



CODE OF PRACTICE FOR FARMED BUFFALO IN WESTERN AUSTRALIA

BUFFALO

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PREFACE

The **Code of practice for farmed buffalo in Western Australia** is based on *The Australian Model Code of Practice for the Welfare of Animals - Farmed Buffalo* and has been adapted for use in Western Australia. The original *Model Code* was prepared for the Standing Committee on Agriculture and Resource Management (SCARM) and endorsed by the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) for use as a national code. It was prepared in consultation with the relevant industry organisations and State agencies.

This Code has been prepared to assist all persons handling or using buffalo in Western Australia, and reference to this Code is made in Regulations provided under Section 25 of the *Animal Welfare Act 2002* for the purposes of a defence against cruelty. It is not intended to be used for either audit or compliance purposes.

This Western Australian version of the Code is supported by the livestock industries and the Department of Agriculture. It is based on current knowledge and technology. It will be reviewed in the future on a needs basis, to take account of advances in the understanding of animal physiology and behaviour, technological changes in animal husbandry and their relationship to the welfare of animals.

For anyone using animals for scientific purposes, as defined in the *Animal Welfare Act 2002*, this Code should be read and used in conjunction with the 'scientific use code'.

Further copies of this Code are available from the Department of Local Government and Regional Development or from the Internet at:
<http://www.dlgrd.wa.gov.au>

1. INTRODUCTION

1.1

This Code should be read in conjunction with other relevant Western Australian codes of practice.

The Code is intended as a guide for all people responsible for the welfare and husbandry of buffalo with the aim of achieving humane husbandry throughout all types of buffalo farming enterprises. Assistance and specific advice on management and disease control in buffalo should be obtained from qualified advisers, whose services are available through government and private agencies.

1.2

Buffalo are used in situations which vary from controlled extensive grazing to harvesting of uncontrolled or feral stock. Future buffalo farming systems might involve more intensive systems. This Code deals with farmed buffalo. Owners, managers and handlers have a responsibility to care for the welfare of buffalo under their control, whether they are farmed or harvested.

1.3

The basic behavioural, anatomical and physiological needs of buffalo are considered in this Code.

1.4

Buffalo behaviour is similar to, but significantly different from, cattle behaviour.

1.4.1 The importance of competent personnel managing and handling buffalo cannot be over-emphasised. The important skills are an ability to manage and handle buffalo in such a way as to prevent stress while utilising their natural behaviour such as their ability to think, search for exits and remember the positions of feed and water troughs. The handler must have the skills to recognise the early signs of distress or disease and initiate prompt and appropriate preventive or remedial action.

1.4.2 Buffalo do not scare easily. Instead they will rapidly become obstinate, excitable, aggressive and even dangerous when mishandled. Poor handling can often result in long term difficulties as buffaloes have good memories. One or two episodes of bad handling will affect subsequent behaviour in domesticated situations.

1.5

The basic requirements for the welfare of farmed buffalo are:

1.5.1 Water, food and air to maintain good health.

1.5.2 Social contact with other buffalo, but with sufficient space to stand, walk freely, lie down, escape aggressors, stretch and groom.

1.5.3 Protection from predation.

1.5.4 Protection from disease.

1.5.5 Protection from the adverse effects of extremes of climate or unseasonal changes in weather conditions. For example it is essential to provide a shaded area and also highly desirable to provide the paddocked buffalo with a wallow or dam during hot (> 33°C) weather. Protection from cold wet weather is also required.

1.5.6 Provision of reasonable precautions (e.g. fire breaks), against the effects of natural disaster.

1.5.7 Protection from unnecessary, unreasonable or unjustifiable pain, suffering and injury.

2. WATER

2.1

Buffalo must have access to an adequate supply of suitable drinking water. This is approximately 25–30% more than required by cattle in the same climatic conditions.

2.2

Buffalo should not be deprived of access to water for periods longer than 12 hours, unless in transit. Buffalo which are dehydrated will engorge themselves on reintroduction to water and deaths will result. Access to water must be controlled for the initial period.

2.3

The water requirements depend on age, body weight, production level, temperature, humidity, and dry matter content of the feed eaten. (Approximate consumption rates of water for cattle are in *Appendix 1* - these are a useful guide for buffalo if increased by 25–30%.)

2.4

Buffalo can easily become heat stressed and dehydrate rapidly during mustering. After mustering in hot or humid weather, buffalo should be cooled down with the aid of a sprinkler system and then provided with an initially restricted access to drinking water. It is more appropriate to muster and handle buffalo in the cooler parts of the day in tropical areas.

2.5

Buffalo used to drinking salty water may need special consideration. If they refuse fresh water, they may need a gradual change from salty (25% sea water) to fresh water. The volume of salty water required is higher than for fresh water.

3. AIR

3.1

Buffalo should not be kept in, or exposed to, any situation where the air is so contaminated with dust or noxious chemicals as to be detrimental to the health and welfare of those animals. Use of sprinklers or misters to settle dust is recommended. Dust is not only a health hazard but also impedes smooth working of buffalo in yards.

3.2

Beware of the effects of cold/wet conditions and the chill factor especially in poorly adapted animals. The provision of shelter from cold winds and rain either in a paddock or on transport trucks is considered essential in southern regions.

4. FOOD

4.1

Buffalo should have access to, or be provided with, food that will maintain health and vitality. They should not be deprived of access to food for periods longer than 24 hours. Buffalo in poor body condition should not be deprived of access to food for periods longer than 12 hours.

4.2

Food available should meet the requirements of maintenance, growth, pregnancy and lactation, and provide for any extra demands, such as exercise or cold stress.

4.3

Stocking rates should be adjusted in accordance with the seasonal variations in pasture, especially if no supplements are being fed. The feeding pattern of buffalo differs from that of cattle in that buffalo tend to eat most of the feed in an area before moving to the next. The complete paddock, therefore, needs inspection when gauging the remaining amount of pasture.

4.4

Buffalo should be protected as far as possible from toxic plants or other substances deleterious to their health. It should not be assumed that buffalo are less susceptible to toxicities (or to disease) than cattle.

4.5

Special attention should be given to the nutrition of lactating cows. Poor nutrition of lactating cows will result in decreased milk production and high mortalities in calves. Buffalo calves are more dependent on milk in their diet than cattle calves of a similar age.

5. DROUGHT

5.1

Drought is defined as a severe food and/or water shortage following prolonged periods of low rainfall. It is not a normal seasonal decline in the quantity and quality of food available.

5.2

Where minimum water and food requirements cannot be met (whether or not drought conditions prevail), buffalo should be moved, agisted, sold or humanely slaughtered. Allowing any animal to die of dehydration or starvation is contrary to laws of this country.

5.3

Buffalo being fed for survival should be attended to at least twice weekly, and where possible be classed into appropriate groups to avoid undue competition. Shy feeders may require special attention and treatment, depending on the type of food and strength of competing buffalo.

5.4

Weakened or poorly conditioned buffalo which go down after limited exercise are not fit to travel.

5.5

Weakened buffalo required to be moved from a property should be transported to their destination by the shortest possible route utilising techniques that minimise handling and other stresses. Weakened buffalo should not be transported with strong animals.

5.6

Weakened buffalo should be given special protection as far as possible against exposure to extremes of weather, especially when in transit.

6. PROTECTION FROM CLIMATIC EXTREMES AND PREDATION

6.1

All reasonable steps should be taken to minimise the effects of climatic extremes or unseasonal changes and other factors that produce either cold stress or heat stress.

6.2

Buffalo are susceptible to heat stress and provision of shade, wallows, sprinklers or misters to protect them is considered essential for hot periods (> 33°C) irrespective of the predicted normal ambient temperatures.

The signs of overheating are:

- increased reddening of hide on the brisket, under the belly and between the legs;
- 'tonguing' (the tongue hangs from the mouth);
- panting;
- obvious bloodshot eyes;
- very hot to touch;
- increased rectal temperature (normal temperature varies considerably).

6.3

Calves, and buffalo in very poor condition, are susceptible to chilling. Wind shelters should be provided to protect calves from cold stress. This form of stress is exacerbated by wind chill factors and by wetting of the skin. Buffalo transported from the tropics to the colder southern areas are susceptible to chilling and require special care until they acclimatise.

6.4

Plans should be made and reasonable steps should be taken to ensure protection from the effects of natural disasters. Care is necessary in paddock design to include safe high ground in areas subject to flooding. Adequate fire breaks should be maintained. Buffalo should be attended to as promptly as practicable in the event of fire, flood, injury or disease.

7. INTENSIVE STOCKING SYSTEMS

7.1

Feeding facilities should allow adequate access for all buffalo and should be maintained in good repair and clean condition. (Minimum requirements for feed and yard space for cattle are in *Appendix 2* - these are a guide for buffalo.)

7.2

The design, location and construction of a feedlot and/or a feed pad should take account of topography, climate, age and size of animal, space and feed requirements, and labour and management skills available. Adequate provision should be made for cleansing, drainage and waste disposal.

7.3

Passageways, races, entrances and exits should be designed to take full advantage of the highly developed social behaviour and movement patterns of buffalo.

7.4

Tethering or hobbling must not be accepted as normal husbandry procedures. Where these are used it is essential that the collars, ropes and similar materials used for tethering or hobbling buffalo should be constructed and used so as to avoid inflicting injury and pain. Tethered animals must be under constant supervision.

7.5

In the case of housed buffalo, ventilation, whether mechanical or natural, should assist in removing from the environment excessive heat, moisture, carbon dioxide, dust, noxious gases and airborne infectious organisms, and replacing these with fresh air. This air should be distributed in a manner appropriate to the location of the stock and the design of the building.

8. BUFFALO HANDLING FACILITIES, MUSTERING AND YARDING

8.1

Sheds, pens, yards, lanes, ramps and other areas where buffalo congregate should be constructed and maintained so as to minimise stress, injury and disease. The design and construction of such areas should enable dust and noise to be minimised. Yard design should avoid sudden changes in level, poor lighting, narrow passages and awkward or 90° turns. Yards should be of strong construction particularly around areas of confinement. Buffalo are much more capable of destroying yards than cattle of a similar size. Well-designed yards will take advantage of the natural behaviour of buffalo to follow a leader and encourage the free movement of animals through the facility. Effective visual barriers and visible passageways and gateways will assist easy working of buffalo. Objects such as water troughs, free-stall divisions, gate hinges and feed barriers should be carefully sited so as to avoid injury to buffalo. Yard pens should be calf-proof.

8.2

Floors of yards, sheds, pens and loading ramps should have a surface that minimises slipping (e.g. a roughened or grooved finish) but still allows easy regular cleaning.

8.3

Holding yards should be designed to minimise stress or injury and allow all animals held to lie down or exercise.

8.4

Yards should be constructed and maintained to avoid development of boggy areas. Yards should have sufficient slope to provide effective drainage. Uneven

or steeply sloping surfaces which greatly increase the risk of falling and surfaces or gratings that create contrast or visual perception problems should be avoided. Buffalo may display defensive reflexes when confronted with such situations and make sudden unpredictable movements.

8.5

Buffalo should spend as little time as possible confined on surfaces that can predispose to lameness especially in wet conditions when the horn of the hoof is softened.

8.6

Facilities should permit adequate restraint of buffalo that require inspection or treatment. Races and crushes should be constructed to permit efficient handling of buffalo without unnecessary danger to animals or handlers. Head restraint facilities should be constructed to allow quick release and to avoid the risk of choking.

8.7

Buffalo must not be driven to the point of collapse.

8.8

The use of electric jiggers and/or dogs in working buffalo through yards and forcing pens is counterproductive as the animal's natural instinct is to turn and face danger. Judicial use of electric jiggers may be needed in races.

8.9

The use of goads for the handling and moving of buffalo should be limited to an absolute minimum necessary to complete the procedures. The use of patience and reward in handling buffalo are the greatest principles. They can be trained to walk unassisted through a race just by having hay in the yard at the end of the race.

8.10

Goads should be made of cane, leather or plastic pipe. 'Flappers' (leather straps attached to a cane) are acceptable. Metal rods, metal pickets, metal piping, wooden strikers and fencing wire are not acceptable.

8.11

Electric goads, operated only by battery or hand dynamo, can be used in moving buffalo in races, however, the animals must have room to move.

8.12

Deliberate breaking of an animal's tail to cause it to move is totally unacceptable.

9. MANAGEMENT PRACTICES

9.1 General

9.1.1 Restraint should be the minimum necessary to perform management procedures efficiently. However, when it is necessary, restraint must be very firm and strong as buffalo possess immense strength and will inflict severe injury on themselves or handlers if not effectively restrained.

9.1.2 Management practices that may cause pain may not be carried out if painless practical methods of husbandry are available.

9.1.3 Management procedures and practices carried out on buffalo should be performed competently.

9.1.4 Any injury, illness or distress observed should be treated promptly.

9.1.5 All operations should be undertaken hygienically.

9.1.6 Excessive handling of females during the final half of pregnancy should be avoided as they are particularly prone to abortion after exposure to stress at this time.

9.2 Supervision

9.2.1 In any situation, supervision should be by competent stock persons.

9.2.2 Frequency and nature of inspection should be related to the likelihood of risk to the welfare of buffalo and the handler.

9.2.3 Buffalo kept under intensive management in sheds, lots, or yards should be inspected at least twice daily, fed at least daily and have continuous access to water. Specific care is needed to detect and feed shy feeders.

9.2.4 Grazing buffalo require supervision according to the class of buffalo, density of stocking, availability of suitable feed, reliability of the water supply, age, pregnancy status, climatic conditions and management practices.

9.2.5 Absentee landowners have a legal responsibility to ensure that buffalo grazing their land are inspected and treated in a manner which will avoid welfare problems.

9.3 Castration

9.3.1 Surgical castration without local or general analgesics/anaesthetics must be confined to calves as young as possible, and under the age of six months. Castration of older buffalo is only permitted under veterinary supervision or in exceptional circumstances.

9.3.2 Non-surgical emasculation by crushing of the spermatic cord or with rubber rings should not be performed.

9.4 Spaying

9.4.1 Surgical spaying should only be carried out under the direct supervision of a registered veterinary surgeon using the appropriate anaesthetic/analgesia and surgical technique.

9.4.2 The development and the use of proven and reliable non-invasive alternative (e.g. an immuno-sterilant) is recommended to replace surgical spaying.

9.5 Identification

9.5.1 A suitable method of identifying buffalo needs to be developed. In cattle, ear-tagging, ear-marking, ear-notching, ear-tattooing, udder-tattooing, udder implanting, freeze-branding, electronic characterisation and photography are the preferred methods. In many situations, however, fire branding remains the only practical method of permanently identifying cattle. None of these methods is totally practical in buffalo. Firebrands rarely last the lifetime of the animal as they lose definition with the scarring process. The legal requirements for the identification of buffalo are identical to those for cattle.

9.5.2 Branding with corrosive chemicals is unacceptable.

9.6 Dehorning

9.6.1 Buffalo develop extreme dexterity with their horns and can use them to inflict severe injuries to handlers and other animals if provoked.

9.6.2 To minimise injury to handlers and other animals, buffalo should be dehorned as young as possible and preferably prior to weaning and timed to avoid fly worry.

9.6.3 Dehorning of buffalo without the use of local analgesics should be confined to calves and weaners under 9 months of age. Older animals may be 'tipped' without anaesthetic in order to reduce their potential to cause injury.

9.6.4 Dehorning by means of chemicals must not be performed.

9.7 Mating

9.7.1 Testing bulls for mating capacity is not a normal procedure in the buffalo industry. Restrictions are that the test, if used, should only be performed using mature females with normal reproductive organs; such females should not be used for longer than two hours in any 24-hour period and in a manner which results in no trauma to bulls or cows.

9.7.2 Female buffalo should not be joined to bulls that, because of incompatibility of size, are likely to cause mating injury or calving difficulties.

9.7.3 Semen collection, artificial insemination, embryo collection and transfer, and associated operations should be performed only by, or under the direct supervision of trained, qualified operators.

9.7.4 Trainee artificial inseminators should practise this procedure only under the direct supervision of a registered veterinary surgeon or a trained and experienced artificial inseminator.

9.8 Artificial rearing of calves

9.8.1 Buffalo calves, in particular those taken from feral cows and those with less than 8 temporary incisors, pose particular management problems in rearing. Refer to *Appendix 4*.

9.8.2 Housing for artificially reared calves should have a dry lying area with adequate drainage, internal surfaces and floors that will not cause injury, and satisfactory ventilation, climate control and lighting for the comfort of calves. Provision of protection against heat stress as described in Section 6.2 is essential.

9.8.3 Careful attention to group size and composition, access to feed, milking shed location, ancillary accommodation, lighting, air inlets and outlets, handling facilities and stalls can alleviate problems of health, stress or aggression.

9.8.4 Multiple calf rearing systems, where individual calf pens are used, should be constructed and placed so that each calf has the opportunity for visual contact with at least one other calf. An allowance of 1.5–2.0 m² of floor area per calf should be provided to prevent overcrowding. The total shed volume should provide for at least 5.5 m³ per calf.

9.8.5 In areas where cold stressful conditions are experienced regularly, enclosed shelter or housing plus high energy foodstuffs should be provided for calves.

9.8.6 It should be noted that buffalo milk is much more concentrated than cows' milk, particularly in respect to protein and fat content. Digestive upsets can be precipitated by using unmodified cows' milk.

9.8.7 Calves should receive at least two litres of fresh or preserved buffalo colostrum within the first 12 hours following birth. Thereafter, calves should be fed initially at least three times daily on liquid buffalo milk, modified commercial milk replacer or colostrum in sufficient quantities to provide essential requirements for maintenance and growth. Access to roughage is necessary from a day or two after birth to allow rumen development. The importance of hygiene in calf feeding cannot be overemphasised.

9.8.8 Skim milk-based milk replacers should not be used to feed calves under three weeks of age, unless they are a properly balanced formulated mix of protein, fat and vitamins. Milk replacers should be reconstituted according to manufacturers' instructions. Milk and milk replacers should not be fed in excess of body temperature (39°C).

9.8.9 Calves should be weaned off milk, milk replacer or colostrum only when their digestive systems have developed sufficiently to enable continued growth and maintenance of good health. To assist the development of the correct flora of protozoa and bacteria in the rumen of the calves they should be drenched with 50 ml of fluid derived from the rumen of slaughtered buffalo. This will eliminate the 'pot-gutted poddy calf syndrome'.

9.8.10 If large numbers of calves are reared, it is desirable that they should be divided into groups based on age and size, to reduce competition for food and allow closer observation and management.

9.9 Calving and weaning practices

9.9.1 Care should be taken to minimise calving difficulties, by the adoption of proper management practices.

9.9.2 The nutrient intake of the pregnant or lactating female should be maintained at a level that will ensure calf survival, but minimise calving difficulties.

9.9.3 Calving cows should be kept under frequent surveillance, where possible, with minimal disturbance, and difficult calving should be promptly diagnosed and alleviated by a competent operator.

9.9.4 Manual removal of retained foetal membranes is seldom helpful. They should only be removed by a competent operator.

9.9.5 Calves should be weaned only when their digestive systems have developed sufficiently to enable continued growth and maintenance of good health.

9.9.6 Buffalo handlers should recognise the importance of weaning time in educating young buffalo to management practices. Weaners should be:

- kept under control and handled for an adequate time;
- educated to handling by stock persons;
- worked through yards;
- introduced, if appropriate, to working dogs;
- handled with a minimum of stress and a maximum of reward for proper behaviour as they respond rapidly by developing useful memory.

9.9.7 The dam's condition should be taken into account when deciding when to wean.

10. HEALTH

10.1

Appropriate preventive treatment should be administered to buffalo for diseases that are common in a district or are likely to occur in the herd.

10.2

Internal medications, such as vaccines and drenches, and external medications, such as dips and pour-on formulations, should be stored and given in strict accordance with the manufacturer's instructions and recommended methods of administration. Overdosing may harm stock and under-dosing may result in failure to reach the required prophylactic or therapeutic effect. Expiry dates should be strictly observed.

10.3

Some pour-ons sold for use on cattle are unsuitable for use on buffalo possibly due to skin differences.(e.g. 'Ivermectin').

10.4

Sick, injured or diseased buffalo should be given prompt and appropriate treatment or humanely slaughtered. Separation of such buffalo from others is recommended until the condition resolves. Where emergency euthanasia is necessary and the animal cannot be moved it should be performed on the farm in a humane manner.

10.5

Experience in New Zealand indicates that buffalo are very susceptible to Salmonellosis and Yersiniosis and consequently should be vaccinated against these diseases.

10.6

Buffalo are susceptible to Malignant Cattarah Fever and should be kept completely isolated from sheep at all times.

11. AGISTMENT

The responsibility for the welfare of agisted buffalo rests with the occupier of the land upon which agistment is held unless agreement is made to the contrary.

12. FERAL BUFFALO

12.1

Feral buffalo control poses special welfare problems and while these are addressed in specific welfare codes, there are elements which are common to both feral and domestic stock.

12.2

The presence of feral buffalo affects the welfare of the domestic herd, because of difficulties in mustering, handling, population control and control of disease. The presence of feral buffalo makes it difficult to assess stocking rates in specific areas, depletes the available feed supply and leads to nutritional stress.

12.3

Feral buffalo can act as a reservoir for disease-causing organisms and impede the application of disease control measures to domesticated buffalo. In handling feral buffalo, unacceptable stress to the majority of the animals can often be avoided by the destruction of a recalcitrant animal. In such circumstances it is sometimes not possible to destroy the animal in the recommended manner, however the most humane available method of destruction must be employed.

12.4

Populations of feral bulls fight with domesticated males and unnecessarily stress the females. They prevent controlled breeding, mitigate against low input breeder management and the controlled improvement of the herd gene type.

12.5

Following capture of feral buffalo, it may be necessary to undertake surgical procedures such as tipping of the horn, in order to minimise stress and injury to the group into which the feral animals will be released.

13. EMERGENCY DESTRUCTION OF BUFFALO

13.1

Buffalo should be euthanased by firearm by the frontal or poll method (see Figure 1). Captive-bolt pistols are only suitable for younger stock. The point of impact for the frontal method should be adjusted depending on the elevation of the head. New operators should be trained in these procedures by experienced operators. For mature buffalo a heavy-calibre firearm is required.



Figure 1: Humane destruction of buffalo – recommended position for frontal and poll methods (suitable for firearm only).

13.2

When the animal has been stunned using a captive-bolt pistol, it must be bled out as soon as it collapses to the ground by severing the major vessels of the neck. To avoid injury to the operator due to the animal's involuntary leg movements, the operator should stand behind the neck. Due attention must also be given to the horns as a kick may bruise but the horns will injure.

13.3

It is recognised that exceptions to the recommended practice may occur under extreme conditions. In those circumstances considerations of common sense for both animal and human welfare should prevail.

13.4

Euthanasia may also be by overdose of anaesthetic by a veterinarian. All other methods of euthanasia are unacceptable.

APPENDIX 1 – WATER FOR LIVESTOCK

1. Guidelines for consumption

(Note: These are average figures and there will be wide variation in practice depending on climate and the water content of feed.) As a guide buffalo require an additional 25-30% more water than these cattle figures.

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

[Source: Tulloch, D.G. (1972). Some aspects of the ecology of the water buffalo in the NT. *In*: A collection of papers related to the Northern Territory buffalo industry, pp. 18-28. (J.B. Moran and B.D. Ford, editors) Darwin: ASAP.]

2. Mineral salts and potability

This assessment of quality for stock consumption is made on the basis of mineral content (salinity) only and does not consider other possible contaminants or pathogenic organisms. The salinity of natural water is made up of a number of salts which exist in the water as 'ions'. The major ions are normally chloride, bicarbonate, carbonate, sulphate, calcium, magnesium and sodium. Total dissolved ions (TDI) is a measure of the total salinity or saltiness of the water.

Waters of high salinity can cause physiological disturbances such as gastrointestinal symptoms, wasting disease and sometimes death of animals. The severity of the symptoms can depend on other factors which must be taken into account with a knowledge of local conditions. The recommendations given, therefore, are meant as guidelines only.

Factors to consider

Tolerance to salinity varies from high to low in: sheep, cattle and buffalo, horses, pigs, poultry.

Climate - e.g. animals are less tolerant of saline waters during hot, dry periods.

Age and condition - lactating, growing and weak animals require better quality water.

Composition of pastures - higher salinity water is tolerated better if stock are on green pastures.

Habituation - stock not accustomed to saline water can suffer ill effects or refuse to drink, but adjust if introduced gradually (and visa versa).

Composition of feed - salt content of feed should be reduced if water is saline when stock are on prepared feed.

It is important to note that in summer and during dry periods, the salinity of water in dams, rivers and troughs increases due to evaporation, and drinking troughs should be flushed regularly.

Current recommendations

Total salinity levels given in Table 1 are acceptable provided harmful specific ions or salts are within the limits given in Table 2.

Table 1. Suitability limits for total salinity

Stock	Acceptable maximum upper level for	
	Concentration mg/L TDI	Limited periods mg/L TDI
Beef cattle and buffalo	9,000	10,000

Table 2. Suitability limits for specific ions or salts for stock

Salt	Maximum concentration for stock (mg/L)
Magnesium	400
Sulphate	1000
Nitrate ^{1,2}	100
Nitrate	10
Fluoride ¹	2
Sodium bicarbonate ³	1000

Notes

¹ Dangerous levels of nitrate and fluoride are not commonly found in natural waters.

² Animals can probably tolerate considerably more nitrate than the levels given. The danger lies in conversion of nitrate to nitrite before or after ingestion. Keeping the water well aerated and free from contamination will lessen the risk.

³ This level applies if animals are unaccustomed to the water. They will probably adjust if the water is introduced gradually.

APPENDIX 2 – MINIMUM REQUIREMENTS FOR TROUGH AND YARD SPACE IN INTENSIVE CATTLE SYSTEMS

(These sizes are to be used as a guide for buffalo as the space required will also depend on the size of the horns.)

Feed troughs (if feeding once daily):

Yearlings	250-300 mm/head
15 months to 2 years old	300-380 mm/head
Bullocks	380-460 mm/head

Feed trough (if feeding 3-4 times daily):

Young cattle	150-180 mm/head
Steers and bullocks	180-300 mm/head

Self feeders

75-100 mm/head

Yard space

average 15 m²/head

In the design phase, an allowance 10% greater than the estimated need should be included to provide for flexibility in feed type and ration and to minimise bullying.

APPENDIX 3 – FEED REQUIREMENT GUIDELINES

Source: *National Academy of Sciences Nutrient Requirements of Beef Cattle*. Sixth Revised Edition, 1984.

General statement

Cattle should be provided with enough food which contains sufficient energy, protein and minerals to satisfy their appetite requirements. The dry matter intake of cattle approximates 2.5% of liveweight daily. The quality of food must, therefore, be adequate to satisfy their nutrient requirement, as they cannot consume more food than this amount.

Dry cattle

With dry matter intake limited to 2.5% of liveweight daily, feed should contain sufficient energy to allow for maintenance. Higher needs exist when stock are in a productive phase. Feeds must contain a minimum of 1.5Mcal/kg nett energy for maintenance only.

Breeding cows

In the final stages of gestation and during lactation feed requirement increases. To maintain body condition, feeds containing 1.5 Mcal/kg nett energy become inadequate.

Table 1. The feed requirements (kg dry matter/day) of steers, heifers, dry cows and bulls at maintenance

Liveweight (kg)	100	200	300	400	500	600
Total energy requirement (Mcal)	3.4	5.5	7.58	9.41	11.12	12.74
Nett energy in ration (Mcal/kg)	(----- kg DM required daily -----)					
1.5	2.30	3.67	5.05	6.27	7.40	8.49
2.0	1.70	2.75	3.79	4.70	5.56	6.37
2.5	1.36	2.2	3.03	3.76	4.45	5.10
3.0	1.13	1.83	2.53	3.14	3.71	4.25

Table 2. The feed requirements (kg dry matter/day) of steers, heifers, dry cows and bulls gaining 0.6 kg per day

Liveweight (kg)	100	200	300	400	500	600
Total energy requirement (Mcal)	4.4	7.56	10.37	12.87	15.22	17.43
Nett energy in ration (Mcal/kg)	(----- kg DM required daily -----)					
1.5	2.99	5.04	6.91	8.58	10.15	11.62
2.0	2.25	3.78	5.19	6.43	7.61	8.72
2.5	1.80	3.02	4.15	5.15	6.09	6.97
3.0	1.50	2.52	3.46	4.29	5.07	5.81

Table 3. Feed requirements (kg dry matter/day) of pregnant cows one month before term.

Liveweight (kg)	300	400	500	600
Total energy requirement (Mcal)	10.7	13.10	15.50	17.80
Nett energy in ration (Mcal/kg)	(----- kg DM required daily -----)			
1.5	7.13	8.73	10.33	11.87
2.0	5.35	6.55	7.75	8.90
2.5	4.28	5.24	6.20	7.12
3.0	3.57	4.37	5.17	5.93

Table 4. Feed requirements (kg dry matter/day) of lactating cows

Liveweight (kg)	300	400	500	600
Total energy requirement (Mcal)	10.7	13.10	15.50	17.80
Nett energy in ration (Mcal/kg)	(----- kg DM required daily -----)			
1.5	10.33	11.93	13.50	15.07
2.0	7.75	8.95	10.15	11.30
2.5	6.20	7.16	8.12	9.04
3.0	5.17	6.00	6.77	7.53

APPENDIX 4 – MANAGEMENT OF ORPHANED OR WEANED BUFFALO CALVES

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Background

Large numbers of buffalo calves are orphaned as a result of disease control and domestication programs currently being undertaken in the Northern Territory. Little attempt has been made in the past to raise these young animals because of high labour and feed costs and their reputation for being difficult to hand rear (high mortality rates). However, while sources of buffalo for domestication are declining rapidly, their value has increased significantly, especially that of potential breeding stock, and this trend is likely to continue in the future. Raising orphaned calves, therefore, has become a more attractive management option. Tulloch (1972, 1979) successfully bottle-fed calves that were removed from the dam at birth, and in another case, goats milk drunk from a cake tin was used to raise a calf from 2 weeks of age (Padgham-Purich 1988, *pers. com.*). However a trial done by Gilham (1986) at Berrimah Research Farm, found that young animals separated from dams after one or more days, could not be encouraged to drink from a bottle or bucket. They did not take milk substitute in liquid or solid form, but readily accepted solid food or good quality forage. More recent attempts by the Department to raise large numbers of 'untruckable' buffalo calves in a feedlot situation have been very successful (Witherspoon 1987, *pers. com.*).

Understanding buffalo behaviour

The buffalo is a highly social animal with strong instincts. Consequently mother and young relationships are closely bonded and the buffalo usually becomes more stressed when separated from the dam than the calves of cattle. Buffalo by nature are also relatively intelligent animals and learn quickly from more educated companions. Because of their intelligence and social habits stress can be alleviated by keeping them in groups of five or more animals together with an older domesticated animal. A consistent feature of young calves up to 6 months of age is their slow ungainly gait which is often accompanied by dragging of the hind legs and swaying hindquarters. This may be mistaken for

chronic ill-thrift with no prospect of recovery and on that basis the animal is destroyed. While in some cases, ill-thrift and malnutrition may be implicated, as long as the animal is eating this characteristic will normally disappear as the animal gets older. Many people do not realise that buffalo are quite susceptible to heat stress. This is because of their poor ability to sweat. Their skin has fewer sweat glands than that of cattle. Buffalo therefore need at least shade and continuous access to cool drinking water. When animals are held in yards in hot weather, a wallow or a sprinkler system turned on for an hour during the heat of the day is preferable. The ungainly gait of the calves is particularly noticeable when they are heat stressed.

Basic management practices

Hold in quiet yard with shade, water and feed trough.

Not less than 5 animals per group together with educated older animal.

Work animals frequently but quietly through the yards.

Treat animals of 6 months of age or more for internal parasites.

Place salt block in feed trough.

Feeding strategy

A. 0–3 months (under 75 kg; 1–3 temporary pairs incisors):

Orphaned calves under 3 months of age can suffer mortality rates of up to 25% unless they can be bottle or bucket fed or fostered by a willing lactating buffalo cow (3-4 calves per cow) in addition to receiving solid feed. If labour inputs or foster mothers are not available, the calves should be held with an educated yearling or older animal.

Basal diet - Always feed to appetite a good quality hay such as pangola at an expected rate of 1-2 bales per 10 animals per day. A house paddock of grass-legume mix

with plenty of green feed will also provide an adequate basal diet for older calves.

Supplements - Additional concentrated nutrients are also recommended. Any one of the following suggested formula may be fed twice a week at the appropriate *daily* rate:

1. Lucerne chaff/calf pellets – 150 g of each/hd/day.
2. Cracked sorghum/meat meal – 150 g of each/hd/day.
3. Forage sorghum cubes (Vitacube) - older calves only at 0.5 kg/hd/day.

B. 3–6 Months (75–125 kg; 4 pairs of temporary incisors):

Lot feed in a group for at least one month before considering holding them in a paddock of good quality pasture. Continue supplementation in the dry season. Mortality rates up to 10%.

Basal diet - Feed good quality hay to appetite (approx. 3 bales per 10 animals per day).

Supplements - Lucerne chaff/calf pellets or cracked sorghum/meatmeal – 250 g of each ingredient/hd/day. Forage sorghum cubes (Vitacube) may be fed to gradually replace the basal diet of hay.

C. 6–12 months (125–175 kg; 4 pairs of worn temporary incisors):

Lot feed in a group for at least one month before putting them with the domesticated herd. In the yards feed good quality hay or forage sorghum cubes. Supplement as before up to 500 g of each ingredient/hd/day but reduce intake of supplement a few days prior to turning out. Groups of young buffalo will generally do well where there is abundant green feed. For example, on flood plain pastures of Hymenachne or Paragrass, or on saved legume pastures of Cavalcade, Verano, Glenn, and Wynn Cassia (Lemcke 1988, *pers. com.*).

Age by teeth (and horn) characteristics

Table 1. Comparative age and liveweight according to eruption of teeth and horn rings

Eruption of incisors	Approximate age	Liveweight
1 st pr of temporaries	0-7 days	35-45 kg
2 nd pr of temporaries	2 weeks	
3 rd pr of temporaries	30 days	50-60 kg
4 th pr of temporaries	4.5 months	80-95 kg
Well worn full mouth of temporaries	9-10 months	140-165 kg
1 st pr of permanent	30-36 months	330-360 kg
1 st horn ring	11 months+	150-175 kg

APPENDIX 5 – SOURCE OF INFORMATION AND FURTHER READING

FAO 1974. *The Husbandry and Health of the Domestic Buffalo* (W.R. Cockrill, editor) Rome: FAO.

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