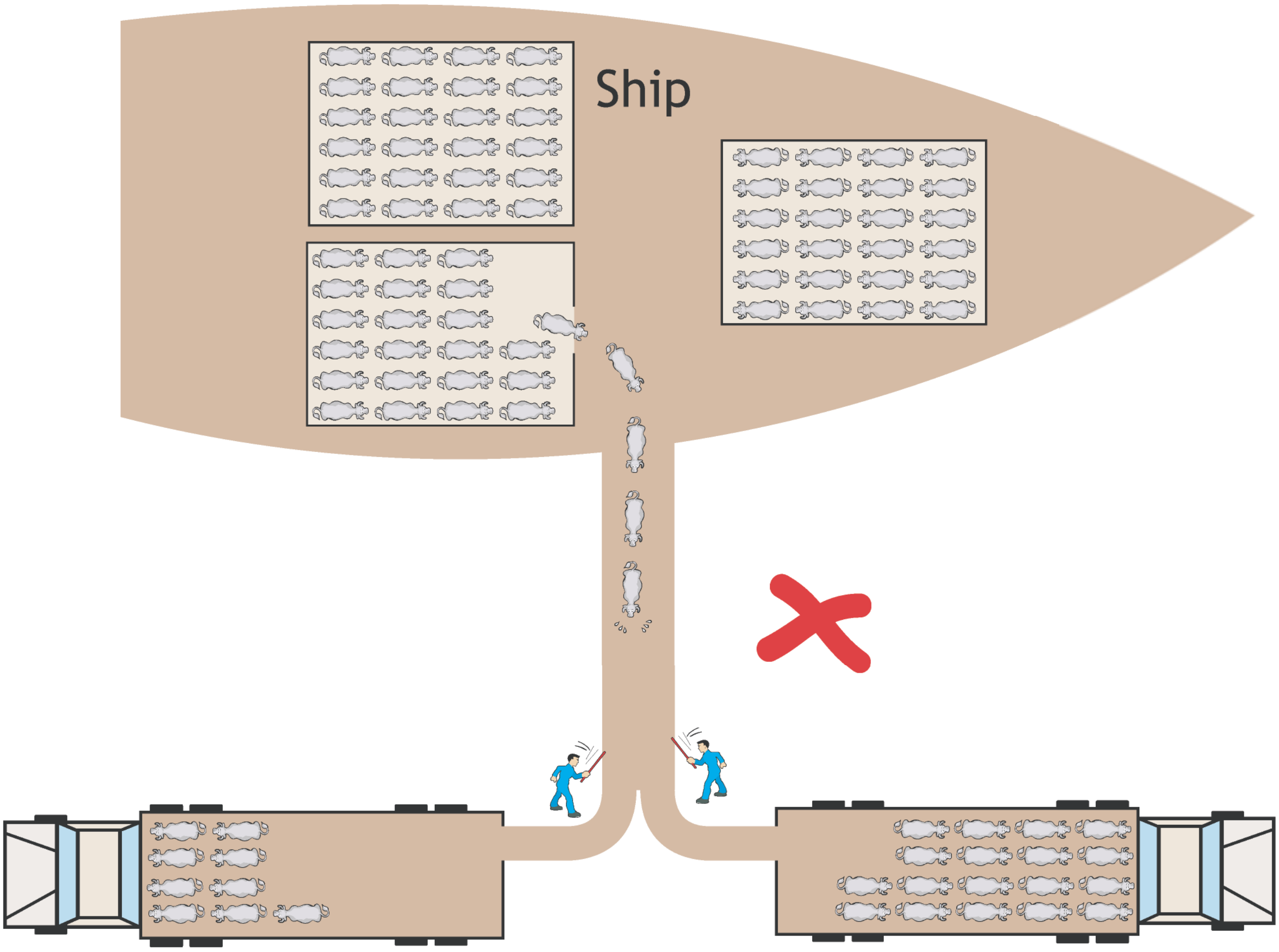
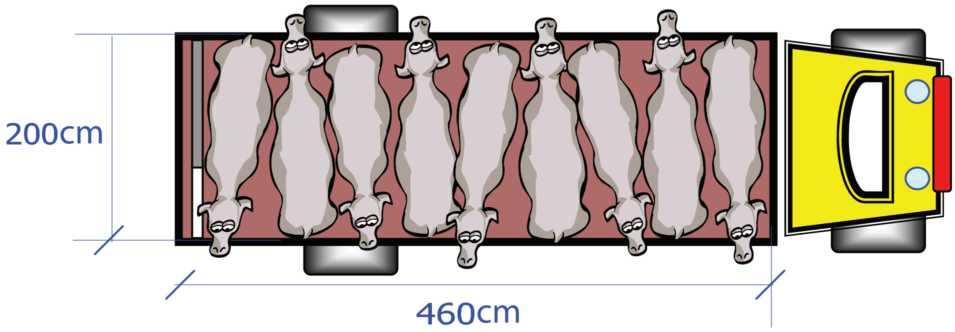


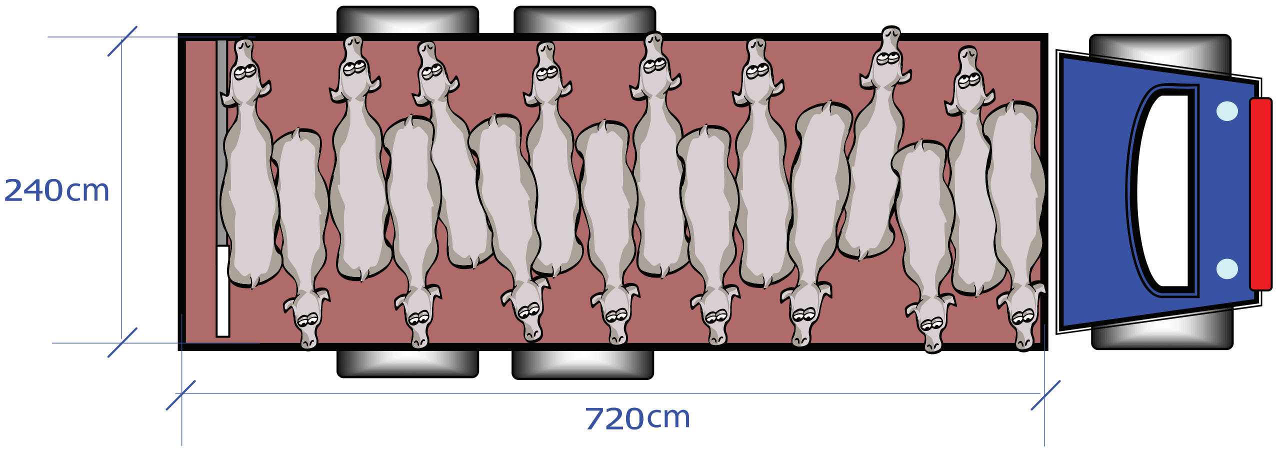
Figure 12. Don't stand in front of the cattle banging the race alley with sticks!

Loading your truck

Correct loading for Colt Diesel
9-10 head of 300-350 kg cattle
or 8 head of 450-500 kg cattle



Correct loading for Tronton truck
16 head of 300-350 kg cattle
or 13 head of 450-500 kg cattle



Don't load so many cattle so that they cannot move at all or so few so that they have no support when the truck moves.

Figure 13. Correct loading for Colt Diesel and Tronton trucks.

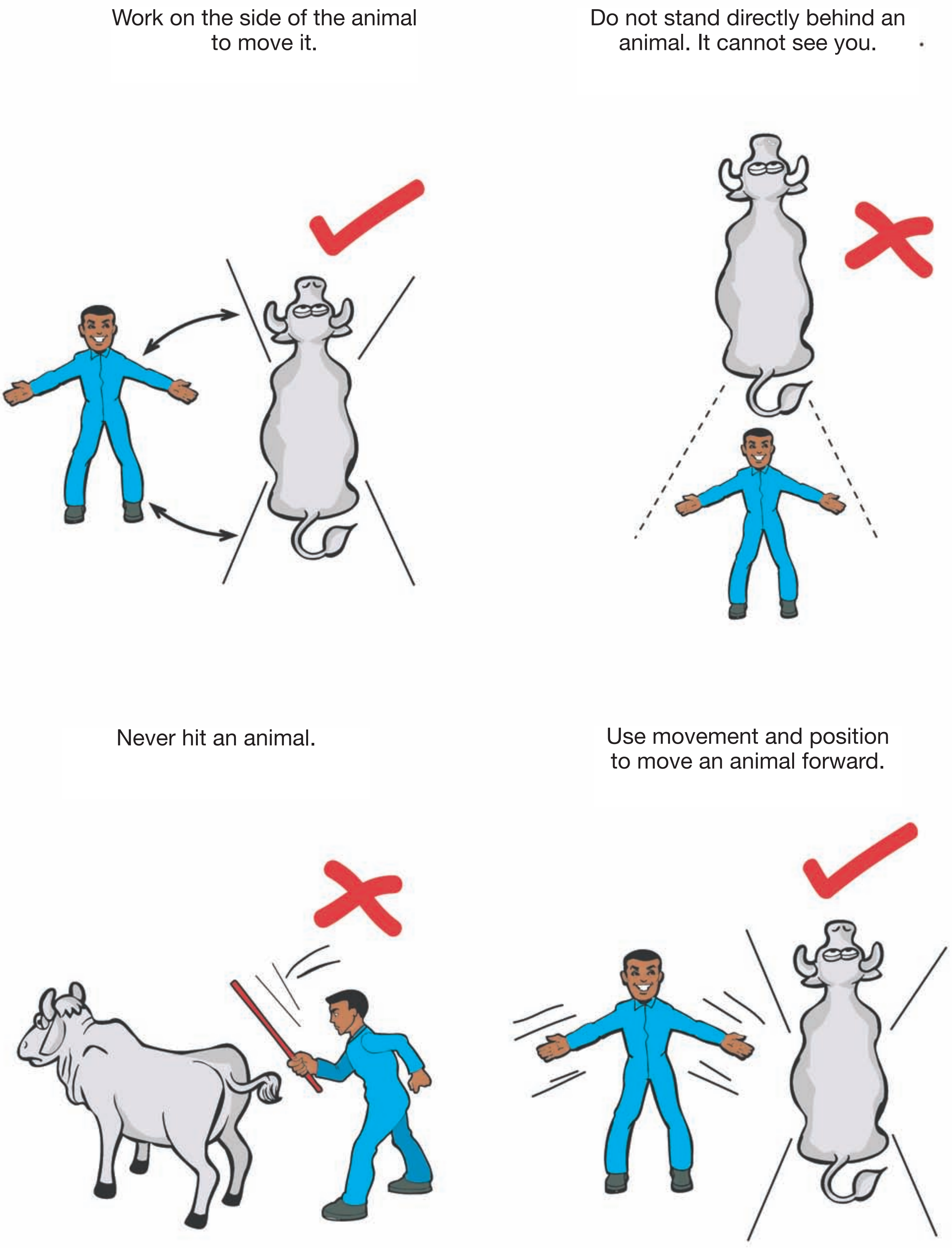


Figure 14. The basic rules for handling livestock.

Summary

- Be aware of your obligations under the OIE Animal Welfare Standards.
- Improving animal welfare will have commercial benefits for both employer and employee.
- Animals like their distance from us = their flight-zone.
- Avoid entering their flight-zone and creating agressive reactions.
- Cattle are instinctively herding ‘prey’ animals and avoid ‘hunters’ such as humans and dogs.
- The most important member of the mob or group is the leader. The leader creates movement and gives direction.
- Never apply so much pressure that the animal is isolated. It may become dangerous and difficult to control.
- Position – always work on the side of an animal so that it can see you.
- Whatever pressure is applied, must always be released.
- You cannot make an animal go where it does not want to.
- Do not apply pressure to an animal that has nowhere to go.
- Make sure that you are communicating clearly with the animal and with other workers.
- Quiet cattle will be easy to handle; upset and frightened cattle can be trouble and will make you lose your time and temper.

Understanding how cattle react and work is the key to their tractability and welfare.

Combine this with a well-designed feedlot and top-grade equipment for a truly efficient operation.

(Above) Curved race with non-slip flooring.

(Bottom) A hydraulically-operated crush with under-chin head restraint and automated cattle ID and scales.

Module 5

Animal health in the feedlot

Module 5
Animal health in the feedlot

Keeping cattle healthy is a key part of a profitable feedlot.
This module introduces the important principles for managing, and maintaining, good animal health.
These principles include:

- preventing disease and recognising sick cattle
- developing a preventive herd health plan
- use of treatment protocols and veterinary drug lists
- the relationship between nutrition, health and disease
- the correct use of antibiotics and other drugs
- the feedlot drug cupboard, and proper recording of drug treatments
- clinical signs and treatments for some commonly encountered feedlot diseases

Contents

Introduction

A good feedlot health program begins before the feedlot. Australian health protocols ensure that exported cattle are free from common diseases and parasites, and that they have been vaccinated against the major preventable diseases.

On the ships, exporters and stockmen focus on keeping the cattle healthy and stress-free.

Fewer than 1 animal in 1000 of Australian cattle imported into Asian ports die, but stock may be at a higher risk while they are being transported from the port to the feedlot and for a short time after this.

"Prevention is cheaper than cure."

Disease in the feedlot can largely be prevented through good management by emphasising husbandry, nutrition, biosecurity and preventive health programs.

Feedlot health programs

Focus on disease prevention

Maintaining animal health and preventing disease in feedlots is going to depend greatly on the experience of:

- stockmen – who have to be both skilled animal handlers and observers
- veterinarian
- animal nutritionist

– all operating under a planned preventive health program.

Any problems must be observed and identified early, and then diagnosed accurately. Proper diagnosis may need the feedlot's veterinarian, backed by the local vet laboratory.

Remember:

- many disease conditions have similar symptoms
- not all diseases can be treated with antibiotics

Sick cattle indicate a breakdown in the feedlot preventive medicine programs.

Heat stress and the feedlot environment –

Daily recordings of temperature, humidity, wet bulb temperature, and wind flow are used with Heat Index charts to predict likely heat stress events, and the risk of heat stress if working cattle in yards.

Cattle with high *Bos taurus* content are particularly sensitive to heat stress.

Local areas without shade, or without a good breeze, may increase local pen temperatures, as may overcrowding.

Observation skills

Early detection of problems relies almost exclusively on using skilled observers. Experienced stockmen are usually very good observers, and less experienced staff should be trained in observation techniques.

Recording the observations and the solutions or treatments for any problem allows management to develop plans or protocols for most cases.

Teach your workers good observation skills.

Understanding normal cattle behaviour

Stockmen must first know what normal behaviour is before they can determine any abnormal behaviour.

Key observations every day

Stockmen must see, listen and smell:

- the behaviour of all individual cattle and of the whole pen.
- all facilities – pens, troughs, food, water, shade, shelter, facilities
- the local environment – temperature, humidity, wet bulb temperature, ventilation, shade, breeze.
- especially check hospitalised cattle and the pens that the sick cattle came from.

Essential observations should be made every day.

Regular observation and action will prevent an animal losing too much condition.

Essential observations to be made every day:

General demeanour – Are cattle resting comfortably, ruminating after feeding, eating, or are some shy feeders. Do any cattle approach the feed trough and then not eat? Are any cattle standing off by themselves or lame, bloated or scouring?

Respiratory rate – Are some animals breathing faster or heavier than normal? Can you hear any difficult breathing?

Respiratory rate is an excellent indicator of heat stress, and the efficiency of feedlot ventilation.

Appetite – Stressed cattle stop eating. Is feed left in troughs in any pens?

Water consumption – Are all cattle drinking? Are all water troughs filling quickly enough?

Dehydration – The level of dehydration can indicate health and condition.

Faeces – Note the shape, colour and consistency of dung.

Urine – Has the urine changed colour or smell?

Eye discharges – These can indicate 'Pink Eye' infections, and may also be a clue to early respiratory infections. Any eye discharge will require immediate investigation and treatment.

Are the animals relaxed and content?

Simple skin pinch test for hydration

Pinch an area of loose skin on the neck of the sick animal.

If the skin immediately springs back to its normal position, the animal is fully hydrated.

If the skin stays up in a little wrinkle for up to 10 seconds and the coat looks dull, and the animal has mildly sunken eyes, the level of dehydration is up to 6%.

If the skin stays in the pinch position for more than 10 seconds and the animal has deeply sunken eyes and a very dry, dull coat, the dehydration will be greater than 6%.

How much water?

If a 350kg steer is 6% dehydrated, it is deficient by about 20 litres of water— about one day's normal water consumption.

Does the sick animal require electrolytes in addition to other treatments?

Any nasal discharges must be attended to immediately.

Dry and mounded dung. Poor feed, low protein?

Feedlot staff must be trained to be effective observers.

Sloppy dung with bubbles. Acidosis?

Nasal discharges – and dirty noses can indicate impending respiratory disease, and should be acted on immediately.

Individual body temperature – in sick animals, an elevated temperature may indicate heat stress or, in sick animals, an infection.

Smell – the smell of dung can indicate acidosis; smell on breath may suggest ketosis in energy-deficient cattle; the smell of ammonia in bedding indicates that it needs to be changed.

Sound – Are any animals breathing with difficulty or coughing, and grunting or teeth grinding (which can indicate severe pain)?

Stocking densities – Overcrowding in a pen may prevent individual animals from eating or drinking or even from lying down and resting comfortably.

The Hospital pen – cattle needing treatment in a hospital pen need to be closely monitored and examined to gain more information. The hospital pen should be well-ventilated and shaded, and have bedding to allow sick cattle to lie comfortably and rest.

Looking at dung

Fresh dung can indicate disease or nutrient imbalances causing digestive upset.

Healthy dung pats are well formed, green to golden colour, and do not have an offensive smell.

Dung that is dry, in balls, or mounded and has a high fibre content generally indicates low protein or energy.

Dung that is sloppy brown or black with an offensive smell may mean acidosis or intestinal upsets. Bloody diarrhoea with an extremely unpleasant smell usually indicates bacterial infections such as *Salmonellosis* or *Coccidiosis.*

Very watery dung causing diarrhoea may simply be the result of indigestion after a change in feed ration, but requires immediate investigation.

Is grain present? The presence of grain shows that feed has passed through undigested. Squeeze the grain particles – starch in the hulls shows that some feed value is not being extracted. The grain may need to be processed or milled more thoroughly, or the diet may require more fibre (roughage) to slow the passage of food down and allow normal digestion.

Fibre particles over about 1–2mm long may indicate that cellulose-digesting bacteria in the rumen are not digesting fibre efficiently. This may be due to poor rumination, low rumen pH (high rumen acidity), or high rates of forage passage. You may need to add more fibre or hay to the diet.

The absence of faeces can be important. Cattle with diseases which stop rumen and gut function (such as Milk Fever or Ketosis) may not produce any dung at all.

Recognising sick animals

- Do cattle come to the feed trough more slowly than normal, and do they eat when at the trough?
- Can all cattle rise and walk? Are they generally resting comfortably and ruminating (chewing cud)?

General signs to look for daily include: appetite, depression, lameness, stiff movements, nasal and eye discharge, coughing, increased breathing rate, panting, mouth breathing, crusted muzzles, sunken eyes, rough hair coat, loose or extra firm faeces, poor abdominal fill, straining to defaecate or urinate, swollen legs.

Sick cattle:

- are depressed and hold their heads lower than normal
- often have a “distant” or disinterested attitude
- tend to hide behind other cattle or stand alone
- usually have less gut fill than normal
- generally have a dry, dull hair coat
- may have soft, repetitive coughing and an increased breathing rate
- may have watery, dull eyes and a clear nasal discharge
- may have stiff movements or shortened stride and drag their toes
- may tuck their tails tightly between their hocks
- may get their tails trodden on and skinned and damaged if they spend much time lying down.

If sick animals are hospitalised, observe the pens they came from extra carefully.

Sick cattle with infectious disease have a rectal temperature at or over 39-40°C


Recognise the signs of a sick animal.


A damaged tail may indictate the animal is sick and frequently lying down.

Maintaining normal rumen function

The rumen needs to be regularly filled with fibre, nutrients and water for good fermentation. The proportion of the different types of rumen microbes depends on the type of nutrients provided in the diet. (Refer also to Module 6 Ruminant nutrition)

- Any change in the ration must be made slowly over 1–2 weeks to allow the microbe populations to adapt.
- When resting, cattle regularly regurgitate food from the rumen for further chewing; this breaks food particles into finer pieces and stimulates salivation. Fibre (roughage) must be eaten every day for rumen function and saliva production. The saliva buffers the pH of the rumen and will help prevent acidosis.
- Simple mistakes such as irregular feeding, or long periods without feed and water, can dramatically upset rumen function and may lead death within 24 hours.
- Rumen dysfunction may cause scouring.


Hungry cattle – long periods without food can upset rumen function.

Developing a preventive herd health plan

A preventive herd health plan is a strategy used to help prevent and treat health disorders in the feedlot. The plan and protocols must be developed in conjunction with a veterinarian.

Planned preventive health programs for the feedlot include:

- Biosecurity – quarantine of new arrivals for at least 14 days, and limiting access of people and animals to the feedlot
- Disease prevention protocols
- Vaccinations at induction – to reduce losses from easily preventable diseases
- Parasite control (internal and external) at induction
- Stress reduction – to minimise stress from factors such as nutrition, handling, transport, and environmental, as well as from disease.
- Stringent regular observation protocols
- Early detection and identification of disease problems
- Formal treatment protocols for anticipated disease problems
- Good nutritional management
- Prudent informed use of hospital pens, antibiotics and other veterinary drugs
- A veterinary drug list
- Withholding periods for each treatment used in your feedlot
- Environmental management – development of good safe facilities, adequate shade, shelter, food and water, ventilation.

Wet bedding and deep dung can allow infections of wounds and result in lameness.

Skin damage from lying in wet conditions for too long.

Treatment Protocols for each health disorder will include:

- List the health disorders routinely encountered in your operation
    1. *Disease in special at-risk groups* – new arrivals, fat cattle, late pregnancy/calving cows
    2. *Disease caused by faulty feeding or feedstuffs* – acidosis, impaction, indigestion, bloat
    3. *Disease caused by faulty handling or faulty facilities* – injuries, wounds, heat stress
    4. *Disease caused by infectious agents* – viruses, bacteria, internal or external parasites
- Develop a list of key symptoms associated with each disorder
- Develop a primary and secondary treatment protocol for each disorder
- Define what drug(s) to use, when, what dose rate, how often, where the injection is given, and the withholding period for the drugs used.

A Veterinary Drug List will be developed by your veterinarian, listing all pharmaceutical products approved for use in your feedlot, including:

- vaccines
- parasiticides (internal and external)
- antibiotics
- anti-inflammatory drugs
- eye preparations
- topical wound treatments and fly repellants
- all other injectable drugs (such as rumen stimulants and vitamins).

This Drug List will list all essential features of every drug staff may use, including:

- drug name – active ingredient and concentration (many brands of the same drug have different concentrations)
- pack size
- storage requirements – air conditioning, refrigeration
- dosage
- length of treatment course, intervals for treatment
- route of injection and injection site
- any warnings or contra-indications on use of this drug (always on the label)
- conditions for which this drug will be used on the feedlot
- record of expiry dates of drugs.

When all of this preparation is complete, feedlot staff will have a document for each potential disease.

Work out out why these animals are suffering from illthrift.

Many disease conditions in feedlots may appear to be similar.

Nutrition, stress and disease

Poor management in feedlots can be the greatest cause of stress.

- All forms of stress build up.
- Digestive upsets and lameness are the most common.
- Poor nutrition and stress both reduce immune responses.
- Reduced immunity allows feedlot disease such as pneumonia to begin.
- Unbalanced nutrition can create diseases such as acidosis and bloat.
- Deficiencies of minerals can cause ketosis, milk fever, transport tetany and other metabolic diseases that cause serious stress.
- Parasites reduce the value of nutrients and reduce performance.
- Environmental stress, such as heat stress, rapidly reduces feed consumption.

Poor nutrition and stress lead to disease.

Common health problems

Clean pens and clean feed.

The main causes of feedlot disease are:

- nutrition – deficiencies or excess
- infections
- injuries.

This section lists the most common feedlot conditions that staff must be able to recognise and understand. It also describes the two most frequent, and economically important, feedlot disease conditions — lameness and non-eaters. For detailed descriptions of other common feedlot diseases, refer to veterinary textbooks.

Nutritionally-based diseases

- **Deficiency of energy** – pregnancy toxaemia, ketosis, fatty liver, poor weight gain or weight loss
- **Excess of energy** – acidosis, rumenitis, polioencephalomalacia, nutritional diarrhoea
- **Deficiency of minerals (calcium)** – milk fever, transport tetany
- **Deficiency of dietary fibre** – indigestion, acidosis, feedlot bloat, inanition, liver abscesses, dietary diarrhoea
- **Excess of rough, unpalatable, indigestible fibre** – impaction, poor weight gain and production
- For female breeding cattle at critical times of stress, such as late pregnancy and calving —ketosis, milk fever, fatty liver syndrome, transport tetany, pregnancy toxaemia.

Steer infected by ephemeral fever (3-day sickness) spread by midges.

Infectious diseases

- Respiratory infections/ pneumonia – runny noses, fever, depression and rapid breathing. Take to sick pen and commence antibiotics as early as possible. Isolate from healthy cattle.
- Bovine Ephemeral Fever (3-day Sickness)
- Foot rot and foot abscess
- Pink Eye
- Diarrhoea (infectious)
- Ringworm

It may be best to slaughter downers before giving expensive drugs.

Stress diseases

- Heat stress
- Transport stress

Injuries and wounds commonly **seen on arrival at feedlots**

- **Lameness** – swellings, small cuts and abrasions.
- **Wounds** – require topical or injectable antibiotics and fly repellants
- **Downers** – If unconscious, emergency slaughter is often appropriate.

If downers are bright and alert but simply weak, they will probably recover, but first make sure there are no fractured bones or other serious injury. Develop a protocol to identify and manage any downer cattle before treatment is applied. Emergency slaughter may be an option before drugs with withholding periods are given.

Foot injurries can quickly develop into lesions unless treated immediately.

Non-eaters (Shy-feeders, illthrift, inappetent)

The most common problem with feedlot cattle in Asia is failure to eat and gain weight. Causes range from nutritional disorders and specific diseases to the stresses associated with travelling long distances. Whatever the cause, non-eaters must be recognised and treated as soon as possible with injectable antibiotics (Sulphadiazine and Trimethoprim), Dexamethasone and vitamins daily for at least three days.

Wounds should be treated immediately.

Lameness and injury

Lameness is probably the second most common problem. It is generally caused by trauma and infections in the hoof or lower leg. Bacteria thrive in the hot, moist and muddy conditions in feedlots, and infect any open wound. Cattle, especially new arrivals, must be handled carefully to avoid any injury. If any open wounds are seen, they must be treated immediately to prevent infection and lameness. Treat wounds and lameness with long-acting penicillin and tolfidine every three days

Acidosis

Acidosis can be caused by many factors. Ruminant digestion naturally produces acids (VFAs), with different feedstuffs resulting in different amounts and rates of acid production. A rapidly digestible feedstuff (e.g. grain or cassava) will produce acid quickly; thus effective fibre (e.g. rice straw) must be fed with this to stimulate rumination and produce enough saliva to buffer rapid acid production.

Feedlot management must always maintain healthy rumen fermentation.

If the acids produced from energy sources are not buffered, the pH of the rumen will slowly drop. Microbes are highly pH specific and so roughage-digesting bacteria will start to die off under the increased acidity.

Most acidosis in Asia is caused when cattle are not given feed. If they cannot eat, they stop producing saliva, but fermentation and volatile fatty acid production continues.

When cattle come off transport, they must be given roughage (and water) as soon as possible so that they will start to buffer the rumen acidity. They will then be able to eat concentrate.

Acidosis is common in feedlot cattle when animals are introduced to high-energy diets too quickly when roughage is too low.

Feeding fibre stimulates salivation and balances excessive production of acid in the rumen.

See Module 6 on Nutrition for more information on the causes and treatment of acidosis.

All cattle from Australia are vaccinated for HS at induction, and blood-tested for brucellosis.

Haemhorragic Septicaemia

Some parts of South-east Asia have an endemic condition known as **Haemhorragic Septicaemia (HS).**
The main risk of infection is when new arrivals of Australian cattle come into contact with local cattle or buffalo. These can carry the infection into the feedlot if security is not satisfactory.
In Indonesia, all cattle are vaccinated for HS at induction to the feedlot.

Symptoms of HS

Immune function is reduced, and cattle show similar signs to pneumonia, with excess salivation, nasal discharge, a painful oedematous swelling under the throat, congested mucous membranes, respiratory distress and eventual collapse.
Temperature is over 40.5°C.
Treatment is best with Micotil 300, as with pneumonia. Anti-inflammatory drugs such as Tolfedine may be required (15 mL/300 kg bodyweight IM).

Pneumonia

Pneumonia is infection of the respiratory tract and is prevalent in Asian feedlots.

Pneumonia in Asian feedlots tends to be mild with minimal signs. Fortunately it is not nearly as severe as the pneumonia (Bovine Respiratory Disease BRD) seen in western feedlots.

The most obvious sign is failure to eat and gain weight—a typical non-eater—and generally the animal will have a temperature over 39.5°C.

Pneumonia should be treated with antibiotics and non-steroidal anti-inflammatory drugs (for example injections of Oxytetracycline and Tolfidine) for at least three days.

Bos taurus cattle under extreme stress can develop acute *Pasturella* pneumonia, which can lead to sudden death. Signs in the dead animal include white foam and fresh blood from the nostrils, with lungs full of blood at post mortem. Prevent by reducing stress.

Note: Further detailed information is available in the MLA Tips & Tools: feedlots: Controlling Bovine Respiratory Disease in feedlot cattle.

Transit tetany

Transit tetany is often seen in cattle transported long distances. Transport Tetany primarily affects well-fed cows in advanced pregnancy, during, or immediately after the stress of a long journey.

Cause

- Drop in calcium and magnesium levels in the bloodstream

Recognition

- Animals may be restless and stagger, or they may appear crazed, rushing around the pen trying to attack people and crashing into walls before falling over.

- There may be partial paralysis of the hindquarters, muscle spasms, excitability and the animal may froth at the mouth and lie down.
- Animals may not be eating and grind their teeth.

Treatments

- Intravenous injections of calcium borogluconate (25% solution at 400–800 mL/cow) or calcium borogluconate with magnesium sulphate (5% solution, same volumes) can be given very slowly.
- Give a third to half intravenous, then the remainder by subcutaneous injection.

Prevention/ongoing management

- Animals in advanced pregnancy should be given dry feed that contains adequate calcium and magnesium for several days before transport.
- Load and handle animals with a minimum of stress and excitement. Avoid overcrowding and poor ventilation.
- If transport time is long, feed, water or rest animals en route.

Fatty liver syndrome and ketosis

Fatty liver syndrome and ketosis are caused by restriction of feed, feeding high-fibre, low-quality roughage or by any upset of the rumen by feed changes, high excitement states or toxic products.

Cause:

- If feed is restricted, the liver starts to convert fat into glucose for the needs of the body. The by-products of this metabolism build up and damage the liver cells while fatty by-products accumulate—resulting in fatty liver syndrome and ketosis.

Recognition:

- Signs are not obvious and animals may seem healthy until they die.
- Signs may include slight depression, loss of appetite, hyper-excitability, lowered faecal output, hard faeces, and teeth grinding.

Treatments:

- There is no specific treatment for fatty liver conditions.
- However, useful therapies may include glucose infusions, glucose precursors and glucocorticoids

Prevention and ongoing management:

- Reduce the severity and duration of any negative energy balance.
- Avoid obese cattle, rapid diet changes, unpalatable feeds, and environmental stress that could reduce feed intake.
- Thin cows can be fed additional energy to increase body condition scores without causing fatty liver, but extremely fat cattle should continue to be fed to prevent fat mobilisation.

The best site to give an injection is not always the most convenient.

Giving injections

Injections are the most efficient way to deliver drugs to feedlot cattle when treating disease.

Injections can be:

- **intramuscular (IM) –** rapid onset and longer duration than IV
- **subcutaneous (SC)** – slowest onset of action and longer duration than IV or IM
- **intravenous (IV) –** fast action, and for fluid infusion.

All IM and SC injections in cattle should be forward of the shoulder—in the neck.

Do not inject cattle in the top of the rump or back of the leg.

- Restrain cattle properly and humanely to reduce movement
- Only give products at the dose, and by the route recommended by the manufacturer.

When injections are not given properly, scar tissue develops due to tissue irritation, and abscesses can form. Injection site lesions in carcases are a major cause of trimming and financial loss.

Tips

- Try not to inject cattle in dirty, wet situations – it increases the chance of infection. Pick an area of clean, dry skin for injection.
- Always follow proper instructions regarding the volume per injection site. When injecting antibiotics, do not exceed 10 mL per injection site.
- When more than one injection is used at a time, they should be least 10cm apart.
- Do NOT mix products together in the same syringe unless the label clearly says so.
- When possible, use products that can be given subcutaneously – they cause less tissue damage.
- Always read the product label before use.
- Store and use products according to label directions only.
- Always check the product expiry date.
- Only use registered veterinary products suitable for cattle.
- If dosage or administration is different to label recommendations, the withholding period may change.
- Use disposable needles and syringes as much as possible. Clean automatic syringes with boiling water, not chemical sterilisers.
- Change any bent or dull needles.

Injection site lesions in carcases are a major cause of trimming and financial loss.

- Needles for subcutaneous injections should not exceed 18mm long
- The best needles for intramuscular injections are 18G x 1½inch (1.2mm x 38mm).

Keep product sterile
Keep the injectable product in the bottle or container sterile.

Make sure that the rubber stopper is clean (wipe it with alcohol on a cotton swab if necessary) before inserting a needle.

Giving intramuscular (IM) injections
- Use the neck in cattle, *not the rump*.
- Draw air into the syringe and inject the same amount of air into the product bottle as you intend to draw product out (if injecting 10mL, inject 10mL of air into bottle before drawing out 10mL of drug. This is especially important in plastic bulk packs).
- After filling the syringe, point the syringe upwards and tap the barrel with your finger to make any air bubbles move up into the syringe tip. Slowly and carefully push the plunger to eject the air bubbles.
- Give intramuscular (IM) injections deep into muscle. Use a 1½ inch x 16 or 18G (38mm x 1.2mm) needle. The needle should enter the skin at 90° to the skin surface.
- Insert the needle, then attach the syringe once needle is in place. Check that there is no blood in the needle by pulling back slightly on the plunger and observing for blood.
- If clear, inject the drug and withdraw the needle. Discard used needles.

Giving subcutaneous (SC) injections
- Preferably use subcutaneous injection when given a choice of IM or SC on the product label. It causes less tissue damage.
- Give SC injections half way up the neck in front of the shoulder in cattle.
- Use a 18mm 16G or 18G needle
- Lift a fold of skin to make a skin 'tent'. Insert the needle through one side of the tent at an angle of 30–45° to the surface. When experienced, you can insert the needle without holding the skin.

Giving intravenous (IV) injections
- Get advice and training from your veterinarian as this is a specialised technique that requires expertise and practice.

Consequences of poor injection technique

- Treatment fails if product absorption is delayed or blocked.
- Drug residues in meat or milk if drug cannot be absorbed and metabolised in time.
- Animal suffers from nerve damage, tissue irritation and abscesses.
- Excessive losses through trimming at slaughter due to abscess, tissue scarring, broken needles.

Tip

The rubber stoppers in product bottles tend to dull needles quickly.

Insert a sterile 'filling' needle through the stopper when giving multiple injections. This reduces contamination of the product.

Read the product label carefully before use

The label of all registered animal health products will include:

- the dosage to be given
- the timing of the administration (when, and how often, to be given)
- the route of administration (IV, IM or SC is most common – but some products require intranasal, topical, intra-uterine, intra-mammary, or oral routes)
- warnings – such as not for use in lactating cows producing milk for human consumption
- indications for use – the disease conditions the product is designed to treat
- withholding times – from both meat and milk
- proper methods of storage and disposal
- expiry date.

Prudent use of antibiotics

Antibiotics may be necessary in feedlot medicine to manage infectious disease, reduce livestock pain and suffering, and to minimise losses due to disease.

Always read the product label before using medication.

Responsible use of antibiotics will minimise antibiotic resistance developing in bacteria and maintain long-term effectiveness of these valuable drugs for humans and livestock.

When using antibiotics:

- use veterinary advice to select the right antibiotics
- establish written protocols for any antibiotic used on your feedlot – include dose, route given, intervals for treatment, length of treatment and frequency of treatment
- treat animals according to your written protocols
- use the correct dose, given by the proper route, for the proper length of time
- treat the fewest number of animals possible
- withhold treated animals or animal products properly
- record the treatment.

When considering treatment with antibiotics:

- Is treatment with antibiotics really necessary? Is the infection bacterial?
- Is this the correct antibiotic, at the correct dose rate, for the correct course? Different antibiotics have different ranges of effect.
- Is there a better treatment alternative?
- What is the withholding period for that antibiotic?
- Is slaughter a better option for this particular animal before drug use?

Antibiotics are not all the same

Antibiotics are given by different routes, in many different formulations, for specific bacteria. The label describes the range of bacteria the antibiotic is effective against.

Oral antibiotics:

- Wherever possible, do not use oral antibiotics to treat sick animals.
- Oral antibiotics generally disrupt the bacterial population of the rumen.
- Oral antibiotics may increase the risk of disease (many bacteria are resistant to some antibiotics).
- Animals that are sick often have depressed appetites and do not eat or drink much.
- Water or feed medication of antibiotics cannot control individual dose rates.

Which injectable antibiotic?

Tetracyclines
Broad-spectrum antibiotics for general purpose use such as wound treatment. Relatively cheap and widely used.

Penicillins
Broad-spectrum for general purpose use such as wound treatment. Cheap, widely used. Several different forms of penicillin. Amoxycillin, benzathine penicillin, and procaine penicillin are the most common but have different absorption rates. Daily treatment is generally required to maintain therapeutic levels with procaine penicillin. Benzathine penicillin generally lasts longer (72 hours). Duplocillin (Intervet) is a long-acting penicillin.

Erythromycin
Broad-spectrum for general use. Expensive, not as widely used. Daily treatment required.

Streptomycin
Streptomycin binds to tubules in the kidney for extended periods.
Streptomycin treatment of food animals is banned in Australia.

Above and below. Drugs kept under refrigeration in lockable storeroom.

Drug security – lockable drug storage and lists of staff with authority to use each drug.

VET PRODUCTS USED AT

PRODUCT	WHP (days)	ESI (days)
Arrest	0	21
Aseptol	0	0
Benacillin	30	30
Calcigol	0	0
Ceton	0	0
Chloromide	0	0
Cydectin	14	14
Debrisol	0	0
Dexapent	10	10
Draxxin	35	35
Engemycin	14	14
Excenel	3	3
Flukare C	21	56
Lectade	0	0
Lignocaine	0	0
Micotil	28	28
Orbenin	0	0
ProGro	0	0
Propen	5	5
Propercillin	5	5
Rhinoguard	14	14
Terramycin LA	42	42
Tolfedine	10	10
Trisoprim 480	28	28
Tympanyl	0	0
Ultravac 5 in 1	0	0
Utozyme	14	14
Virbamec Injection	30	42
Virbamec LV	21	21
Vitamin ADE	0	0
Vitamin B Complex	0	0
Vitamin B1	0	0
Vitamin B12	0	0

A typical list of the drugs and medicines in stock and their withholding periods.

Sulphonamides

Intermediate spectrum of activity. Mainly used to treat bacterial gut infections, respiratory tract and urinary system. Daily treatment generally required.

Neomycin

No real advantage over other available antibiotics, but is a serious residue concern in kidney. Use not recommended.

Short- or long-acting antibiotic?

It is generally desirable to maintain therapeutic concentrations in the body for at least three days. This is achieved with long-acting injections, or repeat doses of short-acting preparations. When deciding, consider the ease of treatment and the residue risk (withholding period). Withholding periods for antibiotics in meat can vary from 3 to 42 days.

Anti-inflammatory drugs

Anti-inflammatory drugs provide stress relief by reducing pain and inflammation that occur with injury and disease. They are often use in combination with antibiotics to quickly reduce fever (body temperature), reduce tissue swelling, and reduce pain and suffering.

All anti-inflammatory drugs are Schedule 4 drugs, with potential for side effects, and should only be used under close veterinary supervision.

Anti-inflammatory drugs are either cortisone drugs (steroids), or NSAIDs (Non-steroidal anti-inflammatory drugs).

Corticosteroids (Cortisones)

These are used primarily to relieve pain and stress and to reduce inflammatory reactions. They help mobilise the body's energy reserves, and are often used in Ketosis or Pregnancy Toxaemia, and even in downer cattle, for that reason.

Non-steroidal anti-inflammatory drugs (NSAIDs)

There is a wide range available for cattle. These drugs block inflammation processes and reduce fever, as well as providing pain relief. They have less potentially serious side effects than cortisone drugs for general use, and are recommended for feedlot use.

The feedlot drug cupboard

Once appropriate treatment protocols have been developed, the feedlot will require a range of **simple drugs and products** for first aid treatment and a range of **specific veterinary drugs** such as antibiotics and anti-inflammatory agents.

First Aid products

Keep stocks of commonly used first aid products. Many disorders are easily treated without using veterinary drugs.

A good selection would include:

- liquid paraffin, 2 litres
- bloat oil such as Tympanyl (Intervet) (vegetable cooking oil or margarine in hot water can be used)
- antibiotic, fly-repellent wound spray such as Cetrigen
- Orbenin® or Opticlox eye ointment
- bicarbonate of soda – 1kg
- vinegar – 5 litres
- Epsom salts – 2kg
- 70% alcohol
- 1% Povidone iodine solution
- 0.5% chlorhexidine disinfectant

Veterinary products

- A range of **broad-spectrum antibiotic injectable solutions** for general purpose antibiotic therapy of wounds and injuries may include short and/or long acting penicillin, oxy tetracycline injectable solution and possibly a trimethoprim/ sulfadiazine solution such as Trivetrin or Trisoprim.
- **Specific antibiotic injectable solutions for bovine respiratory disease** management. These may be Micotil 300 (tilmocysin), for example. Drugs recommended for treatment of pneumonia include: Tilmicosin, Tulathromycin, Ceftiofur, Florfenicol, Tylosin (ASEL v 2.2, December 2008)
- A **non-steroidal anti-inflammatory agent** injection such as Flunixin, Ketoprofen or Tolfidine will allow specific anti-inflammatory therapy of painful, stressful conditions.
- A small supply of **corticosteroid injectable solution** will allow specific treatment for those cattle suffering diseases such as ketosis or pregnancy toxaemia. Corticosteroids also stimulate appetite in some cattle. These drugs must be used carefully under veterinary advice, and must not be used in pregnant females.
- **Calcigol Plus (500 mL packs)** or other calcium/magnesium supplements to treat 'downer' cattle or specific mineral deficiencies. Metabolic diseases such as milk fever (hypocalcaemia) and hypomagnesaemia in calving breeders.

Record the withholding period of all drugs and keep to them.

First-aid products in neat storeroom, with induction drug register.

Record all treatments carefully—the response cannot be measured unless the treatment is recorded!

Drugs and medicines in air-conditioned store room.

Hints for animal health treatments in the feedlot

- Dexamethasone (cortisone) once or twice only for tissue swelling such as lung oedema (difficult breathing), swollen legs and footrot, and nervous diseases, with antibiotics.
- NSAIDs provide the best pain relief.
- Antibiotics all have different actions. Choose correctly for the condition.
- Do not use pneumonia antibiotics for general purpose use.
- Slaughter early before drug treatment if you think drugs will not help. Assume most cattle 'downers' are injuries.
- Avoid over treatment. Treat five days at most before serious veterinary examination is requested.
- Only use drugs at the recommended dosage, for the recommended period.
- Avoid injections into the rump or back legs – these are the expensive meat cuts.

Veterinary products

Keep them in a locked cupboard.

Store them under air conditioning or refrigeration, as per manufacturer instructions.

Keep only products described in your treatment protocols.

The hospital pen

The hospital pen needs:

- good ventilation and shade
- adequate feed and water trough space for all animals
- room with bedding for patients to lie down and rest
- a stock crush for examining and treating sick animals
- a refrigerator or air conditioner for veterinary products

Module 6
Ruminant nutrition

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Ruminant nutrition

This module describes the ruminant digestive system and the nutritional factors for efficient digestion in the feedlot.

The importance of fibre in balancing the digestion of protein and energy is stressed as an imbalance that can lead to acidosis.

Basic feedlot feeding management describes how feed should be presented and how much is needed.

The appendix contains technical information and data.

Contents

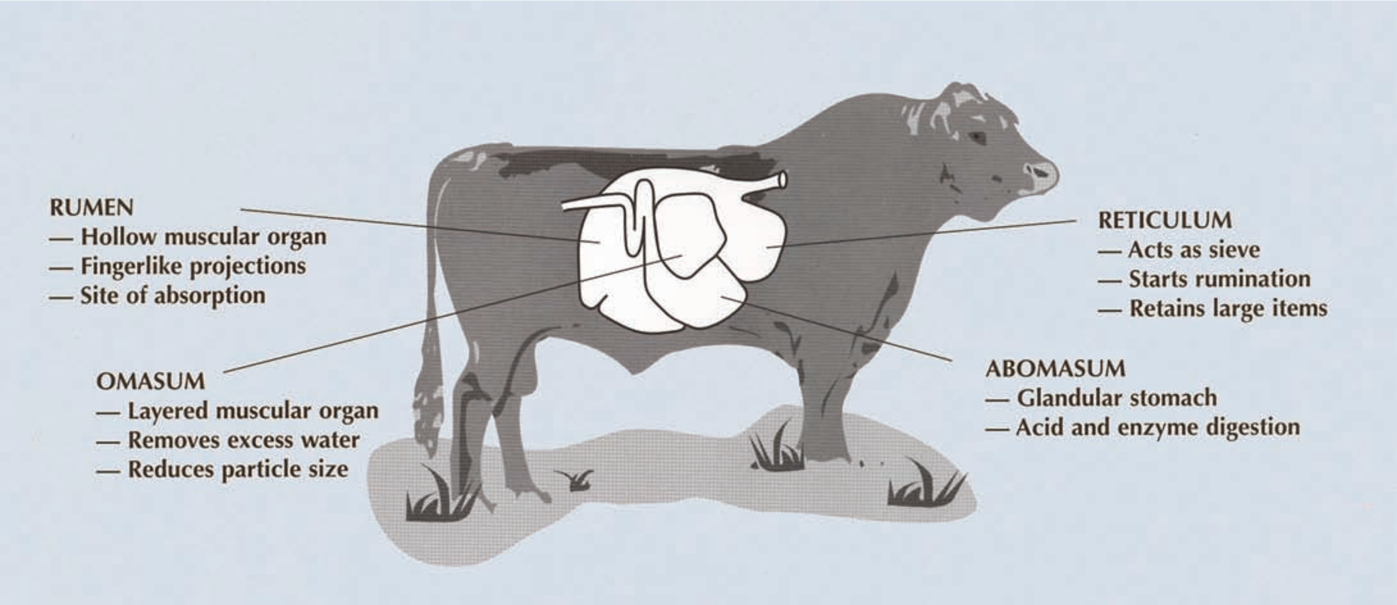
Introduction

Understanding what happens to feed given to cattle in the feedlot helps you to understand what to feed and what to look for if something goes wrong.

The functions of the rumen

The ruminant animal has a digestive system that consists of a four compartments—the reticulum, the rumen, the omasum and the abomasum—each with a special function.

Figure 1 – Digestive system of a bovine



The reticulum has a tough honeycomb-like surface and feels like flexible, durable rubber.

Reticulum – The reticulum is where all material eaten collects. It interacts with the rumen to push (regurgitate) food back up into the mouth to be chewed again—a process called rumination. This rumination is stimulated by long fibres in roughage; chewing grinds down the fibres and promotes the production of saliva.

Rumen – The rumen can be described as a large (up to 120 litres) vat or drum where carbohydrates and proteins are broken down by microbes into usable substrates. It is the largest of the four stomachs with the rumen fluid containing a complex mix of bacteria, fungi and protozoa.

These microbes:

- turn cellulose and starches into volatile fatty acids (VFAs) to be used for energy
- use carbohydrates and nitrogen to make protein for reproduction of new microbes. This microbial protein itself is then digested further down the digestive tract.

Some facts about the rumen environment

The rumen:

- is 85–90% water
- is filled with microbes — bacteria, fungi and protozoa
- is kept at a constant temperature of 38–40˚C
- is mostly anaerobic
- has a relatively stable pH of 5.5–6.5
- is a fragile system.

Rumen microbes can:

- turn inorganic nitrogen into protein that can be used by the animal
- use carbohydrates in cell walls of plants (lignin, cellulose and hemi-cellulose) for energy
- convert starch and roughages into volatile fatty acids for use as energy by the animal
- manufacture B Group vitamins to be used by the animal to metabolise glucose for energy.

The multiplying microbes are themselves digested as protein in the abomasum. Higher microbial populations in the rumen lead to higher energy conversion and so better feed efficiency.

Rumen microbes allow ruminants to digest roughages that cannot be used by humans, pigs or chickens, but the complex digestive system is less efficient than that of the monogastric.

Volatile fatty cids (VFAs) are transferred into the animal's blood stream through long finger-like projections (called villi) on the surface of the rumen. Long villi transport VFAs more quickly and so increase energy efficiency.

The production of VFAs (propionic, acetic and butyric acid) causes the rumen environment to become more acidic unless it is buffered by the animal's saliva. Too fast production of VFA from excess starch will decrease the pH in the rumen rapidly, causing acidosis unless balanced with roughage. If pH falls too low, the villi are burnt and VFAs are absorbed less efficiently.

Omasum – The main purpose of the omasum, with its much folded surface, is absorption of water from the rumen fluid, but some VFAs and electrolytes are also absorbed. Decreasing the water content of the rumen fluid increases the effectiveness of the digestive acids and bile secreted in the abomasum.

Abomasum – The abomasum is the fourth stomach (with the same function as a 'true stomach') and secretes digestive acids and bile. The microbes are digested, and their protein is used by the animal. Fats are broken down to triglycerides which are transported and used throughout the body. Any extra starch that may have escaped the rumen environment is also digested.

Small intestine and large intestine – The intestinal system in a ruminant is somewhat similar to that of a monogastric animal. The small intestine absorbs minerals and proteins while the large intestine absorbs more water along with some VFAs, proteins and minerals.

Healthy rumen lining covered with villi.

Lining of the omasum absorbs water from the rumen fluid.

The common bacteria, protozoa and fungi found in the rumen, and their roles, are detailed in Table 1 of the appendix to this module.

Clean water must always be available. This means having a gravity-fed supply holding enough for water for all animals for at least 2 days.

Raised water tanks can supply essential water even when power is cut.

Saliva

Saliva is the buffer that keeps the rumen fluid at a stable pH of 5.5–6.5. The animal produces about 40 litres of saliva each day when it is eating or ruminating. Saliva contains approximately 0.78% (130 milli equivalents/litre) sodium bicarbonate equivalent to 312g of sodium bicarbonate per day. If an animal stops chewing, it will stop producing saliva and the acid level in the rumen will rise, maybe causing acidosis (see page 9).

Ruminant nutrient balance

The animal's nutrition must be balanced; shortage of any one component will prevent the digestive system from working efficiently. The ruminant animal requires water, energy, protein, minerals, vitamins and effective fibre to function properly. Some fat is needed but too much interferes with fermentation in the rumen.

If the animal does not drink enough water, there is no point in feeding the other components as the animal cannot use these efficiently. If it has water but not enough energy, there is no point in increasing the protein.

Fresh water of good quality must always be available.

Water

Water is not a nutrient but is vital; the ruminant digestive system is 85–90% water. Water is needed for many processes including:

- as a substrate for fermentation
- to transport minerals and metabolites
- for health of all body cells
- to excrete toxic and unwanted substances
- for all homeostatic functions, including blood balance and temperature regulation.

Water quality and suitability for livestock

Cattle in Asia drink about 40 litres per head each day—up to 100 litres on hot days. Fresh clean drinking water must be available at all times; if the animal becomes even slightly dehydrated, it will eat less and so grow more slowly.

Water quality is affected by dissolved salts in the water. If total dissolved salts are higher than 5000 parts per million (ppm), the water should be analysed for mineral salt content to see which mineral is excessive and formulate the ration around that.

You should:

- ensure stock have good clean water available at all times
- have at least two days' supply for the entire feedlot in storage, usually gravity fed
- test drinking water annually for salts content; it should not exceed 5,000 ppm
- clean water troughs at least every second day to keep the water fresh and free of scum and mould.

Energy

All bodily functions, including digestion, require energy. Rumen microbes break down both structural carbohydrates (roughages) and non-structural carbohydrates (such as in maize or cassava) to make energy.

The most useful measure of the energy in a ration is metabolisable energy; this is what is left after energy has been used or lost in gas, dung, urine and heat. (See figure 1)

The body uses energy for different purposes; some for maintaining the body functions to stay alive and some for production—for growth or milk or pulling a plough.

If cattle in a feedlot are being fed enough only for maintaining life but not enough for growth, there is no financial return for all the feed supplied. (Refer to Tables 6 and 7 in the Appendix.)

The most effectively used source of energy for a ruminant animal is starch. Starch digestion yields volatile fatty acids that are used efficiently by the animal.

As too much starch leads to high acid levels, care must be taken when providing feeds (such as corn, pollard, cassava, potato waste and noodle waste) that are high in starch. Adequate effective fibre must be fed to stimulate rumination, balance the pH in the rumen and to prevent acidosis.

Feeds high in cellulose (rice straw, corn stalk and kings grass) encourage rumination and so decrease the chance of acidosis. Not all cellulose is the same; palm kernel meal may be high in cellulose but does not promote rumination (see section on fibre below).

VFA digestion

VFAs supply about 70% of the animal's energy requirements. The three main volatile fatty acids are:

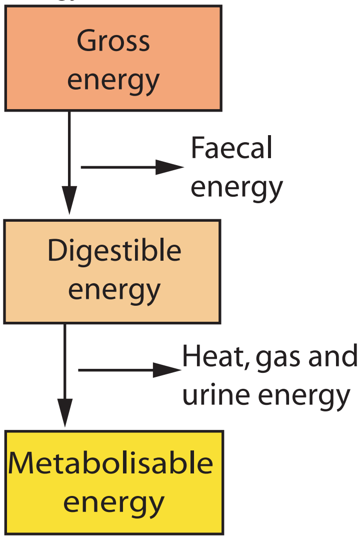
- propionic acid – the most efficiently used, made from starch digestion
- butyric acid
- acetic acid – the least efficiently used, made from fibre digestion.

These acids are absorbed through the lining of the rumen and are then transported to the liver to be used for various functions in metabolism.

Fat digestion

Fats are digested mainly in the abomasum where secreted bile salts, enzymes and acids break them down into triglycerides. Triglycerides are transported and used in the body for storage or in cellular metabolism.

Figure 1. Schematic path of energy use



Tapioca chips are high in digestible energy and must be balanced with digestible protein. They must be milled (below) so that they mix well in the ration.

Milled tapioca chips.

Protein meal in store.

Protein

The four main sources of nitrogen in ruminant nutrition are true protein, non-protein-nitrogen (NPN), microbial protein and bypass protein. Proteins are made up of amino acids which are utilised as building blocks throughout the body; they vary greatly in structure and function.

Feedstuffs vary greatly in protein digestibility. Grains and most protein supplements have high protein digestibility (75–85%), lucerne has about 70% protein digestibility, while grass hays have 30–35% digestible protein. Aging and weather damage lower protein digestibility.

When reading the analysis of the protein content, check the metabolisable protein and not just the total protein. A high total protein may be misleading if the digestibility is low, for example, copra and palm kernel meal (PKM) are similar protein content but copra is 55% digestible whereas PKM is 48%. Nitrogen deficiency in the diet reduces production of microbial protein which, in turn, will decrease rumen efficiency. Thus a protein deficiency may result in an energy deficiency because the microbes cannot maximise fermentation. As little metabolisable protein is stored in the body, it must be fed continuously to be available.

True protein refers to the protein in natural plant feed stuffs such as soy bean meal and palm kernel meal.

Protein meal.

Bypass protein is true protein that passes through the rumen to be digested in the abomasum. A protein will become bypass protein depending on its amino-acid structure and digestibility, and the rate of digesta flow. High levels of tannin can protect the amino acids from digestion. Ruminants digest about 30% of their protein as bypass protein.

Non-Protein Nitrogen (NPN). Ruminants can make protein from non-protein nitrogen sources—commonly urea or ammonium sulphate. The nitrogen is converted to ammonia in the rumen, and the microbes combine the ammonia with an energy source in order to reproduce. If the ammonia cannot be used by the microbes because there is insufficient energy, it is absorbed across the rumen wall into the blood stream. If the blood ammonia level becomes too high, the animal will die quickly of what is commonly termed ‘urea toxicity’ or ‘ammonia poisoning’.

Microbial protein refers to the bodies of the microbes themselves. Microbes multiply at an enormous rate, have a short life and pass in the rumen fluid into the abomasum for complete digestion and absorption in the small intestine. Microbial protein can supply 50–100% of the animal’s protein requirements, being the best source for ruminant digestion as it closely mirrors cattle amino acid requirements.

Minerals

Minerals are used mainly for structural purposes and as catalysts for enzymatic reactions. They are required for growth, maintenance and production. Deficiencies of different minerals can cause specific diseases; for example, a selenium deficiency may cause 'white muscle' disease.

There are two main categories of minerals—macro and micro. Macro minerals, such as calcium, phosphorus, magnesium, sulphur, potassium, sodium and chloride, are required in considerable quantities (Table 2 of the Appendix). The micro minerals (trace elements) include cobalt, copper, manganese, selenium, iodine, zinc and iron, and are required in comparatively small amounts (Table 3 of the Appendix).

The functions and daily requirement of macro and micro minerals can be seen in Tables 2 and 3 of the Appendix to this module.

Mineral lick block.

Vitamins

Vitamins are implicated mainly in immune, hormonal and nervous system reactions at a cellular level, and may be fat-soluble or water-soluble.

The fat-soluble vitamins (A, D, E and K) are stored in the liver and/or adipose tissue of the body for later use; the B group vitamins are water-soluble. B group vitamins do not generally need to be supplemented as the rumen microbes generate adequate amounts. However, water-soluble vitamins, particularly thiamine, may be given in times of stress such as entry into a feedlot.

The fat-soluble vitamins may be given as a supplement if the cattle have been off green feed for a long period, although cattle store them in their adipose tissue for 3–6 months.

The functions of the various vitamins are shown Table 5 in the Appendix.

Fibre

Fibre is the structural carbohydrate in plant cell walls. Fibre consists of both digestible (hemi-cellulose) and comparatively indigestible fractions (cellulose and lignin). All plant feed contains fibre but it varies in digestibility and therefore function in the diet. The fibre in palm kernel meal is slowly digested but does not stimulate rumination like the effective fibre of rice straw and kings grass. Grains such as crushed corn have limited fibre although it appears in a chemical analysis.

Effective fibre.

Ration with no effective fibre.

Fibre is less effective if chopped too long as cattle have to chew it excessively, slowing their intake.

Fibre is described with regards to its effectiveness and the amount of neutral detergent fibre (NDF) or the amount of acid detergent fibre (ADF) present. (ADF is not often referred to in practice.)

- **Effective fibre** – effective fibre causes the animal to ruminate. To be effective, the fibre must be 2.5–3cm and have a scratchy feel (see also page 13).
- **Neutral Detergent Fibre (NDF)** – refers to the entire cell wall of plant material containing hemi-cellulose, cellulose and lignin. NDF determines feed intake by the animal.
- **Acid Detergent Fibre (ADF)** – refers to the cell wall portion containing only cellulose and lignin and determines digestibility.

For healthy ruminant animals to regurgitate and re-chew their food, they require effective fibre in their diet at all times. This effective fibre scratching on the rumen wall causes the animal to ruminate and so stimulates saliva production.

Feed in the top photograph has good effective fibre; feed in the middle photograph figure has no effective fibre, will not stimulate rumination and will inevitably lead to acidosis. Fibre in the bottom photograph is too long so that the animals have to chew it excessively

Key points

- Cattle must have a constant supply of good clean water available at all times.
- Energy is generally the most limiting factor in a fattening ration. Ruminants cannot use protein efficiently unless there is adequate energy.
- The best diet has a combination of different protein sources—true protein, bypass protein and microbial protein.
- Non-protein nitrogen (urea or ammonium sulphate) provides ammonia. Ammonia can be used by rumen microbes if there is an adequate source of energy (starch).
- With too much ammonia and not enough starch, the animal may die from urea toxicity.
- With too much starch and not enough protein, the animal may die from acidosis.
- Minerals are needed for structural health such as bones, teeth, blood
- Vitamins operate in metabolic, immune, hormonal and nervous functions.

Balancing energy and protein

Factors that affect where protein is digested include:

- speed of flow of digesta – the longer the food is in the rumen, the more likely it is to be digested and not bypass the rumen
- the quality of the protein – different protein sources have different digestion rates; slowly-digested proteins need to stay in the rumen longer. For example, palm kernel meal (PKM) is of lower quality than soybean meal.
- pH of the rumen fluid will affect protein digestibility. Acidic fluid is less efficient, allowing more protein to pass through.
- the amount of starch in the rumen affects protein digestibility. Protein digestion is more efficient with a higher starch content, but too much starch reduces protein digestion because of increased acid levels.

It is important to get the ratio of protein to energy correct when formulating rations. For maximum microbial protein synthesis, carbohydrate and protein degradation must occur simultaneously. Using NPN as the protein source in a high starch diet matches the speed of starch digestion and so maximises microbial protein synthesis.

High levels of NPN must not be fed on a diet of roughage or one lacking in starch. As roughages generally have slow energy release and the ammonia is released quickly, there will be insufficient energy available to utilise the ammonia. Ammonia gas can then escape into the blood and cause ammonia poisoning or urea toxicity.

Acidosis

Acidosis occurs in feedlots throughout the world and can be caused by a number of factors. Ruminant digestion naturally produces acids (VFAs), with different feedstuffs resulting in different amounts and rates of acid production. A rapidly digestible source of starch (i.e. grain or cassava) will produce acid quickly; thus enough effective fibre (e.g. rice straw) must be fed with it to stimulate rumination and produce enough saliva to buffer this rapid production of acid.

If the acids produced from energy sources are not buffered, the pH of the rumen will slowly drop. Microbes are highly pH-specific and so roughage-digesting bacteria will start to die off under the increased acidity. One microbe (*Streptococcus bovis*) thrives in an acid environment but it produces more acid (lactic acid) and thus speeds up the decrease in pH.

Some cattle are hanging back from the trough; this could indicate sub-acute acidosis.

Acidosis in Asia is generally caused when cattle are not given feed. If they cannot eat, they stop producing saliva, but fermentation and volatile fatty acid production continues.

Cattle coming off transport must be given roughage as soon as possible so that they will start to buffer the rumen acidity. Then they will be able to eat the concentrate.

Acidosis can be acute or sub-acute.

Acute acidosis is severe and can lead to death. At this stage, the animal needs to be taken out of the pen, given a probiotic to get the bugs in the rumen active again and fed digestible roughages. Concentrate feeds should be added back into their ration only slowly and they need to have as much highly digestible forage as possible to get them back on their feet.

Sub-acute acidosis is harder to diagnose and may only be evident through depressed intakes or low weight gains. It must be prevented as it will significantly decrease production. If rumen pH drops below 5.5, the animal's ability to digest feed will decrease.

Above and below. Signs of acidosis – watery dung and bubbles of gas.

Watery dung and bubbles of gas.

Signs of acidosis – not eating, tucked up and standing on the backs of the front feet.

Clinical signs of acidosis

Signs of acute acidosis:

- animals go off feed
- dung is watery and may contain bubbles and mucus
- cattle stand on the backs of their hooves to take pressure off sore toes and may appear lame
- cattle appear tucked up from being off feed
- low body condition score and losing more weight
- excess salivation and licking anything in yard
- kicking at their abdomen and showing general signs of discomfort
- liver abscesses in post-mortem.

Signs of sub-acute acidosis:

- depressed feed intake
- depressed weight gains
- lower feed conversion efficiency
- uneven dung consistency
- lethargy
- panting
- excessive salivation.

Long periods of acidosis will damage the liver and so decrease digestive capacity. The rumen wall becomes swollen and greatly damaged reducing the absorption of VFAs and ammonia.

Preventing acidosis

To prevent acidosis, the following factors should be checked:

- *Balance starch, protein and roughage intakes*. For example, a source of highly fermentable starch (such as raw cassava) should be complemented with a rapidly degradable source of nitrogen such as urea. Consider using feed such as sawit to dilute the starch and feeding some effective fibre.
- *Use probiotics or yeasts* to turn lactic acid into propionic acid which the animal can use for energy while increasing the pH of the rumen.
- *Introduce the feed slowly* (typically over a period of about two weeks) and do not make sudden changes in the ration —microbial populations are quite pH-specific and will populate effectively if pH remains fairly constant. Changing feeds rapidly will result in rapid changes in pH which will kill off the current microbes.
- *Deliver feed consistently*. Animals should have feed available to them at all times. Animals without feed in front of them all the time will not be ruminating or producing saliva to buffer the pH.
- *Have sufficient chemical and effective Neutral Detergent Fibre* (NDF) in the ration. Without enough physically effective fibre in the diet, the animals will not ruminate or produce saliva to buffer rumen pH.
- *Reduce stress.* Stress causes animals to go on and off their feed. Stressed animals will stop drinking and thus eating. This reduces rumination and salivation, resulting in acidosis.

Cattle resting and ruminating well – and healthy.

Healthy cattle lie down and ruminate after a good feed of effective fibre.

Key points

- Protein and energy intakes must be carefully matched for efficient digestion and production.
- Too much starch without nitrogen can generate acidosis; too much NPN will kill the animal with urea toxicity.
- Too much protein and not enough energy will waste expensive protein.
- Cattle coming off transport must be put on a roughage diet first.

Basic feedlot feeding management

Nutrient requirements and feeds

Feed fibre before the concentrate.

Fresh supplies of feed in a well-managed store.

This section looks at some basic management practices for a successful feedlot. It includes:

- induction and what to look for
- electrolytes
- feeding roughage before concentrate
- the importance of chop length
- mixability
- freshness and storage of feed
- calculating how much to feed.

Induction and what to look for

When new cattle are starting onto a feedlot ration, their diet must be changed slowly. The cattle arriving from Australia will have been fed on a maintenance ration of pelleted hay while in the assembly depot and on board the ship, and must be introduced to the new fattening ration slowly.

On arrival, they should be fed roughage followed by a starter diet for a minimum of ten days; once they have adjusted, the ration can be changed to the finisher diet slowly over the next week.

Watch for cattle that are not eating, have runny dung, look 'hollow' or are suffering from ill thrift. If any of these symptoms are seen, the animals must be pulled out and put in a separate pen for closer management.

Feeding roughage before concentrate

Rumen pH must be stable for maximum rumen efficiency. If animals eat or are fed concentrate first, they will produce little saliva and therefore the rumen will be more acid. By feeding the roughage first, the cattle will already be producing saliva to balance the concentrate portion of their diet.

Chop length of roughage

Roughage should be cut to a correct length of between 2.5 and 3cm for adequate rumination. If the chop length is too long, the animal must chew more to break it and so decrease its feed intake. If chop length is too short, it will not stimulate rumination.

Mixability

The ration must be mixed to be uniform and free-flowing with no large lumps of any one component—especially when feeding urea which can potentially be toxic. If the ration is not mixed well, change the mixing blades or the entire mixer.

Freshness and storage of feed

Old and wet feed will grow moulds, especially in the warm and humid tropics. Although most moulds may only decrease intake, but some can produce mycotoxins that can be fatal. Fresh feed is particularly important in breeding herds.

This roughage is too long for animals to eat easily.

Electrolytes

Electrolytes are salts of Na, Cl, K, Ca and Mg; they help animals recover faster from the stresses of shipping and transport to yards for fattening, and from the yards to slaughter. Electrolytes pull water into the cells, effectively rehydrating the animal faster and with less water than drinking plain water. They help maintain weight and efficient digestion.

Animals that are more hydrated at a cellular level urinate less in the truck, reducing slipping and bruising, and are also more relaxed. Electrolytes can encourage the animals onto feed within 12 hours after arrival at the feedlot rather than within a couple of days.

At slaughter, carcass weights of animals given electrolytes have been as much as 2% higher than untreated cattle because the meat is more plump by water in the cells. This also increases meat tenderness and decreases dark cutting caused by stress and rapid glycogen loss.

Stale feed with large mouldy lumps.

The energy and protein contents of some common feeds in SE Asia are shown in Table 4 in the Appendix. Check whether the energy is coming from the fat, starch or fibre portion of the feed.

Tables 6 to 9 in the Appendix summarise guidelines set by the Nutrient Research Council (an American-based research body that provides the industry standards). Note that the values given here are guides only and may be different for the climate and feeds available in Asia and for different classes of cattle. Consult your nutritionist or agricultural consultant before feeding based on these tables.

Key points

- Cattle should always have feed available.
- Feed roughage before concentrate when they cannot be mixed together.
- Introduce new feed slowly and monitor cattle for bloating and acidosis.
- Monitor the animals' faeces regularly. Liquid dung or dung with bubbles or mucous is a good indicator of acidosis.

It is difficult to regulate the turn-over of fresh feed in an untidy store.

Old feed in the trough means too much was fed out.

When is it coming? Hungry cattle waiting for late delivery of feed.

A white board is used to see what each pen is being fed, the number of cattle in the pen, and how many days they have been there.

Calculating how much to feed

Feed volume must be monitored per pen so that animals get enough feed to reach their production potential but without wastage. The troughs (bunks) should be monitored every day for a light covering of feed.

If the bunk is empty, the animals are not getting enough feed; if there is enough feed to be shovelled out, the cattle are either being fed too much or are rejecting the feed for some reason.

The top photograph shows that the cattle were fed too much as there is still feed in the trough at feeding time. The middle photograph shows that the cattle were not fed enough; their trough is empty and they are looking for feed.

Calculating feed intake

Potential intake per head per day for your livestock should be determined based on certain values.

- average animal weight – 400 kg
- NDF of the diet is 30% dry matter basis
- dry matter of the diet is 70%
- 0.011 is a standard fixed value (= 1.1% of body weight)

A guide for determining approximate feed intakes is:

Average body weight (kg) x (0.011/NDF) = kg of possible intake of dry matter per head

Therefore: 400 (kg) x (0.011/30%) = 14.66 kg of dry matter

If the dry matter content of the diet is 70%, the animals will eat 14.66 kg / 70% DM = 20.8 kg per day.

(See also Appendix Table 10)

Key points

- Monitor troughs each day to make sure all cattle are being fed the correct amount.
- Clean troughs every day to remove any mouldy feed.
- Feed only high-quality raw materials.
- Mix the feed thoroughly so that there are no large lumps of any ingredient.
- Chop the forage to 2.5–3cm lengths.
- If feeding a split ration, feed the roughage first.
- Change the diets gradually during induction, and monitor the animals cattle closely.

Appendices

Table 1 – Common bacteria, protozoa and fungi found in the rumen

Bacteria	*Ruminococcus flavefaciens* *Fibrobacter succinogenes* *Ruminococcus albus*	Strict anaerobes, tolerate a narrow pH range of 6–7, fibre digesters, mostly produces acetic acid.
	Streptococcus bovis	Tolerates pH of below 5, produces lactic acid, acetic acid and ethanol.
	Megasphera eldensii	Lactic acid utiliser.
	Succinomonas amylolytica *Selenomonas ruminantium*	Starch digesters, produce acetic and propionic acids, tolerates a lower pH range but not as low as *S. bovis.*
Protozoa	*Isotricha* *Dasytricha* *Entodinium* *Diplodinium* *Epidinium* *Ophryoscolex*	Can be up to 50% of microbial mass, digest starch and sugars mainly, some will digest cellulose and pectins producing VFAs, they work by engulfing feed particles and bacteria for further digestion, used as protein for the animal.
Fungi	*Neocallimastix* *Piromyces* *Caecomyces* *Orpinomyces*	Mostly used in fibre digestion, can free carbohydrates from lignin for digestion. Populations are inhibited by bacteria.

Table 2 -Macro minerals and their functions

Mineral	Requirement per head per day	Function
Calcium (Ca)	25–35g	Nearly all intake calcium is used in bone and teeth strength and growth; muscle contractions; membrane permeability; blood clotting; milk production; hormones and enzymatic reactions.
Phosphorus (P)	15–20g	Bones and teeth contain 80% of the P in the body. P is required for growth; DNA synthesis; reproduction and lactation.
Magnesium (Mg)	0.1% of ration dry matter.	Mg is implicated in nerve, muscle and bone growth and control; and in milk production.
Sodium (Na)	0.06% of ration dry matte	Cattle have a low requirement for salt but will eat it freely. It is involved in water balance.
Potassium (K)	0.6% of ration on a dry matter basis	K is a major cation in intracellular fluid and is involved in acid base balance; water balance; nerve impulses; and enzymatic reactions.
Sulphur (S)	0.15% of ration on a dry matter basis	Needed in amino acid formation; fungal growth; fibre digestion.

Table 3 - Micro minerals, requirement (mg/ha/day) and functions

Mineral	Requirement mg/head/day	Function and levels required per head per day
Iron (Fe)	500	Fe is used for oxygen transport in the blood, immune system, enzyme reactions, protein metabolism, electron transport.
Manganese (Mn)	400–1000	Mn is found in the brain and nervous system; enzyme activation particularly for carbohydrate, proteins and fats; bone strength; biosynthesis of choline; and enables body to use thiamine and vitamin E.
Zinc (Zn)	500	Zinc is used in vitamin A metabolism; protein, carbohydrate and nucleotide metabolism; bones; wound healing; enzyme function; immunity through hormone system; and is a key component of insulin, testosterone and adrenaline.
Iodine (I)	5	Iodine is required for thyroid health and function; enzyme function for thermoregulation, growth, reproduction and circulation; muscle function; and hormone function, particularly reproductive.
Copper (Cu)	100	Cu is needed for oxygen transport in blood; enzymatic reactions; hormone function; formation and maintenance of tendons, ligaments, bones; aids in the absorption of iron; coat health and pigmentation.
Selenium (Se)	3	Se is essential for immune function and muscle integrity including prevention of white muscle disease.
Cobalt (Co)	2.5	Co is required for B12 formation in rumen; nervous system integrity; protein, carbohydrate and fat metabolism; and red blood cell synthesis.

Adapted from Ewing et al, 2008.

Table 4. Functions of the vitamins

Vitamin	Function
A	Required for integrity of epithelial cells (skin, eye, lining of the gastrointestinal, respiratory, urinary and reproductive tracts) and to fight toxins, organisms and infections that invade the body.
D	Implicated in calcium and phosphorus metabolism. Its main actions are to increase the absorption of calcium and phosphorus from the intestine, and to aid in controlling the rate of movement of minerals into and out of bone. It is involved in bone density and strength, thus preventing rickets and also for expression of oestrus in breeding cattle.
E	Associated with selenium and each can compensate for the other in the fight against free radicals in the body. Vitamin E and selenium help with immune system function. Vitamin E is also important in the structure and function of muscles, preventing ‘white muscle disease’, and in decreasing the incidence of mastitis, metritis and retained placentas. Vitamin E supplementation also helps with meat quality characteristics, mainly colour, tenderness, storage longevity and it decreases lipid oxidation which gives the meat an undesirable taste and appearance.

Table 5 – Common feedstuffs in Asia and some of their characteristics.

Feed stuff	Protein (%)	Energy (MJ/kg)	Comments
Onggok (cassava by-product)	1.5-2.5	10-12	Low in starch and fat; a safe feed; medium palatability.
Cassava	2.5-3.5	12.5-13	High in rapidly fermentable starch; will cause acidosis; low protein; medium palatability.
Pollard	17-19	10.5-12	High starch, medium protein; highly palatable and can lead to acidosis if fed too much.
Brewers grains	15.5-16.5	12-13	Usually about 30% dry matter; medium starch, fat and protein; fairly safe and high palatability.
Rice bran	15-16	10-11	High fat, medium protein and high energy although energy mostly from oil.
Corn	8-10	11-12	High in starch so watch for acidosis; low protein; low oil; very palatable; best cracked rather than crushed.
Sawit Palm kernel meal	14.5-19.6	10.5-11.5	Medium palatability; careful with high oil content; medium protein; low starch, so safe.
Copra	18-22	12-14	High palatability; medium oil content and protein; low starch, so safe.
Soybean meal	45-48	11.5-13	Fat may depend on process; high palatability; high protein quality; medium starch.
Rice straw	3-4	6-7	Very good effective fibre; can have mycotoxins,
Green chop	7-8	10-11	Highly effective fibre; high moisture; needs to be cut at about 2.5–3 cm long; low protein.
Corn bran	8-9	9-10	High fibre; low starch; palatable.
Rice hulls	3-4	4	High fibre; low starch, protein and energy.
Cocoa hulls	10-12	9	High palatability; high fibre; low starch.
Coffee hulls	10-12	5	Lower palatability; high fibre; low starch.

Table 6 – Nutrient requirements for maintenance in beef cattle

	Body weight (kg)	200	250	300	350	400	450
Metabolisable energy	MJ/day	17.15	20.25	23.22	26.07	28.8	31.46
Crude protein	g/day	202	239	274	307	340	371
Calcium	g/day	6	8	9	11	12	14
Phosphorus	g/day	5	6	7	8	10	11

(NRC 7th Edition, 2000)

Table 7 – Nutrient requirements to achieve 1.5kg of gain in beef cattle above maintenance requirement

	Body weight (kg)	200	250	300	350	400	450
Metabolisable energy	MJ/day	17.74	20.96	24.02	26.99	29.9	32.59
Crude protein	g/day	441	440	442	432	391	352
Calcium	g/day	39	36	33	30	27	25
Phosphorus	g/day	16	15	13	12	11	10

(NRC 7th Edition, 2000)

Table 8 – Nutrient requirements for a replacement heifer through pregnancy (mature wt 545kg)

Months since conception		1	2	3	4	5	6	7	8	9
Metabolisable energy	MJ/kg	4.23	4.23	4.33	4.33	4.42	4.51	4.69	5.06	5.52
Crude protein	% DMB	7.23	7.2	7.2	7.22	7.31	7.5	7.85	8.45	9.46
Calcium	% DMB	0.24	0.23	0.23	0.22	0.22	0.22	0.31	0.3	0.3
Phosphorus	% DMB	0.18	0.18	0.18	0.18	0.18	0.17	0.23	0.22	0.22

DMB = Dry matter basis (NRC 7th Edition, 2000)

Table 9 – Nutrients required for a beef cow milking 8 litres of milk (mature weight 545kg)

Months since parturition		1	2	3	4	5	6	7	8	9	10	11	**12**
Metabolisable energy	MJ/kg	9.0	9.2	8.8	8.7	8.4	8.2	6.9	7.0	7.3	7.5	8.0	8.7
Crude protein	% DMB	10.1	10.7	9.9	9.3	8.5	7.9	6.0	6.2	6.5	7.0	7.7	8.8
Calcium	% DMB	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3
Phosphorus	% DMB	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2

(NRC 7th Edition, 2000)

It is important to understand the types of protein and energy used to reach recommended values. You cannot reach the energy value using all fat or all grain, similarly with protein. Consult a nutritionist before formulating any rations.

Table 10 – Example for a pen whiteboard for showing how much each pen is being fed, the number of cattle in the pen, and how many days they have been there.

Pen Nomor				
Shipment				
#Ekor/pen				
	Rumput		Concentrate	
	kg/Ekor	Bagasi	kg/Ekor	Bagasi
Total/day				
Pagi				
Sore				
Malam				

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Glossary

Acid Detergent Fibre (ADF) – cell wall portion containing only cellulose and lignin. ADF helps to determine digestibility.

Acidosis – a disorder caused by a drop in pH in the rumen of an animal.

Adipose tissue – fatty tissue carried either in the muscle, around the muscle or in the abdominal cavity.

Cellulose – is the structural component of the primary cell wall of green plants.

Bunk – term commonly used in Australia for the feed trough

Dry Matter Basis (**DMB) –** means the amount of any given nutrient in a 100% dry substrate, as there is no variation with different moisture levels, DMB gives a more even analysis.

Enzymes – proteins that speed up or slow down chemical reactions

Fermentation – chemical reactions induced by living organisms that split complex organic compounds into relatively simple substances.

Hemi-cellulose – similar to cellulose but less rigid in formation.

Ill thrift – generally cattle that are not feeling 100%.

MJ/kg – megajoule per kilogram is the unit used to determine energy in feeds and also requirements.

Monogastric – animal with only one main site of digestion e.g. humans, pigs, chickens.

Morbidity (Morbid) – illness or ill thrift.

Neutral Detergent Fibre (NDF) – refers to the entire cell wall of plant material containing hemi-cellulose, cellulose and lignin. NDF helps to determine feed intake of the animal.

Permeability – the rate of flow of a liquid or gas through a porous material such as through the stomach wall.

Roughage – the indigestible portion of plant foods that pushes food through the digestive system, absorbing water and easing defecation. Roughage referred to in this module include rice straw and Taiwanese Kings grass. Superior types of elephant grass include: Taiwan (*Pennisetum purpureum* cv. Taiwan A-144) and King Grass (*Pennisetum purpureu*m x *Pennisetum americanum*).

Ruminant – animal with a four-compartment stomach and that regurgitates to re-chew its food.

Rumination – the act of bringing food back up the oesophagus for re-chewing, mixing with saliva and re-swallowing it.

Synthesis – formation of a compound from simpler compounds or elements.

VFAs – volatile fatty acids, energy substrates formed in the rumen from fermentation. Cattle use VFAs for energy to grow and to maintain their systems.

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Module 7
Feedlot management

Module 7
Feedlot management

Management of the cattle and their feeding and welfare within the feedlot are components of basic animal husbandy.

Of equal importance to the business is how the whole feedlot operation is run. This module describes management processes for the whole enterprise.

Contents

Feedlot management

The feedlot manager specifies the type of animals needed to meet the local market. After induction, these cattle have to be fed to reach the targeted market weight.

Acceptable levels of 'performance' to produce the desired outcomes include:

- liveweight gain
- sale weight
- carcass quality
- selling price
- profitability in the feeding phase and subsequent sale for the owner of the cattle
- profitability in the feedlot enterprise carrying out the feeding exercise

These outcomes are achieved by combining programs for nutrition, animal health, feedlot operations and general feeding management.

Feedlot management will determine:

- liveweight gain
- sale weight
- carcass quality
- selling price

Nutritional programs

The detailed aspects of this program are described in Module 6 (Ruminant Nutrition)

Typically, the feedlot manager will consult a feedlot nutritionalist (experienced in feeding programs in tropical environments and *Bos indicus*-derived cattle) to develop a feeding program to meet the objectives.

The feeding unit is generally a stand-alone section within the enterprise and undertakes the day-to-day operations of the feeding program.

Each feedlot will integrate a range of site-specific considerations including:

- fresh feed (hygiene in feed stores and pen bunks)
- feeding requirements (types of cattle, complexity of diets)
- ration mixes
- mixing times and consistency
- frequency and timing of feeding
- mechanical and other delivery to pens

Ration delivery

Ration delivery: the correct amount of feed must be delivered on time each day.

The cattle should be fed controlled amounts of feed over a 24-hour period with the feed-out occurring systematically in the same way around the feedlot each day.

This means that the ration ingredients have to be loaded accurately into the mixer truck, mixed and ready to be delivered at the correct time.

Animal health management

The feedlot will have developed an animal health management program that best addresses its cattle program (See Module 5 Animal Health).

The animal health unit is part of the livestock department of the feedlot and will have the day-to-day responsibility for managing all aspects of the program and implementing the best practices to minimise problems of animal health.

Animal husbandry practices

Each feedlot will develop its own practices based on:

- type and characteristics of incoming cattle
- feeder cattle programs
- geographic location
- site-specific characteristics
- feedstuffs available
- feeding programs

Daily husbandry practices include

- pen walking – all cattle should be inspected at least once every day—more frequently with higher stocking densities or if the animals are of higher risk, for example new arrivals or from age

Routine husbandry practices include:

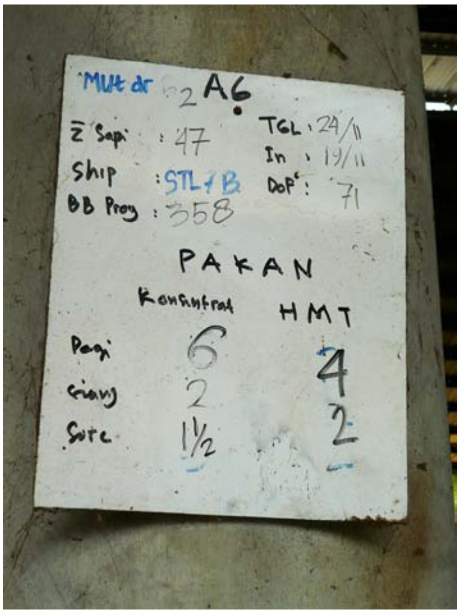
- induction and health protocols
- weighing and sorting animals
- monitoring animal health and treatments
- movement for pen cleaning

Moving animals from a pen and other routine husbandry practices should be scheduled to minimise the time away from feed and water, and to reduce any stresses from handling and groups mingling together again.

Health problems should be treated quickly but the animals need to be given a chance to respond. If they do not respond quickly, a decision has to be made about further treatment in a hospital pen or disposal for sale. This decision will compare the value for sale against the cost of treatment. If the animal is sold, it will not incur treatment costs, will not have to be held and fed in a hospital area where it might lose condition and weight. However, its sale might be restricted because there is a withholding period from drugs used in the early attempted treatment.

(Further described in Module 5 Animal health in the feedlot)

How good is the management of your staff, your infrastructure, your livestock and your business?



Rudimentary instructions for feed mix.

Cattle performance outcomes

A database of the results of the feeding performance for each cattle category should be developed; over time, this will be used by the business to allow:

- reliable budgeting and calculation of the economics of feeding
- evaluation of the feed rations for each category of feeder cattle
- calculation of performance of different categories of feeder animals
- calculation of costs of the weight gain

Feedlot management

Besides the programs for feeding, animal management and health, administration and feedlot operations will determine the ultimate success or failure of the business.

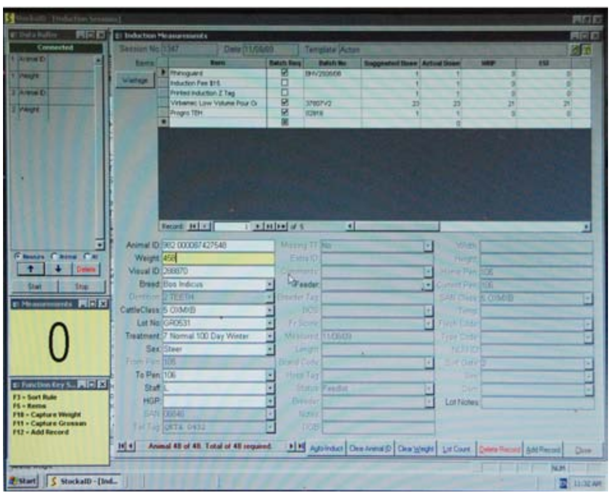
Feedlot administration

Staffing

At the feedlot business level, this means getting the right jobs done on time. This is achieved by having adequately trained and experienced staff with delegated responsibilities for management, supervisors and production employees. As well as the number of employees, the skill level and responsibilities of the individuals need to be matched to the jobs required.

Critical control processes

At a business level, this includes having processes in place to assist all current or future business decisions. These areas can include the type of information and the frequency that it is recorded across the feedlot, the application of contracts to transactions with third parties, quality controls on purchases of feeds and on other aspects of the business, and checks and balances across the business to ensure that, both physically and financially, the business is not exposing itself to an adverse outcome.



The ultimate in computerised recording.

The StockaID program is used to record the details and history of each animal, its health treatments and pen location. It is linked to the automated cattle ID and weighing unit.

Feedlot operational programs

Daily observation of the cattle

A comprehensive monitoring schedule is needed to ensure that cattle are observed daily and that their handling minimises stress and periods off feed while maintaining the day-to-day environment. The entries on this schedule can be used to assess, prioritise and rectify any failures that occur around the feedlot.

Cattle watering facilities

The cattle must have a constant supply of clean drinking water. Check daily for adequate flow of water and for leaks or overflow at the water troughs, and fix any problems immediately. Clean water troughs regularly on a known schedule, but check watering points more frequently for the first 24–36 hours after new cattle are introduced to the pen. An emergency supply of water for all animals for two days should be gravity fed.

Maintenance and repair of infrastructure.

Maintenance of infrastructure

The infrastructure that the cattle come into contact with every day should be checked regularly and any problems fixed as soon as possible. This includes the bunk lines and fence lines, working yard gates, raceways and handling facilities.

Well-maintained and designed infrastructure saves time and tempers.

Maintenance of animal environment

High stocking rates in both covered and uncovered feed pens and high rainfall create more problems than typically experienced in Australian feedlots. Floors of all open pens need to be cleaned frequently during the wet season.

Covered facilities need to be cleaned more frequently throughout the year, with the animals removed as the pens are cleaned. Fresh bedding material is then laid on the clean concrete floors before the cattle are returned.

Regular cleaning will help prevent infection of the hooves, legs and hide.

Maintenance of the animals' environment.

Plant and equipment maintenance

The feedlot business must have reliable plant and equipment. Breakdowns in South-East Asia can have serious consequences if parts are not immediately available locally.

The key principles are regular preventative maintenance and developing a back-up plan that can be deployed in the event of machine failure.

Minimise problems by:

- having spare capacity on hand in case of a mixing breakdown or feed delivery failure
- carrying a range of critical spare parts for the mixing and hauling equipment

Electronic weighing and recording to provide critical information.

Fresh beef from Australian cattle for sale in the wet market.

- having sufficient stockpiles of a suitable feed, such as silage, that can be fed in bulk if required to stop cattle from becoming hungry

Feedlot environment and surrounding farm

This applies to the feedlot waste disposal program and to any supporting farming operations. Waste disposal programs may be a significant part of the day-to-day operation, with both on-site and off-site disposal to manage the volumes of waste produced. Where possible, manure and liquid effluent should be used on the farm for its fertiliser and agronomic value.

Ultimately the feedlot will want to be viewed as a responsible neighbour. Depending on cattle numbers, weather conditions and the programs used at the feedlot, environmental issues will likely be an important aspect of the feedlot's operation.

Sales transactions

Fat cattle presented for sale and dispatched should be in good health, unstressed, and not injured or bruised. The animal's value is likely be determined by its liveweight but the price received will depend on market conditions; it will be biased by the buyer's knowledge of the expected yield and carcase attributes, and by the reputation of the feedlot.

Feedlots should develop a base of regular customers to sell their cattle that are ready for market. These customers are mostly butchers who supply beef to the local traditional 'wet' markets. Typically, they come to the feedlot and purchase the required cattle and then take them to a slaughtering facility. The cattle are processed overnight and the beef delivered to wet markets for sale early in the morning. The beef is then purchased for use that day, cooked as beef dish or commonly used as an ingredient in the popular bakso meat balls.

Broad specifications for local markets

Table 1. Typical local market characteristics

Type	% of Consumption	Live weight of cattle (kg)	Carcass weight (kg)	P8 fat depth (mm)
Wet markets	70	425–500	210–260	3–4
Supermarkets	25	425–500	210–260	6–12

Table 2. Broad specifications for feeder cattle

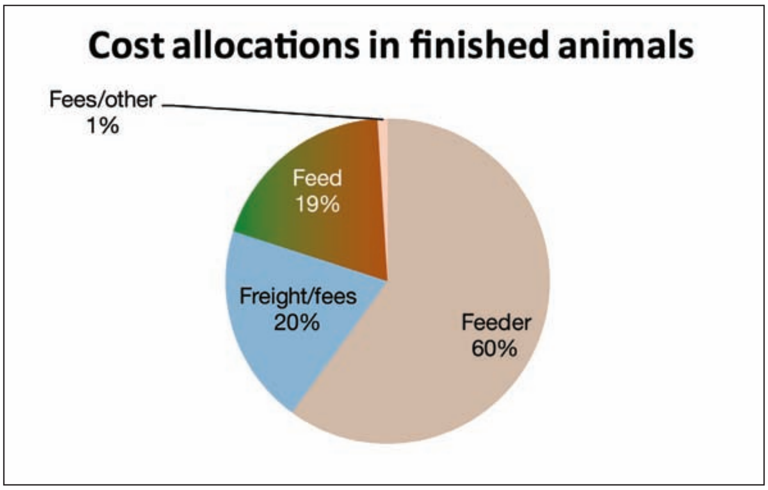
Feeder spec.		Finishing cattle specifications			
Type	Age (teeth)	Entry weight (kg)	Sale weight (kg)	Carcass wt (kg)	Other key criteria
Steer	0-6	325–400	450–500	235–260	Lean beef, some fat cover (see Table2)
Heifer	0-6	300–375	400–500	200–250	Lean beef, as for steers
Cow	8	350–450	425+	210+	Lean, no fat
Bull	8	350–500	500+	265+	Lean, no fat

Economic outcomes

Evaluation of feeding performance

For the best sale price, the animals have to be fed a high-quality ration for long enough to add weight on the type of animal in demand in the market — but without too much fat. Other attributes that a less scrupulous buyer may try to use to 'discount' the live cattle price at times include its age, type and sex, the colour of the hide and the presence of horns.

Figure 1. % Allocation of costs in finished animal



Purchase and delivery of the animal are 80% of the total value of the finished animal, and these costs are established many months before the animal can be sold. Feed accounts for about 20% of the finished cost, and it is within this 20% that the feedlot has to generate sufficient feeding performance, at a competitive cost, to produce an animal that can be sold competitively into the local market.

Physical feeding performance

In general, to be profitable, the animal has to gain at least 1.35kg of liveweight per day over a 100-day feeding program, with this daily gain achieved by the consumption of 12–15kg of a suitable ration each day.

A daily feed intake of 13.5kg and a daily gain of 1.5kg represent a feed conversion ratio of 9:1 on an 'as-fed' basis. ('As-fed' refers to the weight of the ration as provided and not to its dry matter; this allows more simple calculation of feed conversion efficiency from feedlot records.)

The feed conversion ratio provides an indicator of ration quality and ultimately of feeding costs. If lower-quality feed components are used, at the same price, feed consumption may go up or gain might drop— either increases the feed conversion. This would result in an increased cost of gain, higher cost of production, and lower than targeted growth rate.

Financial outcomes

The financial outcome is generally represented as the gross value received from the sale of the animal, less all costs.

The cost of feed may or may not include the running costs of the feedlot. This will depend on whether the feedlot owns all its cattle and charges the feed to the cattle at 'cost' or whether feed is charged at a 'marked up' price to cover the feedlot operation's costs and profit expectation. This latter system is typical of a custom-feeding operation where a third party owns the cattle and the feedlot operates as a service provider.

Final return less actual animal costs, feed costs, and (all) business costs represents the profit or loss of the enterprise in the exercise. This margin also has to cover any economic loss due to the death of animals, and losses in revenue if salvage slaughter returns are less than the budgeted return.

Business operating costs can be calculated back to an actual cost per head per day, or a cost per tonne of feed fed. This is generally done on a time-based method, and will be influenced by many variables, but will provide a reliable estimation of cost of production for the business.

These feedlot non-feed cost items, which are likely to include fixed costs as well as variable costs, together with the feedlot's actual head count will have a significant impact on a month-to-month basis for the financial results of the business.

At the cattle level, good feeding, in terms of sales and physical performance results at least, mean that the 'feeding' exercise may have been profitable— even if the larger feedlot business did not perform so well.

From these animals in the paddock in northern Australia ...

... to these in a feedlot in SE Asia.

The product is good.

What is your profit?

Cost of gain

The cost of producing 1kg of liveweight gain can be used to compare various feeding programs by using the feed conversion ratio.

A daily feed intake of 13.5kg and a daily gain of 1.5kg represent a feed conversion ratio (FCR) of 9:1.

If the feed cost is $175.00 per tonne (17.5 c/kg), a feed conversion ratio of 9.0 to 1 means that 9kg of feed is eaten for each 1kg of live weight gain (LWG). Thus the kg of growth has cost:

(17.5 cents x 9.0) = $1.575 per kg

If the animal was fed for 100 days at a gain of 1.50kg per day, the cost of its feed would be $236.25.

1.5 (kg av. wt gain/day) x $1.575 (cost/kg LWG) x 100 days
= $236.25

If the feed conversion ratio was 10.0:1, the cost for the same gain and ration price over the 100 days would be $1.75 per day, or $262.50— an extra $26.25 per head.

When multiplied by the total number of animals being fed, the importance of getting good feed conversion is highlighted as it has a significant impact on the profitability of the feedlot.

Ideally, the market price for finished cattle is higher, allowing cattle to become ‘more profitable’ if they are fed for longer.

In practice, the relationships between costs and revenue are not so simple and feeding profitability becomes more marginal. The local wet market does not require the level of finish that a supermarket does, and is not willing to pay top price for the top product.

Control over the original purchase price of the cattle, as well as the cost of feeding and maximising the sales price is needed to achieve a profitable outcome.

The feeding 'break-even' calculation

Table 2. Example of a steer break-even calculation for an Indonesia feedlot

Exchange rates	Rupiah-AUD	7800
Typical 2008–2009	US$/AUD $	0.76

Costing			AUD $	Rupiah
Weight in (kg)	345			
Delivered FIS	$1.90		$655.50	Rp5 112 900
Shipping US $/kg	$0.65			
Surcharge US $/kg	$0.00			
Total US $/kg	$0.65			Rp1 749 150
AUD equivalent	$0.65		$180.16	Rp6 862 050
TTL AUD FAS	$2.55			
Unload/truck/clear	Rp300 000	(/head)	$38.46	Rp300 000
Tax basis points	2.5%		$21.99	Rp171 551
Total cost landed at feedlot			$940.21	Rp7 333 601
Medical	Rp25 000	(/head)	$3.21	Rp25 000
Welfare/other	Rp13 000	(/head)	$1.67	Rp13 000
Feeding	Rp19 000	(/day)		
Days fed	85		$207.05	Rp1 615 000
Management charge	Rp20 000	(/head)	$2.56	Rp20 000
Total cost per head			$1,154.69	Rp9 006 601
Feedlot gain per day	Sale weight		**Breakeven AUD$/kg**	**Breakeven Rp/kg**
(kg/day)				
1.30	455		2.53	19 773
1.375	462		**2.50**	**19 500**
1.450	468.25		2.47	19 235
Sale price	per kg liveweight			Rp20 000
Profit or (Loss)				
	per kg liveweight			Rp500
	Net per head		$30	Rp234 000

Module 8

Breeding under feedlot management

Module 8
Breeding under feedlot management

Some feedlotters breed and produce calves in their feedlots. This module discusses the importance of getting heifers and cows in a suitable body condition for the best conception rates, and suggests suitable breeding programs. It describes methods of mating, and management of breeders and calves.

Contents

Breeds of beef cattle

Brahmans – The most popular pure-bred Bos indicus in Australia and the USA.

Under feedlot conditions

There are numerous breeds of beef cattle throughout the world, including some unique to SE Asia. The main production characteristics of many breeds have been incorporated into breeds and commercial herds in northern Australia. These characteristics have included tolerance of hot (humid and arid) conditions, resistance to ticks, ease of calving and ability to forage over vast distances. Characteristics under more recent selection include fertility, conformation and temperament.

Suitable breeds and types

The most important beef breeds and types in northern Australia are pure *Bos indicus* and *Bos indicus* x *Bos taurus.* Straight breeds may be pure *Bos indicus* such as the Brahman and more recently the Tuli and Boran, or stabilised *B. indicus* x *B. taurus* crosses such as the Santa Gertrudis, Droughtmaster and Belmont Red. All have their strengths—and weaknesses.

Droughtmasters – Australia's composite breed, formed by crossing Brahman, Shorthorn and Devon cattle.

Many beef enterprises have crossed their original herds of British breeds with pure-bred bulls to produce the typical 'Brahman-cross' steers imported live into SE Asia. Other enterprises run three-way cross or reciprocate to limit the content of any particular type and to try to continue hybrid vigour.

Some large enterprises are back-crossing with British or European breeds to improve conformation and for more specialised markets. These animals are transported from the harsher conditions of breeder properties to be 'back-grounded' before being finished in feed-lots in Australia.

Most live-export cattle from Australia are Brahman-cross and are well adapted to hot conditions—including high humidity, in SE Asian feedlots. All Zebu-based cows give birth to small calves and generally have minimal problems when calving.

Some cattle producers in Indonesia wish to breed under feedlot conditions; indeed nearly all cattle owned by small farmers in Indonesia are reared and fed in pens—although not necessarily with scientifically-based rations.

This module covers the management of breeding herds under feedlot conditions. The type of breeding female may be restricted by the market but the choice of sire is open to the world through artificial insemination—with suitable quarantine security.

Santa Gertrudis – a composite breed consisting of 3/8 Brahman and 5/8 Shorthorn, originally bred in USA.

Key points

- All animals to be bred or fattened in SE Asia must be adapted to the local hot and humid environment.
- Most Zebu cows give birth to small calves with minimal trouble whereas cows, and especially heifers, of some European breeds have dystocia problems.

Body Condition Score

Body condition score (BCS) refers directly to the amount of fat that an animal is carrying. A body condition score of 0 indicates a severely emaciated animal while a BCS of 5 is grossly obese.

Table 1. Description of Body Condition Score.

BCS	Description
0	Severely emaciated
1	The individual bones are sharp to the touch, with no fat at the head of the tail. Hip bones and ribs are prominent.
2	The individual bones can be felt easily, but feel rounded rather than sharp. There is some tissue cover around the tail head. Individual ribs are no longer visually obvious.
3	The short ribs can be felt only with firm thumb pressure. Areas either side of the tail head have fat cover which can be felt easily.
4	The ribs cannot be felt and fat cover around the tail head is easily seen as slight mounds, soft to touch. Folds of fat are beginning to develop over the ribs and thighs.
5	The bone structure of the animal is no longer noticeable and the tail head is almost completely buried in fatty tissue.

Adapted from www.dpi.vic.gov.au

Table 2. Problems associated with thin or fat body condition in breeders.

Thin condition BCS 1	Fat condition BCS 4-5
1. Failure to cycle	1. Costly to maintain
2. Failure to conceive	2. Increased dystocia
3. Increased calving interval	3. Impaired mobility
4. Increased days to oestrus	4. Failure to cycle
5. Decreased calf vigour	5. Failure to conceive

BCS may reflect as much as 60kg difference between one body condition and the next.

In a breeding enterprise, body condition score should be optimal at different periods of the cow's reproductive cycle. At conception, the BCS should be around 2 but it should rise closer to 3 at calving to allow the cow to produce more milk and become pregnant again.

Body Condition Scores

Body condition score of one.

Body condition score of a little less than two.

Body condition score of three.

Body condition score of four.

Body condition score of about five.

Cows should be monitored for body condition score throughout the year but particularly before calving. It is easy to lose the cow, calf or both during parturition if the cow is too fat or too thin.

BCS at calving will also have a large impact on milk production for the calf and the time to getting back into calf.

Strategies to manage breeders before calving to decrease the chances of calving difficulties are shown in Table 3. These are rough guidelines and the weight recommendations will depend on the frame size of the animal. This guideline is based on a cow that has a weight of 450kg at a body condition score of 2.5.

Table 3: Management in the first two trimesters of pregnancy to achieve a BCS of 2–3 by calving

BCS	Weight (kg)	Management to achieve BCS of 2-3
0	300	Needs to gain so much weight that it is not economical to try to mate a cow in this condition.
1	360	Needs to gain at least 60–120kg; economics are questionable.
2	420	Satisfactory but could gain some more weight.
3	480	Good but do not allow cow to gain more weight.
4	520	Needs to lose about 60kg.
5	600	Needs to lose about 120kg.

Breeding cows should have the correct body condition score to optimise their fertility. Skinny cattle must be drafted out and fed a higher plain of nutrition. If the cows are too thin, they do not have the body reserves to be get back into calf. If over condition, fat gathering around the ovaries of a breeder makes it harder to conceive**.** Fat cows must receive less feed but should not be starved as this can lead to birthing difficulties.

Key points

Body condition scoring is essential in any breeding program and cows should be evaluated on a regular basis.

Get the BCS correct in the first two trimesters of pregnancy. It is hard to change BCS in the third trimester as the calf is growing rapidly and taking most of the nutrients.

Cows too thin in the breeding cycle have:

- trouble cycling and conceiving
- a higher chance of abortions
- longer intervals between calves
- less colostrum production and poorer calf immunity
- poor milk production and weaker calves

Cows too fat have similar problems and will have more trouble calving (dystocia).

Breeding program for pen-fed cows

Figure 1 shows a typical breeding calendar. The aim of management is to achieve one calf each year.

Figure 1. Suggested breeding calendar

Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
3rd trimester; calving											
			Monitor progress and BCS								
					Breeding/joining						
						Joining; 1st trimester; monitor BCS					
									2nd trimester Monitor BCS		

The breeding program shown in Figure 1 may or may not use a synchronisation program (see 'Cycling and signs of heat' in Appendix). In the above example, cows calve in March and April at the end of the wet season. Calving in the wet season results in limited roughage being available and higher immune challenges. After the wet season and throughout the dry season, roughage is more easily available and can be harvested and stored without becoming mouldy.

During the wet season, bacteria and fungi are abundant in the calving pens, and will prevent the calf growing at an optimal rate. During the dry season, herd health is higher overall and this allows the calves to develop their immune system before the next wet season.

Key points

Plan your breeding calendar ahead of time; this makes:

- monitoring and record keeping easier
- gives you goals to reach
- helps you to cull non-performing cows

Calving through the wet season can inhibit calf growth as roughage is in short supply and there is a higher immune challenge for the calves.

Limited roughage means less milk fat and poorer growth of the calf. Milk fat comes directly from acetate production which the animal will produce when eating roughage.

Cycling and signs of heat

Cows cycle about every 21 days. Knowing this can help determine when an animal is next due to cycle and to prepare for Artificial Insemination (AI).

Sign of heat – cow smelling urine.

Detecting heat

This is the next step in the chain of events that lead to pregnancy. Many Zebu cattle cycle during the night and this is difficult to observe directly. AI in the morning captures the suggested 10 hours from onset of heat. Close monitoring of the cows is essential and is made easier using heat detectors.

Signs of heat in a cow:

- allowing other cows to ride
- swollen or redness of the vagina
- elevated temperature
- depressed appetite
- bunting other cattle
- resting its head on other cattle
- bellowing
- irritability
- a roughened tail or mud on their back indicating riding has occurred

Heat detectors are devices that are stuck on the back of the animal about 10cm from the top of the tail head. These white or grey colour devices change colour when pressure is applied, showing the animal has been ridden during the night.

Sign of heat – swollen vulva.

Conception

Conception follows the fertilisation of an egg by a sperm and the implanting of an embryo. Sperm can be introduced naturally by a bull or by artificial insemination (AI). The choice of natural or artificial insemination depends on the goals of management.

Natural mating or AI?

Advantages of using a bull for insemination include:

- limited handling of cattle
- no costs for semen straws, AI technicians or heat detection aids.

Disadvantages of using a bull for insemination include:

- cost of new or replacement bulls
- danger of inbreeding if bulls not replaced
- difficult to change breed of bull quickly
- cost of feeding bull all year
- handling of the bulls can be difficult
- calving is spread out and inconsistent

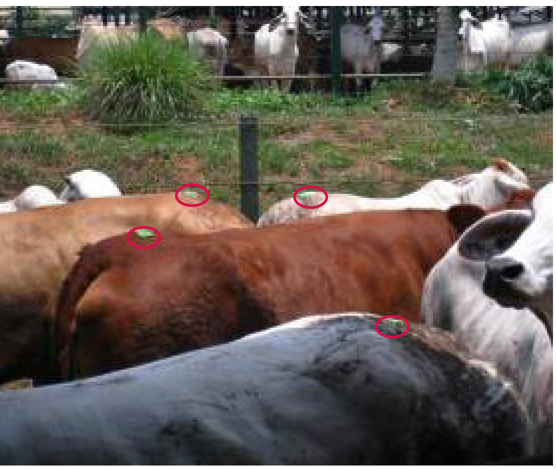
Sign of heat – cow being ridden.

Key points

Heat detection is essential for timely AI.

Heat detectors are useful but must not be triggered by rain or other outside influences.

Kamar heat mount detectors before and after dye released by pressure from mounting cow.



Heat detection devices, placed above tail of cow and triggered by pressure when ridden by another cow.

Advantages of using AI include:

- less risk of introducing venereal disease into your herd
- use of bulls of superior genetics
- choice of different breeds for heifer replacement or for fattening
- synchronised calving allows easier management of nutrition
- cheaper than feeding a bull all year
- higher conception rates increase productivity
- better safety for herd and staff

Disadvantages of using AI include:

- it can be expensive if not done properly
- must have an experienced AI technician
- heat detection is critical
- works best with a synchronisation program that can result in peaks in labour demand

For successful AI

Viability and storage of semen

Check that the number of live sperm per straw is guaranteed and that the semen is coming from a reputable semen storage and distribution centre. The bull's semen is diluted with a carrier fluid in the AI Centre and should still contain a minimum 10 million live sperm per straw at time of insemination. The straws are snap frozen and stored at ultra-low temperature—usually in liquid nitrogen—in a closed vacuum tank.

Semen stored in straws must remain frozen until just before AI; the tank should be taken into the yard and one straw taken out and loaded into the AI gun at a time.

Artificial insemination technician

All AI should be carried out by a fully trained AI technician, either an employee or from an AI Service. A good AI technician should achieve a pregnancy rate of around 80% on cows (slightly less on heifers).

Key points

Insemination can be natural using a bull or artificial using frozen semen.

- The most suitable system will depend on:
- Is there a bull handling facility?
- Is there a crush for artificially inseminating the animals?
- Is there a trained AI technician or can one be trained?
- Is there a reliable source of good-quality semen?
- Is there a local AI centre with trained inseminators?
- Can the semen be stored, is there a local source of liquid nitrogen?

AI is expensive if it fails. A good technician should achieve about 80% conception if cows are in right body condition.

Breeder management

The breeding herd should be fed a different ration to the finishing cattle. Feeding the finisher steer ration to cows (this is common practice in Indonesia), will make them too fat. Feeding smaller amounts of the finisher ration can cause the cows to become deficient in minerals, resulting in lower milk production or, in severe cases, abortion of the foetus.

Lactating breeders have extra mineral demands, particularly for potassium, calcium, phosphorus and magnesium. The mineral levels in their diet should be monitored closely to prevent deficiencies that can cause low foetus weight and low milk production and can increase the risk of milk fever.

The cow should be fed different diets at different times of the production cycle. In the first and second trimesters of pregnancy, the cows can be fed at maintenance level—unless you are trying to increase or decrease their body condition score.

In the third trimester and particularly at least three weeks before calving, the ration should be higher in anionic salts (sulphur, phosphorus and chloride) and lower in cations (potassium, sodium and calcium). Anionic salts help to change the 'dietary cation–anion difference' (DCAD) of a normal ration (DCAD of around 25) to negative.

A negative DCAD diet makes the blood acidic; this encourages the animal to pull calcium phosphate from her bones into the blood, and prepares her for the large calcium load that will be needed both during and immediately after calving. This will help prevent milk fever.

The concentration of energy, protein, vitamins and minerals in the ration needs to be increased in the last month of pregnancy because the size of the calf reduces the volume of the cow's stomach and she cannot physically eat as much as she requires.

Key points

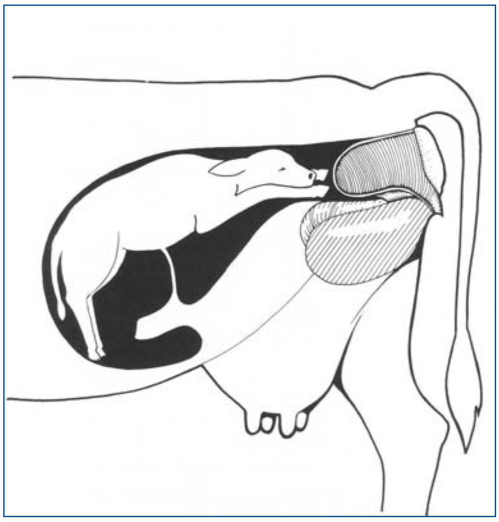
- Breeding cows need to be fed a specific ration—higher in minerals than a standard feedlot ration.
- The composition of their ration should change during gestation to minimise the chances of birthing difficulties.
- In the last trimester, the rapidly growing calf is taking up space that the cow would normally have for food. The nutrient density of the ration must be lifted as the cow cannot physically eat as much.

Calving (parturition)

When the animal is close to calving the abdomen will drop significantly, the udder will appear more full, and the vagina will become swollen and produce a discharge. The udder will fill and mucus will dischaarge from the vagina, which has become loose.

A cow two hours before calving. Notice the mucus coming from the vagina, which has become loose, and the swollen udder.

Table 4 highlights the tasks to be done before calving. This is a handy management guide to ensure that all jobs have been done and everything is correct and ready for the calving event.



Normal position of calf in womb.

Table 4: Pre-calving check list (See also Appendix).

Jobs to be done before calving
Check when each cow is due to calve. Use table in Appendix 1.
Disinfect all calving pens before the cows go in. This will reduce the risk of diseases in new-born calves or their mothers.
Ensure that the creep-feeding (see page 14) set up is ready and functional. The feeders and water must be at a height that the calves can reach easily, and there must be enough room for each calf to lie down comfortably.
Separate cows that are calving at similar times into pens at least a week before calving (Check list in Appendix 1).
Ensure that there is adequate bedding for the animals (clean sawdust or clean concrete). Avoid mud or dirt as feedlots have much higher concentration of bacteria and diseases than open paddocks.
Ensure water is clean and available at all times in the pen.
Clean all feed troughs thoroughly, mycotoxins from mouldy feed can be a major problem around calving and to young animals with an immature immune system.
Monitor cows each day for calving predictions and any difficulties.
Monitor cows after calving to make sure there are no post-parturition problems.
Maintain a clean environment.
Offer special creep-feed to calves after 2–3 weeks of age.

Cycling

Cows will usually cycle within 20–25 days after calving. The date of calving and the date of this first cycle should be recorded; the next cycle or heat will occur about 21 days after the heat.

Cows should not be mated in their first cycle after calving.

Key points

- Cows should be monitored closely whilst giving birth; complications can result in the loss of the cow and or the calf.
- Do not AI animal during the first cycle as she will not conceive.
- Make sure that the pen and troughs are cleaned and prepared for the calving period.

Potential problems at or after calving

Breached or turned calf – If the calf is facing backwards in the womb with its legs underneath, a caesarean section may be required. If the legs are poking out, the calf can be pulled out; but this must be done quickly so that the calf does not suffocate. If the calf is only turned, it can often be turned back (by inserting your arm through the vagina) so that the calf's chest is facing down and its spine aligns with that of the mother. It can then be pulled out the normal way, front legs first.

Mastitis is a major issue in feedlots because the high concentrations of cattle increase the risk of mastitis bacteria spreading between cows. If an uninfected cow lies in the same location as an infected animal, there is a high chance that she will become infected. Mastitis causes the teat to swell so that the calf cannot suckle and obtain enough milk. The infected milk also becomes a thick creamy fluid that the calf cannot suck out.

The risk of mastitis can be reduced by:

- feeding adequate minerals in the diet, particularly calcium and selenium.
- cleaning out of the pens between re-stocking
- separating cows with signs of mastitis from the herd

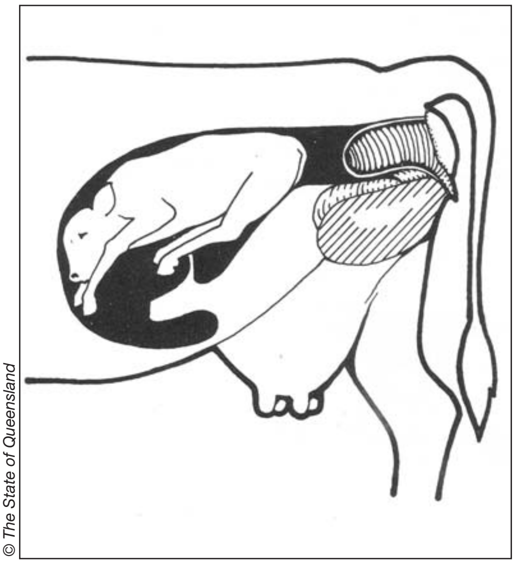
Mastitis is a special problem in beef herds because it is harder to detect and to treat than in dairy herds, which are handled every day. Mastitis is treated by milking the teat dry and injecting the entire content of a tube of antibiotic directly into the teat canal. This is more difficult to do with beef cattle (especially Zebu breeds) as they kick more than dairy cows. Seek help from your vet as to the best antibiotic to use.

Metritis describes the inflammation of both the endometrial and muscular layers of the uterus, and is most likely to occur during the first 10–14 days after calving. It can be caused by a retained placenta, dystocia, still births or twinning. Metritis is best prevented by preparing the cows well for calving.

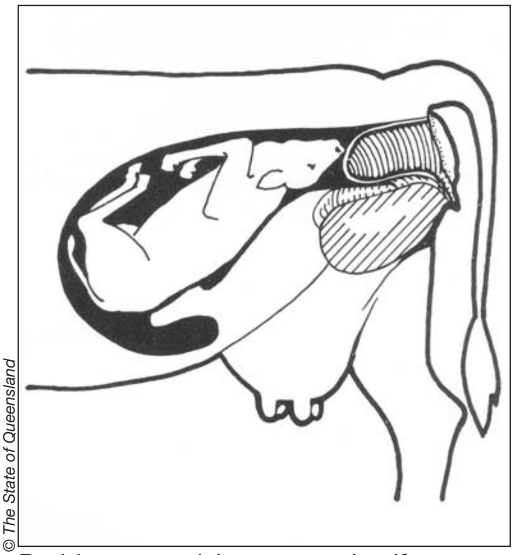
Affected cows are sick and off their food, exhibiting varying degrees of depression and decreased milk yield. Death may occur if metritis is not treated; consult your veterinarian for specific drug treatments.

Milk fever is most likely to occur directly after calving. It is caused by an increased calcium requirement for the production of milk but also by the muscle contractions of labour which use a large amount of calcium. After calving, a cow can get only about one third of the calcium needed for normal function so she has to take it from the blood.

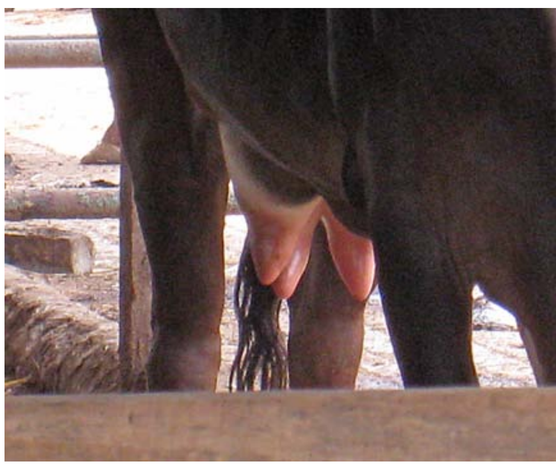
Signs of milk fever include: muscle tremors, off feed, dry nose, lower body temperature, head turned back towards a flank, pupils dilated and a low respiratory rate. The cow will die unless treated quickly with calcium by slow intravenous or



Problems at calving – breached calf.



Problems at calving – turned calf.



Udder with mastitis showing inflamed and swollen teats.

sub-cutaneous injection of calcium borogluconate or similar. Recovery is almost instantaneous. Consult your veterinarian immediately if milk fever is suspected and keep supplies of calcium borogluconate in stock.

Retained placenta.

Retained placenta – when a cow is not able to get rid of all the remaining birth tissues, it may bring on metritis. If severe infection sets in and is not treated, the retained placenta can result in death.

Signs of a retained placenta are high temperature, off feed, low milk production and general ill thrift. This usually happens within the first two weeks after calving. Do not pull the remaining placenta because this may tear the uterine wall leading to infertility or death through infection. If the incidence of retained placenta is over 5% of the herd, there is a management issue that needs to be addressed quickly to prevent further losses in production.

Ketosis occurs when cattle have a very high energy demand, as during lactation. When insufficient glucose is supplied, the cow mobilises body fat to meet this energy demand. This mass movement of body fat to provide energy can lead to toxic levels of ketones in the blood. Ketones are excreted through the urine, milk and breath. A fat animal during pregnancy is more likely to suffer ketosis, particularly when fed a diet that is high in ketogenic material or when they have inadequate energy in the diet after calving. Ketogenic materials include rotten silage and mouldy feeds. Signs of ketosis include: off feed; depressed milk yield; excessive licking; chewing or grinding teeth; blindness and recumbency. Although these symptoms may be mistaken for other metabolic disorders, the cow's breath may smell like acetone (nail polish remover) when she is ketotic.

Key points

- Cows must be monitored carefully during calving and for the next two weeks so that any disorders are detected quickly.
- Monitoring cows during late pregnancy will help to decrease these problems.
- A clean calving area will reduce the risk of disorders such as metritis and mastitis.

The calf on the right is one month older than the calf on the left but its mother has mastitis.

Calf management

Cows and calves should be monitored carefully in a breeding operation. Sickness and deaths need to be recorded to ensure that they are dealt with in the appropriate manner. Table 5 suggests a calendar for managing calves in Indonesia.

Healthy young calf suckling.

Table 5: Calf management check list

Age	Process
At birth	Ensure that the calf has had adequate colostrum, is breathing properly and has no defects.
Weeks 1 and 2	Monitor health of the calf and mother, paying particular attention to suckling ability and udder health. Remove any sick animals from the pens to prevent spread of disease.
Weeks 2 to 4	Provide a specific calf-feed formula even if the calves will not eat much until about four weeks old. At about one month old, the calves should be tagged, inoculated and preferably dehorned, and male calves may be castrated.
1 to 4 months	Continue on with creep feeding and monitoring both calf and mother.
4 to 6 months	Watch the cow's body condition score closely as she will be getting towards her third trimester, when body condition score becomes important. If she is losing weight, wean the calf early.

The longer that a calf can get milk from its mother, the better it will grow. In SE Asia, calves are commonly weaned at three months of age, but they should be left with the mother for up to 6 months if her body condition is good. The cows are being monitored every day and can easily be fed more if she starts to lose weight or condition.

A healthy and alert calf.

Key points

- Managing the calf for its first six months is critical to how well the animal will perform for the rest of its life.
- Weaning the calf too early can be detrimental to growth if it is not fed properly.
- Monitor the cow's body condition. If she is getting too thin, wean the calf but pay particular attention to their health and diet.
- Creep feeding is an essential part of every breeding unit.

Creep feeding

A creep area allows calves to get a special ration and rest away from the large cows.

A creep feeding area is part of the breeding pen that is fenced off so that the calves can enter but the cows cannot. It must be shaded and have feed and water troughs that are at calf height.

Creep feeding allows the calves to have access to special supplementary feed that is tailored to their requirements. The calves' feed should be much higher in energy, protein, vitamins and minerals than the mother's feed, and it should be palatable to maximise acceptance and intake. A combination of roughage and starch is the best for rumen development.

Calves need to eat roughage to stimulate the development of their rumen and concentrate for energy and protein.

By the time a calf is three months old, it can get only half the nutrients it requires from milk. The calf is growing while the mother's milk supply is declining leading to a 'hungry calf gap'; creep feeding is essential for maximum production performance.

Designing a creep-feeding set up:

- calves should have at least 1.5 square metres per head in the creep-feeding area
- feed troughs should be at the right height for the calves
- water must be at the right height and always available
- the entry/exit must be of a width that allows access only to the calves
- the area must be shaded

Processing the calf

The ear tag must be placed between the two main cartilage seams.

***Ear tagging* –**The ear tag must be placed correctly so that it does not injure the ear or rip out. The tag should be placed between the two main cartilaginous seams of the ear. Electronic ear tags should be placed further in, but identification tags need to be placed further out so that they can be read as the animal is coming up the race.

Inoculating – Inoculation, especially against clostridial diseases, will prevent the animals getting sick. Suitable vaccines, with correct date, will be recommended by your vet. The vaccine is injected subcutaneously on the neck with the skin pulled out to prevent injecting into the muscle.

Key points

- While processing the calves, handle livestock quietly to decrease the level of stress generated.
- Place the ear tag in the correct spot to decrease the chance of it being ripped out.

Weaner management

Weaning is one of the most stressful events in an animal's life especially for calves under 6 months of age. Stressed animals will go off water, become dehydrated and will not eat. Giving electrolytes to freshly-weaned cattle will help them to maintain hydration levels and therefore go onto feed more quickly.

When calves are weaned at six months of age, males and females (particularly replacement heifers) must be separated. A heifer for breeding needs to reach mature weight at two years of age and not be too fat, whereas a bull needs to be fat and ready for slaughter at 18 months. This means that fattening bulls and replacement heifers will be on different planes of nutrition.

It is important to monitor the body condition score of heifer replacement calves to prevent them getting too fat. Reproductive efficiency later in life may be impaired if the heifer calves are too fat even by six months old.

Horns get in the way at the trough and are a danger to man and beast. Why not dehorn the calf while it is young?

Key points

- Weaner heifers selected as replacements should be separated from the others as they will need a different plane of nutrition to fattening stock.
- Replacement heifers must not grow too quickly or get too fat as reproduction later will be jeopardised
- Calves will naturally lose weight when weaned; to minimise this, weaned calves should always have access to good, palatable feed and clean water. It can take time and money for calves to regain weight from severe loss.
- Electrolytes can be fed to weaners to encourage them to drink which will in turn encourage them to eat.

Getting the cow back in calf

Once the cow has calved, she should be watched for a heat event about 20–25 days. Although she will not be re-inseminated then, record this date as it will help to determine when she will next cycle. Recording the dates allows you to monitor when an animal comes into heat and thus to determine that she is indeed pregnant if she does not cycle again and when she will be due to calve.

See section on natural heat detection, and Appendix 1 for recording heat.

Appendix 1

Recording cows on heat

	Dates								
Cow Tag #	**Last calved**	**Heat #1**	**AI**	**Heat #2**	**AI**	**Heat #3**	**AI**	**Pregnancy tested**	**Due date**
1	1st March	26th March	x	16th April	x	7th May No Heat		Yes	16th Dec
2									
3									
4									
5									
6									
7									
8									
9									
10									

This example shows that cow tag number 1 was artificially inseminated twice and must have conceived on the second try because she did not cycle again on the 7th of May. As she later pregnancy tested positive, the date of conception and hence the due date for calving can be calculated. Close to calving time, all the cows that are due to calve can be removed for easier management.

Appendix 2

Synchronisation of oestrus

Breeders can be managed either by synchronising the herd to drop all calves around the same time, or by calving year round using heat-detection aids. There are advantages and disadvantages for either system.

Advantages of synchronised mating include:

- can shorten breeding seasons to 60 days or less in heifers
- can concentrate breeding and calving periods
- produces more uniform calf crop with similar ages at weaning
- allows a simple nutrition program tailored to the month of the year
- makes AI programs more practical by reducing time and labour for heat detection

Challenges for synchronisation

- need a well-planned and implemented program for successful results
- need fertile heifers and cows on an adequate nutrition program
- need quality semen for AI, and experienced inseminators
- needs more concentrated labour at breeding and calving times
- may need facilities for bad weather during concentrated breeding and calving periods
- needs good management to ensure high pregnancy rates

Advantages of year-round breeding without synchronisation:

- supply of calves all year
- regular labour requirement
- no additional costs for synchronisation

Challenges for year-round breeding with no synchronisation:

- heats are often overlooked
- nutrition not balanced for all stages of pregnancy
- lower pregnancy rates and hence fewer calves
- lower fertility reduces income from herd
- tailored nutrition and weaning programs are more difficult as calves are of different ages and sizes

Two synchronisation programs work well in Asia. One uses prostaglandin only (either a single or double shot); the other uses both a prostaglandin injection and a progesterone CIDR.

Prostaglandin

Prostaglandin hormone decreases the function of the Corpus Luteum (CL). This allows females to return to oestrus within 2–5 days, thus synchronizing their oestrus cycles. Females in days 17 to 20 of their cycle will come into oestrus over 1–4 days and so will be synchronised. Females in days 1 to 5 of the cycle, and non-cycling females that do not have a mature CL, will not respond to the injection. It is possible to overcome this problem by monitoring the cattle in the week leading up to the synchronisation program.

Single-shot program. This is the most popular program, and has the advantages of lower drug and AI costs and less risk if the manager has a good indication of the percent of females cycling in the herd before the injection is given. However, it requires more labour for heat detection and involves a 10-day breeding period.

The program consists of five days of conventional heat detection and AI. On the sixth day, the manager decides whether to inject the remaining females based on the percent cycling during the first five days. About 20 percent of the females should have cycled during this period to justify injecting the remainder. The injected females are then heat-detected and artificially inseminated over the next five days.

Double-shot program. The program consists of two injections of prostaglandin to all females 11 days apart; then conventional heat detection and AI over the next five days. Alternatively all females can be inseminated 76–80 hours after the second injection. The double shot program has the advantages of a short breeding period with little or no heat detection, but involves higher drug costs and females must be cycling for this program, as in the single shot program, to be effective. This program best fits the manager who knows a high percentage of the females are cycling and is willing to risk the higher drug costs for less time and labour spent on heat detection. Adequate facilities, labour and strict scheduling are needed if mass AI is to be used.

Progesterone

Progesterone is a hormone that acts like a functioning corpus luteum. When the progesterone is inserted, all cows feel that they are pregnant and thus none will cycle. When the hormone is removed, the corpus luteum will start to regress, giving rise to an increase in oestrogen which stimulates the release of luteinising hormone and brings on the events of a standing heat. The cow then can be inseminated.

Controlled Internal Drug Release (CIDR) program

A CIDR is a device that releases a dose of progesterone every day so that the cow's body thinks that it is pregnant. The device must be inserted correctly into the vagina and is held there by the muscles of the cow for seven days. The CIDR device is inserted into all cows that are to be synchronised. On day 6, all cattle are then injected with a prostaglandin injection (for example Lutalise™) and the CIDR is taken out the following day (day 7). All animals will then come into heat between day 8 and day 11. This heat must be detected so heat-detection devices are often used as insurance.

Key notes

- Animals need to be naturally cycling before they are put onto any synchronisation program.
- The 1-shot prostaglandin program is cheaper but requires more management.
- The double-shot prostaglandin program is more expensive, but gives higher conception rates.
- The CIDR program is the most expensive but is the most effective as it can bring on non-cycling cows and heifers.
- There are advantages and disadvantages for all synchronisation programs and also for year-round breeding.
- The choice will depend on the manager's goals and the availability and skills of the labour force.

Glossary

Bunting – describes female or male behaviour when they use their head to bully the other cattle. Females will particularly bunt during heat expression.

Caesarean section – the act of cutting out the calf through the abdomen.

Concentrate – the portion of the diet with no effective fibre, for example PKC, pollard, onggok mixed together.

Docile – a quiet temperament

Hardiness – the ability of an animal to survive harsh environmental conditions

Taiwanese King grass – productive cross-bred varieties of grass (*Pennisetum purpureum*) planted vegetatively and cut for feed; (Also see Module 6. Nutrition)

Properties – equivalent to ranches in USA

Roughage – the indigestible portion of plant foods that pushes food through the digestive system, absorbing water and easing defecation. Roughage referred to in this manual includes rice straw, corn stalk or King grass

Zebu – generic name for *Bos indicus* cattle; Brahmans were originally selected from a mix of several *Bos indicus* beef types and are the best-known pure *B. indicus* breed in Australia.

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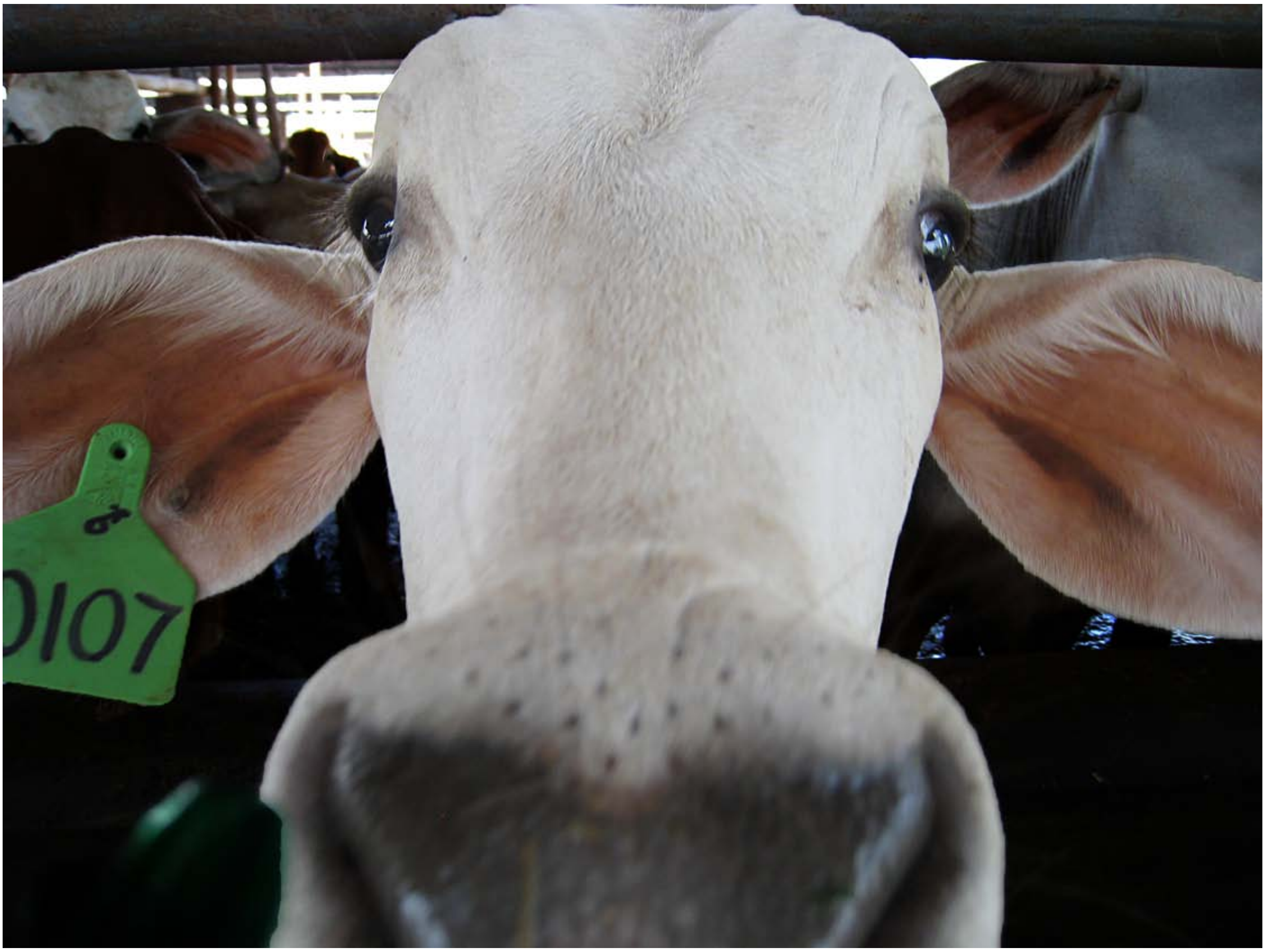

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