final report

Project code: **B.SBP.025**

Prepared by: **Dr Theresa Craig**

Technical Assistance and Research Analysis

Date published: **December 2006**

ISBN: **9781741918892**

PUBLISHED BY
Meat & Livestock Australia Limited
Locked Bag 991
NORTH SYDNEY NSW 2059

Revision of Best Practice Dairy Beef Manual

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government to support the research and development detailed in this publication.

Contents

Summary

With any business enterprise such as Dairy Beef, a complete understanding of the business process will help a person plan management strategies to become successful, efficient, and profitable. This statement is most significant for those who wish to start a business. This book emphasizes the key salient points in the processes of raising dairy beef calves from birth to slaughter. As a beginning and more general overview, this book did not include many fine details that will be required as a dairy beef business further develops. Many of the fine details are unique to each enterprise and are based on locally available manpower, skills, facilities, pastures, feed stocks, and other supplies.

Section 1 emphasizes the preplanning stage where clear business goals should be set. Once established, these goals should be monitored and reviewed throughout the process of raising dairy beef calves. Each individual business may have different circumstances and opportunities; therefore to be successful and profitable, owners and managers must decide on the market and other options that are most suitable to the business situation. This is done by planning, cost estimating, and evaluating various scenarios of a dairy beef enterprise. Once a scenario is selected, its plan for required investments and resources (i.e., capital, time, labor) must be further detailed and aligned with business goals. This now becomes the business plan. Next, the business plan is implemented. Finally as the business plan progresses, accurate records are required to allow comparison of performance goals with expected targets. Adjustments are continually made as appropriate to fine tune the business plan to further improve business success, efficiency, and profitability.

Selecting the best calf source for a specific dairy beef enterprise, as described in Section 2, is extremely important for success. Buyers of baby calves are encouraged to seek professionally managed dairies that meet requirements for healthy calves. In addition, these buyers must know breed and genetics of calves in order for the purchased stock to meet their on-selling market requirements. The source dairy needs to be checked that it is free from diseases and clean. Healthy calves that come from a disease free and clean environment minimize ongoing health issues. Ongoing health issues can greatly reduce the profitability of a dairy beef operation; therefore health issues need to be minimized. Buyers must also account for distance to a rearing facility as extensive travel can adversely affect a calf's health.

Once a buyer finds a suitable source of calves, then the buyer focuses on each individual calf. Calves that are desired are those that have received high quality colostrum within the first six hours after birth. To obtain this information, buyers must build strong relationships and have excellent communication with good suppliers. Consistent and long term relationships between buyers and sellers are based on a fair market price for calves so both buyers and sellers are in a win-win situation. Calves selected for purchase should be healthy, alert, and bright eyed. A critical requirement is that buyers only accept calves that have individual identification with proper background information. Traceability is becoming increasingly important to the final consumer, which means traceability has to start at the source. Section 3 provides full discussion.

Once quality calves are selected, proper transport of calves is required as described in Section 4. Calves need to be "fit and healthy", disease free, and uninjured prior to transport. Low stress handling techniques are required when preparing calves for

transport. The transportation vehicle needs to be checked to insure that it is clean and free from sharp or protruding edges that can cause damage or injury to calves. If calves are less than one month of age, which is normally the case, feed must be provided to them within 6 hours of transportation. In addition, calves must receive liquid food within 10 hours. With this consideration, young calves must arrive at their destination within 10 hours of their last feed. Buyers should keep transportation time for young calves to a minimum. To avoid injury and death during transit, truck drivers should check calves frequently (i.e., after 30 minutes and every 3 hours thereafter) to ensure that no animals are lying down and unable to stand up. If animals do become injured during transport, they need to be immediately treated or humanely disposed.

Section 5 discusses the intake of calves into their new environment. This involves advanced planning prior to calves' arrival to determine all requirements for raising calves such as facilities, equipment, feed, and medicine. Calf housing needs to be stress free, draught free, dry, and hygienic. When calves arrive, rearers should frequently observe each individual calf and provide timely attention to detail when necessary. Animal dehydration and any other health issues must be treated immediately. Detailed record keeping must be maintained to track performance. These records will be needed for the next buyer of the calves. In addition, records allow evaluation of strength and weakness in the system, and the need to implement changes as appropriate.

Rearing young calves to weaning is covered in Section 6. To achieve early weaning in dairy beef operations, calves must consume solid feed early, be raised under good nutritional practices, and have a stress free environment. Sufficient high quality milk and feed concentrate (i.e., calf starter) are required to produce healthy and fast growing calves. Early weaning can only be achieved when the calves' rumen is developed, and this can only occur when solid feed has been consumed. Calves need to be inspected twice daily for early problem detection. Any unhealthy calves need to be isolated and treated immediately, especially in cases of dehydration.

The weaning process is discussed in Section 7. Calves should be weaned only when they meet criteria that allow continued healthy growth. Calves should not be weaned only on age. Abrupt weaning is appropriate when climatic conditions are suitable to minimize additional stress. During weaning, calves need high quality weaner feed and high quality pasture.

Once calves are weaned, their "grow out" phase from weaning to 100 kg body weight occurs. This important topic is covered in Section 8. Producers should inspect calves daily for the first two weeks, then twice weekly as they grow. A critical issue for producers **is <u>not</u> to forget or ignore** calves after weaning. Calves need to be continually monitored for weight gain on at least a biweekly basis. High quality and digestible pasture is required for this still immature animal to reach it's growth potential. Generally, a feed concentrate is also required to meet the nutritional gaps not filled by the pasture. This feed needs to be rumen friendly to help prevent acidosis.

Section 9 discusses calves from 100 to 200 kg live weight. Like all previous stages of the calf's development, their weight gain needs to be monitored. In addition, pasture / grass quality and quantity need to be accessed. Nutritional gaps in pasture will need filling, when necessary, with suitable feed supplements. Complete and balanced nutrition will allow target growth rates to be achieved that meet future market specifications. Calves' scheduled health program needs to be followed and routine health inspection continued.

The normally overlooked growth stage of 200 kg to final market weight is described in Section 10. Each animal's individual weight gain needs to be monitored at least every three to four months, or when feed and/or weather conditions change. On a weekly basis, producers should inspect bulls, pasture quality, and pasture quantity to allow for alternations in feed management. This may involve adding or changing supplementary feed. Producers must also know final market specifications and target sale date, which requires ongoing communication with the buyer(s) on the progress of the animals. The health programs on all bulls need to be maintained, and each animal should have individual and current records for medical treatments, weights, and other life occurrences.

The last section, Section 11, discusses the pre – delivery and delivery of larger animals. Cattle selected for transport need to have good temperaments, and be structurally sound and fit for transport. All treated cattle must have drug and chemical withholding periods honored. Producers need to minimize stress to animals by using good facilities that facilitate quiet, smooth flow of livestock. Dairy bulls should **not** be mixed prior to transport. Animals require good nutrition prior to transport so that their energy levels are elevated which helps to minimize health issues and/or dark cutters. Mustering cattle and trucking animals during weather extremes (i.e., hot or cold) should be avoided. Once animals are mustered, they need to be placed in a holding pen with water, and provided feed consistent with buyer requirements for curfews and the animal welfare codes of practice. Ongoing communications between the seller, agent, and buyer are required to ensure a consignment meets specifications. Finally, a reputable carrier that checks cattle at regular intervals during transportation and uses non-bruise crates and well maintained transport equipment should be selected.

This book provides valuable insight into raising dairy beef calves throughout their life. Important information on the practical aspects of raising dairy beef calves has been backed by proven science. An overall and key "take home" point to a successful enterprise is **"Attention to detail in everything associated with the raising of dairy beef animal."** By doing this, a successful business can be achieved.

Introduction

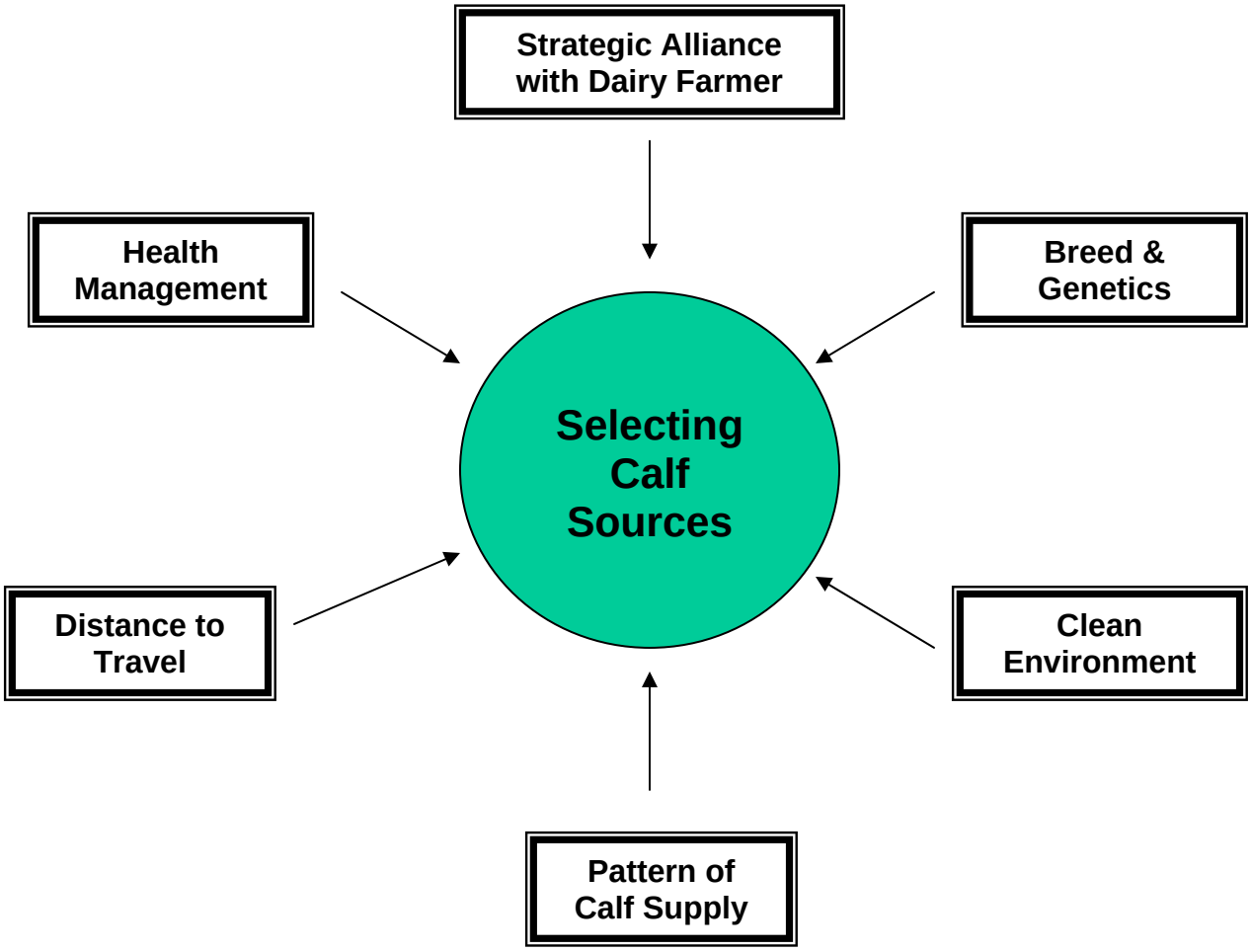
The dairy beef industry has developed from a fledgling opportunistic endeavor to an established industry with international market opportunities. Over time, scientific principles have been applied in a practical manner, which has enabled those involved in the industry to create successful business enterprises. This revised edition of **"Best Practice in Dairy Beef**" incorporates knowledge learned since the last writing and updates the book to meet current industry needs. Experts in particular fields have contributed to this edition to ensure the most useful and current information.

One major change within the industry since the first edition is that the market has switched predominantly to dairy bulls instead of dairy steers. This change should not be viewed with trepidation. Dairy bulls have great natural growth potential and when handled properly, dairy bulls have no behavior problems.

This book focuses on general steps in the rearing and growing processes needed by those entering the business for the first time. In addition, several appendixes have been included for further practical guidance.

The dairy beef industry will continue to grow and evolve. In time, new and improved practices may be established. However, this book should provide a good foundation for many years to come.

Section 2 -*Selecting Calf Sources*



Key Actions

☑ Seek out professionally managed dairies that meet requirements for healthy calves.
☑ Ensure breed and genetics of calves meet market requirements.
☑ Make certain calves come from a clean environment to prevent on going health issues.
☑ Check that source dairy is free from diseases.
☑ Match calf supply to market needs.
☑ Ensure the distance travelled by the calves to the rearing location does not cause excessive stress.

Introduction

The objective of a successful dairy beef operation is to provide high quality, consistent lean beef. This process starts with strong, bright, healthy calves that have come from a clean, disease free environment. Therefore, selecting the dairy(ies) that supply calves is critical to long term success of dairy beef rearing operations. A proper alliance between diary and rearing operations can be a major step to acquiring healthy and high performance calves.

Strategic Alliance with Dairy Farmer

In searching for a diary(ies) to supply calves, a dairy beef buyer must consider the following important points:

- Calves from uniform lines will provide more consistent performance to match business needs and target market. Variable genetics, health, and reliability make providing a consistent product very difficult.
- Calves must be known to be disease free as a sick animal can contaminate an entire calf shed and make healthy calves ill.

Based on the above, dairy beef buyers should focus on purchasing calves directly from dairies that have a proven ability to supply healthy calves matched to business needs. Buyers should avoid calves from saleyards or calf truck sales due to the many unknowns and risks of these animals.

Buyers are encouraged to develop an ongoing relationship or strategic alliance with a dairy(ies) that meet the buyer's needs. To establish this relationship or alliance, buyers should seek out information on dairies; this information may come from departments of agriculture, agents, or other local contacts. Issues to consider in selecting source dairies are discussed in the following sub-sections.

Finally, a long term alliance only works if both parties benefit. Buyers can benefit by having a known reliable source of new calves. Dairy(ies) can benefit by having guaranteed calf sales provided they meet specifications. Lastly, sale prices must satisfy both parties.

Breed and Genetics

Buyers should focus on the dairies that can supply the proper breed and genetics that suit the target market. In some markets, colour is important. The primary criteria for a dairy should be a history of using AI with sires selected from good quality Australian

Holstein bloodlines. Cows having high estimated breeding values for milk production correlate well with dairy bull calves having high average daily gain performance.

Clean Environment

Buyers should feel comfortable that new born calves have been given the best opportunity to thrive. The general appearance of the dairy and animals indicates the professionalism of the people running it.

Key areas to inspect are the milking herd, the calving area, and the nursery area. Buyers should ensure the calving area is as clean as possible because the first hours of a calf's life are crucial to its future health and performance. Buyers may inquire about the dairy's calving down practices, and how the calves are treated before being sold.

Pattern of Calf Supply

Buyers must understand the market for their final product. As a result, buyers will need to schedule calf supply in order to meet their market, optimize facilities, and optimize labour costs. Therefore, the calving pattern of the dairy must meet the needs of buyer.

Seasonal calving herds will suit a dairy beef operation based on batch rearing, but a single calf intake per year will not make best use of the rearing facilities.

Distance to Travel

The distance that calves have to be transported should be minimised to reduce stress and costs. If the calves need to travel great distances, then animals should be older. In addition, proper hydration prior to transporting is fundamental to ensure a healthy calf arrives at its destination. Transport must be appropriate for baby animals by having shelter from sun, wind and rain.

Health Management

Calves are best sourced directly from local farms. Sale yards and calf truck sales are avoided because history of management procedures such as colostrum intakes, disease status, and breeding will be unavailable or, more likely, unreliable.

Consistency of supply will improve the efficiency of a calf rearing system by minimizing operating costs and mortalities during the critical pre-weaning stage of the rearing process. Healthy active calves need to be selected so that they adapt quickly to the rearing system that will keep them alive, healthy, and growing at a rapid rate.

The supply of neonatal bull calves needs to be secured from farms that preferably calve down healthy cows in good body condition in a clean, supervised calving area. Calves should receive at least 4 liters of colostrum within the first 6 hours of life, and afterwards have their navels dipped or sprayed with a 7% iodine solution.

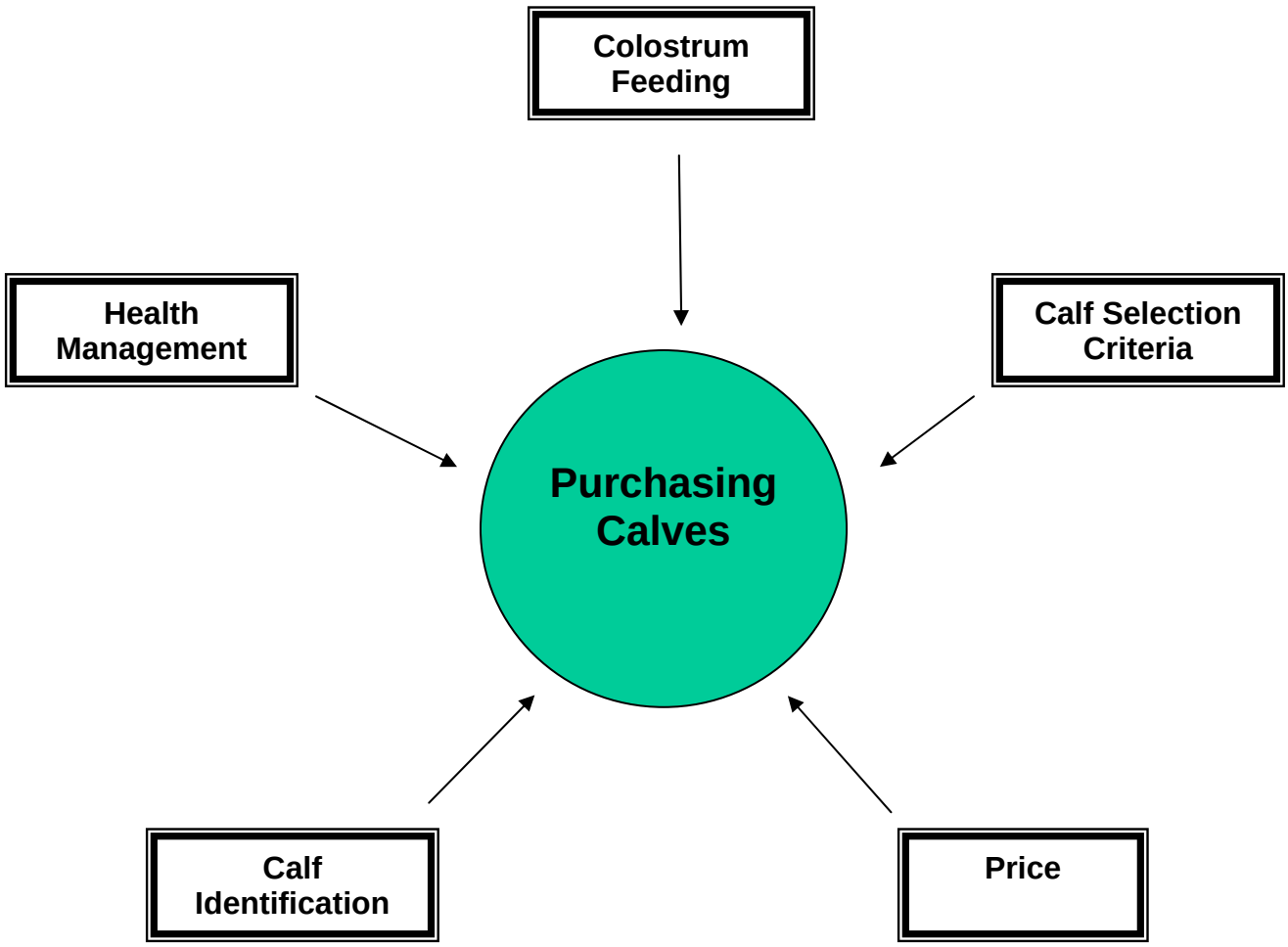
In addition, desired farms for selecting calves are those that have an active vaccination program that includes vaccines for leptospirosis, the clostridial diseases, E.coli and possibly salmonella. Buyers must understand viruses common to the region, and source calves from dairies that inoculate accordingly.

When selecting calves for rearing, the following points need to be considered:

- Calves should be at least four days of age, at least 40 kg live weight, with a dry navel cord, and actively seeking feed.
- Calves with congenital defects or birth injuries should be avoided. Buyers should look for signs and avoid calves with hydrocephalus – enlarged skull; cleft palate or hare lip; inability to stand; stiff limbs; blindness; hair loss; muscle tremors, or lacking an anus.
- Buyers should avoid calves from difficult calvings which is indicated by swollen head, tongue or limbs, broken limbs, or difficulty standing.
- Calves should not have visible hernias, infected umbilical cords or ruptured navels. Buyers should look for increased size, moistness, discharge or tenderness to avoid umbilical problems.
- Finally, buyers should avoid calves from cows newly introduced to the supplying property.

Finally, buyers must ensure that the dairy is free from Enzootic Bovine Leucosis (EBL), Johne's disease (JD), and salmonellosis. To avoid infected calves, buyers may ask for a signed declaration of the herd status from the seller.

Section 3 - Purchasing Calves



Key Actions

☑ Ensure calves have received high quality colostrum within the first six hours after birth.
☑ Select calves that are healthy, alert and bright eyed.
☑ Pay a fair market price for calves so both buyers and sellers are in a win-win situation for a long term business.
☑ Only except calves that have individual identification with proper background information.

Introduction

Buying the appropriate calves to rear is extremely important for trouble free calf rearing. Not all calves will meet the specification required by a properly run dairy beef operation. Through tough screening and selection of calves to purchase, buyers can set a standard that sellers will adhere to. By eliminating potentially problematic animals prior to start, buyers ensure the dairy beef rearing facility is free from disease and other problems.

The first twelve hours of a new calf's life are critical to its future. During gestation, a calf does not receive its dam antibodies through placenta transfer. Dam antibodies (immunoglobins) are first received through the colostrum in the first hours of a calf's life, and the calf's ability to absorb the immunoglobins begins immediately after its birth. Therefore, a calf must get an early and adequate supply of good quality colostrum from its mother, or other freshly calved cows. Without this early colostrum, calves are disease-prone and have higher death rates.[2]

Colostrum Feeding

Colostrum is the first milk produced after calving and has:[1]

- More than 2.2 times the total solids of whole milk.
- About five times the levels of protein and vitamins A, D and E.
- Contains 10 – 15 times more iron than normal milk.

In colostrum, blood proteins transfer passive immunity from the mother to the calf. A colostrum deprived calf requires 3 months to build up its immunoglobin levels to those of a colostrum fed calf.[4]

Freshly calved cows should be milked as soon as possible to produce colostrum because within two days of calving, milk nutrients have returned to levels similar to whole milk. Mature cows that are not the highest milk producers are best for producing high quality colostrum for storage and later use. Cows need to be dry for at least 3 - 4 weeks before calving to ensure high quality colostrum is produced. In addition, the quality of colostrum can be enhanced by vaccinating cows prior to calving with E. coli and 7-in-1 (leptospirosis and clostridial) vaccine.

Experienced calf rearers have found that calves from first calf heifers are the most difficult to rear and have a much higher incidence of scours. This is because colostrum from first and second calf cows is usually not as good quality as mature cows. Most likely, young cows have been exposed to less disease-causing organisms than mature cows, therefore young cows normally transfer less antibodies in their colostrum.

Colostrum can be stored in a refrigerator for about a week without affecting quality, or it can be frozen and kept for several months. Care needs to be taken when thawing as the quality will be reduced if the colostrum is exposed to high temperatures.

For a super start, a calf needs to be born on a 'colostrum conscious' dairy where rearers know the **three Qs** of feeding colostrum:

- **Q**uickly – 2 litres within 3-6 hours of birth.
- **Q**uality – only the best from mature cows.
- **Q**uantity – 4 litres within the first 24 hours.

The best way to guarantee colostrum intake is to stomach tube the calves. This method is becoming a feature of Australian calf rearing.

A buyer needs to maintain good communication with the dairy farmer to determine colostrum and medication status of calves. A buyer should only consider calves that have had at least two litres of best quality colostrum within three to six hours of birth, and four litres within the first 24 hours.

The fact that buyers have to rely on information from dairies about medication, colostrum, and feeding prior to collecting the calves reinforces the value of an ongoing relationship with the dairy farmer. Some calf rearers regard this relationship as so important they purchase all calves from a favoured dairy and resell the few that do not suit their dairy beef operation.

Colostrum feeding to new born calves is essential for trouble-free dairy beef calf rearing. Buyers are totally reliant on the source dairy for early colostrum feeding to calves. However, buyers can test calves for immunoglobin G levels and only buy calves from dairies that produce calves with high immunoglobin G blood levels.

Calf Selection Criteria

Selecting a dairy from which to source calves is not the same as selecting individual calves for purchase. Even when dealing with the best managed dairies, not every calf will suit.

Regardless of market, the best calves will be lively and inquisitive, bright and clear eyed, outwardly healthy, and have a good frame size. As a general rule, Australian Holstein bull calves should weigh at least 40 kg at purchase.

Depending on market, other characteristics may also be important. If sourcing Australian Holstein bulls for a feedlot, then genetics, coat colour, frame size, and conformation are critical. Structural soundness, as indicated by good strong feet and

legs, is required if animals are to grow to live weights of 800 kg or more under feedlot conditions.

Buyers should reject calves lacking size or vigour, or with physical problems such as hernias or umbilical cords that have not been checked and disinfected. Buyers must ensure the calves are properly hydrated, have no laboured breathing, and show no lameness.

When possible, buyers should avoid purchasing calves born under the following conditions:

- In cold, wet weather.
- By induced calving.
- To first calving cows.
- With assistance from the dairy farmer or a vet.

Finally, buyers should engage a consultant or adviser to help with calf selection if they are not experienced or confident enough to perform the assessment described above.

Price

Under normal circumstances, buyers should avoid calves that are offered cheaply or given free. They may be small, lack vigour, carry disease, and/or fail to meet specifications in some other way. These calves are likely to be expensive to rear and extremely unlikely to return a profit. Buyers should place effort into quality calves that have the best chance of repaying.

Buyers should focus on purchasing calves that have had colostrum in the first hours of life. A blood sample tested for immunoglobin G levels gives an indication of the adequacy of good quality colostrum given during the critical time period.

Calf Identification

Markets are now demanding life time traceability of animals. Therefore, animal identification at birth is critical. All calves must be tagged to record property of origin, date of birth, sire, dam, and birth weight if available. Tagging and record keeping for every calf should occur shortly after birth at the property of purchase. Buyers should obtain all individual records at the time calves are collected.

Life time traceability of animals allows learning and performance improvements for the daily beef producers, and earlier identification of any problems that arise.

Health Management

Rearing calves is an expensive business with at least a third of the total cost of rearing a calf incurred during the first twelve weeks of life. Morbidity & mortality rates and animal health costs can have a huge impact on total rearing costs. Damage suffered by a calf during the pre-weaning period is seldom repaired during the post-weaning period.

The fundamental requirement of a neonatal dairy calf is the early ingestion of liberal quantities of good quality colostrum. **The timing of this first feed of colostrum is critical to the future health of the calf.** If this first colostrum is delayed, the newborn calf could be compromised by having an increased risk of disease during the first six months of life, and reduced lifetime productivity.[2]

Colostrum, the first milk secretion produced by the mother's udder after calving, is concentrated with a high percentage of protein, particularly casein; specific immunoglobulins or antibodies; and high levels of vitamins A, D, and E. These nutrients are quickly absorbed by the suckling calf and provide it with immune protection. Colostrum is also a rich source of nutrients which get the calf off to a quick and healthy start. Passive transfer of colostral immunity is a simple equation of timing, quality, and quantity.

Infectious disease is the leading cause of morbidity and mortality in calves greater than three days of age. Failure of passive transfer increases the risk of neonatal mortality.[2] Newborn calves must receive colostrum as soon as possible, ideally within the first hours after birth. Two primary factors determine this tight time period. The first and most important factor is the absorption sites in the newborn's intestinal tract loose their ability to transfer immunoglobulins from the intestine into the bloodstream within 24 hours of birth. The second factor is to prevent disease; the colostrum must get into the blood before normal bacteria colonization of the intestine which begins at birth. In summary, for maximal protective effect, colostrum should be fed within three to six hours of birth, and ideally be given a second time about twelve hours after birth to ensure passive transfer of immunity.

The concentration of immunoglobulin protein in the colostrum determines its quality. Concentration improves in colostrum sourced from cows that have calved several times. Also vital is that first milk from a cow is used (i.e. rather than subsequent milk). In addition, cows should have been vaccinated with an E.coli and 7 in 1 vaccine. Colostrum from first and second calf heifers should be avoided as the quality is generally down when compared to mature cows.

Visual appraisal of colostrum quality based on colour and thickness is an inaccurate method of assessment. Colostrum quality is more reliably measured using a colostrometer. Where colostrum quality is unknown, the usual recommendation is to feed a greater volume (i.e., up to 50% more) of colostrum at the first feeding to increase the intake of immunoglobulins. Calves with low immunoglobulin levels have mortality rates as high as 40% pre-weaning, and depressed growth rates over the next six months. Therefore, calves must have early and adequate colostrum intakes.

Calves should receive at least two litres of colostrum within the first three to six hours and another two 2 litres within the first twelve hours following birth.

Many management variables contribute to failure of passive transfer leading to less healthy and more costly calves. Only 70-80% of calves learn to suckle within six hours after birth and combined with delayed administration or insufficient volume of poor quality colostrum, only 50-60% of dairy calves ingest sufficient immunoglobulins necessary for early survival.[3] Consequently, buyers should avoid calves that are born following calving difficulties, have difficulty standing, are produced by first or second calf

heifers, from induced cows and removed from their mothers too soon, and not drenched with a sufficient volume of colostrum in the first few hours of life.

Although colostrum is a wonderful source of immunoglobulins, vitamins, and other nutrients for the newborn calf, it cannot necessarily reverse the effects of a calf born in dirty, unhygienic conditions. Filthy calving pens or paddocks, and manure encrusted teats will mean calves can be overpowered by bacteria in spite of colostral absorption, leading to intestinal tract infection and neonatal diarrhea. Buyers should personally inspect source farms and avoid purchasing newborn calves from poorly managed and dirty facilities.

References

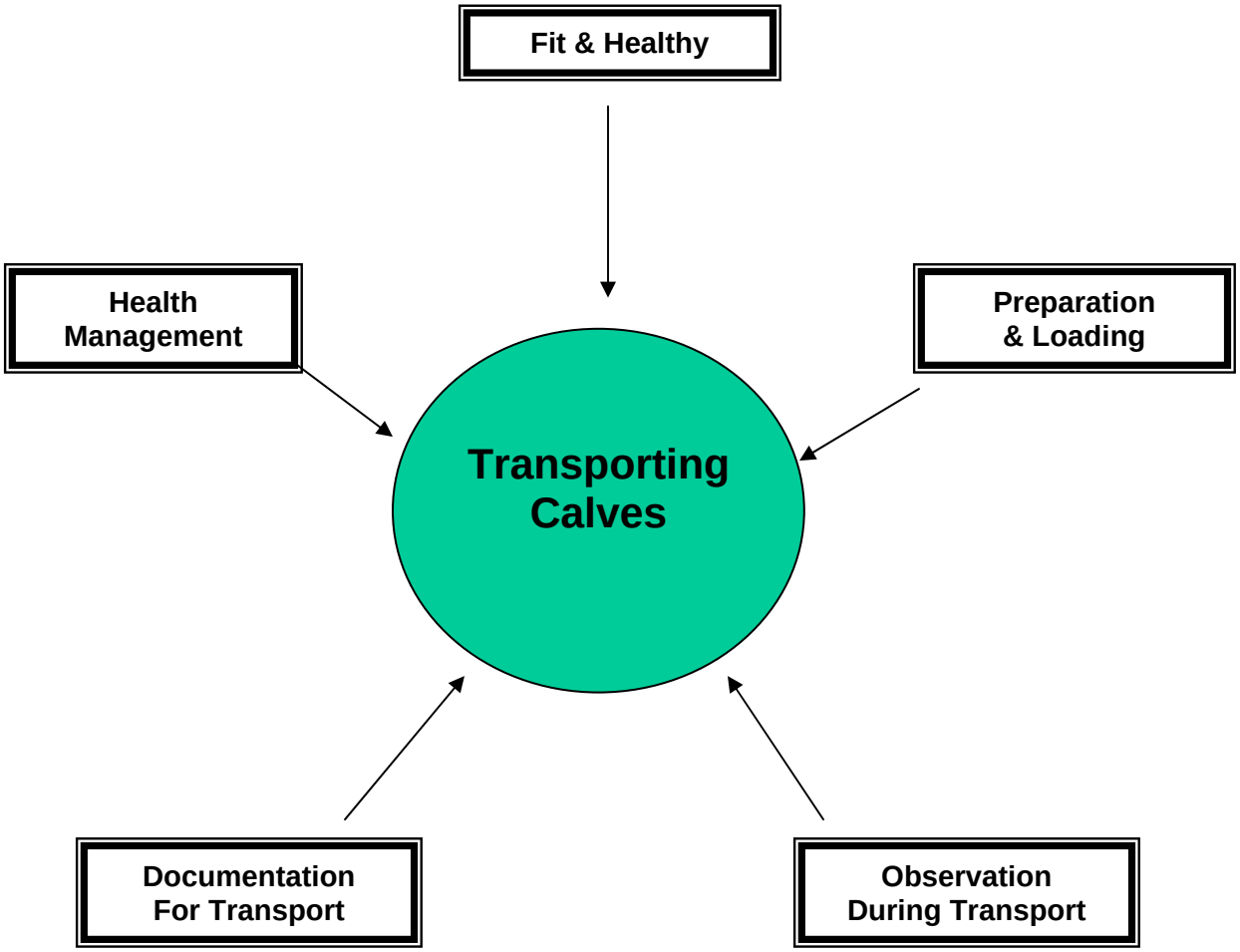
1. Campbell, J. R. and Marshall. R. T. 1975. The Science of Providing Milk for Man. McGraw- Hill New York

2. House, J & Smith B (2003) Medicine of the Calf – Including Advanced Fluid Therapy. In Australian & New Zealand Combined Dairy Veterinarians Conference, Taupo, New Zealand Vol 1.

3. Schouten, BW (2003) Calf and Heifer Rearing. In Australian & New Zealand Combined Dairy Veterinarians Conference, Taupo, New Zealand Vol 1.

4. Selk, G. E., Disease protection of baby calves. OSU extension. F- 3358

Section 4 - Transporting Calves



Key actions

☑ Ensure that calves are “fit and healthy”, disease free, and uninjured prior to transport.
☑ Use low stress handling techniques when preparing calves for transport.
☑ Provide feed to calves within 6 hours of transportation if the calves are less than one month of age. Including transportation time, calves less than one month of age require appropriate liquid food within 10 hours. Therefore, young calves must arrive at their destination within 10 hours of their last feed.
☑ Check and insure the vehicle or vessel for transport is clean and has no sharp or protruding edges that can cause damage or injury to animals.
☑ Advise truck drivers to check calves frequently during transport (after 30 minutes and every 3 hours thereafter). To avoid injury and potential death loss during transit, drivers need to observe and ensure that no animals are lying down and unable to stand up
☑ Immediately treat or humanly dispose of all animals injured during transport.

Introduction

A number of issues need to be considered when transporting dairy calves. Transporting young calves is a delicate process requiring careful planning and good calf management skills. Calf welfare must be the number one priority at all times. Pre-transport planning and preparation can provide the basis for good animal welfare and ultimately result in high meat quality and greater financial return.

The first step is selecting fit and healthy calves for transport. This is followed by calf preparation prior to transport, transport on a suitable vehicle or vessel, and arrival at facilities ready to receive animals.

The goal is to reduce stress and adverse effects on young animals. Efficient yard design allows animals to move with minimal fuss. Using an accredited professional transport operator helps to insure drivers have correct handling livestock skills and performs best practice animal welfare guidelines at all times.

Due to the young age and small size of calves, they are particularly sensitive to conditions outside their natural environment, especially pre-transport preparation (handling & mustering), transport, and the duration of transport. Procedures should be set up to ensure the shortest practical time from sale to their next destination (or other humane disposal).

Fit & Healthy

Prior to calves being transported, they should be inspected to ensure that they are fit and healthy to enable them to cope with the transit period. Calves should be alert, fit, strong, vigorous, able to stand on their own, capable of being transported, and at least 4 days old. The calf’s navel should be dry and the umbilical cord at the junction with the skin should be dry, wrinkled, withered, or shriveled. Calves which do not meet these criteria should not leave the farm.

Calves that are dopey, crippled, or generally unfit should not be transported. Sick or seriously injured calves are to be given the appropriate treatment or be humanely destroyed.

The SCARM Codes of Animal Welfare stipulate that calves less than one month of age should be fed within 6 hours transportation. Including transportation time, young calves require appropriate liquid food within 10 hours. Therefore, young calves must arrive at their destination within 10 hours of their last feed.

Calves that are older than one month of age which await transport, sale or slaughter should not be kept without food for more than 10 hours.

Recommended minimum live weight for calves being sold is 23 kg at the point of sale. Heavier calves are better able to withstand demands of pre-transport preparation along with the transportation period; calves become more resilient with age.

Dairy calves are normally picked up at place of birth and transported directly to the farm to be reared. This is the least stressful method. Alternatively prior to transport to the farm for rearing, calves are taken to an auction for sale or an interim holding facility. These alternatives cause more stress on the calves and increase the possible spread of disease.

Preparation and Loading

Every effort must be made to ensure that calf stress is minimised. A stressed animal does not generate maximum dollar returns as it is more likely to get sick, be more expensive to raise, and have lower growth performance. Calf buyers want calves to arrive, settle in, and begin to grow without setbacks.

Handling calves prior to transport should be performed in a manner that will avoid injury and stress. Experienced handlers advise that slower is often quicker when handling animals. To reduce stress when handling and moving animals to and within holding facilities, handlers use an animal's flight zone and point of balance.

Understanding the flight zone is the key to easy, quiet handling. The flight zone is the animal's safety zone. When a handler penetrates this zone, an animal will move. When the handler retreats from the flight zone, the animal will stop moving. The size of each animal's flight zone will be determined by many factors such as temperament and the angle of the handler's approach. The key is using a pressure and release method when penetrating an animal's flight zone. When the animals go where handlers desire, then they back out of the flight zone. When animals slow down, handlers enter the flight zone to facilitate movement. These handler techniques are displayed below in Diagram 1.

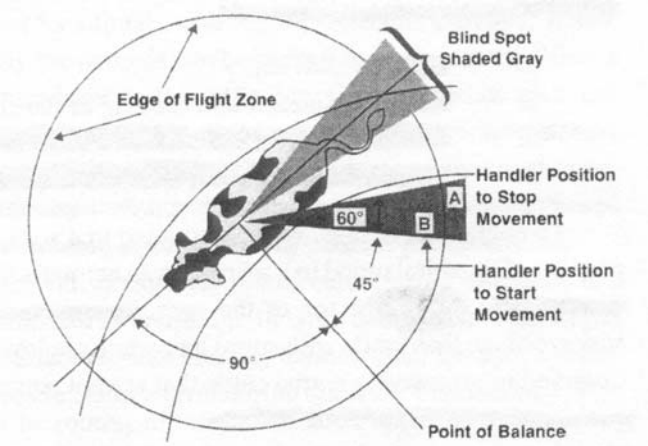
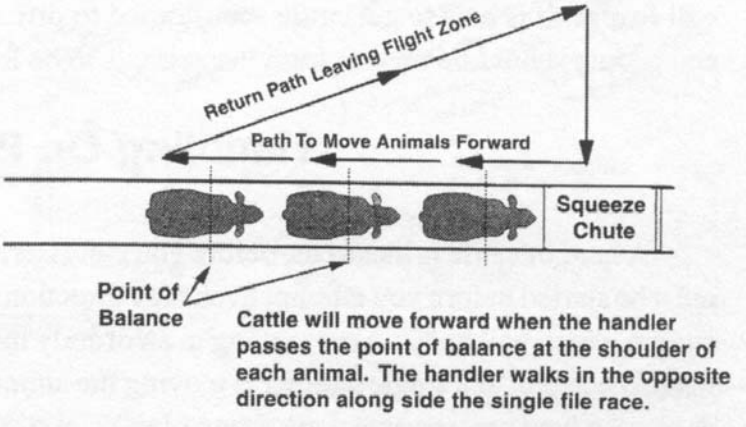


Diagram 1: Flight Zone

The point of balance is the shoulder of each animal. To move an animal forward, a handler must be behind the point of balance at the shoulder, shown in Diagram 1 above[1]. Finally for squeeze chutes, a basic principle is that cattle speed up when the point of balance is crossed in the opposite direction as desired movement[1] as shown in Diagram 2 below.

Diagram 2. Handler Movement Pattern to Keep Cattle Moving Into a Squeeze Chute or Restrainer



Calves should not be prodded with any sharp instruments, kicked, or beaten at any time. The use of electric prods when handling, loading, and unloading are not permitted. The use of dogs is not an acceptable practice unless both calves and dogs have been trained accordingly.

The facilities from which calves are loaded are the responsibility of the producer. Good facilities minimize the stress of loading animals for transport.

The truck or vessel that transports calves should be cleaned thoroughly prior to loading and after unloading to minimize the spread of disease.

Professional livestock transport operators should be used to transport livestock commercially. The Australian Livestock Transporters' Association (ALTA) has its own accredited quality assurance system, TRUCKCARE. This assurance program aims to achieve driver safety and animal welfare. Livestock transporters accredited with TRUCKCARE are skilled in handling livestock and observe best practice animal welfare guidelines at all times. Calf buyers must advise the transport operator of shipping numbers and pick-up times to minimise calves being yarded for longer than necessary.

The driver of the truck is responsible for the care, health, and welfare of calves during transport unless accompanied by the owner or an agent. The owner of the calves should not present "unfit" animals for transport as the truck driver may decide not to load such animals.

The Australian Model Code of Practice for the Welfare of Animals recommends that calves be loaded at a density so as to allow all calves to lie down during transit. While overcrowding must be avoided, too much space can also lead to injuries during travel. Also, calves should be transported in separate compartments to other classes of stock as this will prevent injury from larger animals.

Finally, calves have high susceptibility to stress during transport; therefore, they should not be shifted during weather extremes such as cold, hot, and/or wet.

Observation during Transport

Good animal management and skilled driving are important to the welfare of animals carried by road transport.

Truck drivers should check calves 30 minutes after the commencement of the journey and at least once every 3 hours to ensure that calves are not injured. If calves are being trucked in a mountainous environment, calves should be checked at least twice in a three hour period especially if the road is winding and has steep climbs and descents. In this mountainous terrain, animals must concentrate during transport and they use significant metabolic energy trying to stand and prevent falling or slipping over. Further in wet conditions, animals are more susceptible to slipping if being transported. After driver meal breaks and/or refueling stops, calves should be inspected as soon as stopped and prior to departure.

During checks, the driver should look for any animal that is lying on its side, appears jammed by other animals, has its head locked in an awkward position, and/or is unable to stand up. If the driver observes any of these situations during the journey, then the driver must work to get the animal back on its feet. If the animal is unable to be stood up, then the load should be taken immediately to the closest sale yards and unloaded. If the downed animal is still unable to stand up once the load has been removed from the truck, a veterinarian should be contacted to have the animal treated as required, or disposed of humanely.

Transport operators should ensure that animals reach their destination as quickly as possible and in a condition that is not significantly less than when they were loaded. If

injury or illness occurred during transport then immediately upon arrival, injured or sick calves should either be given appropriate veterinary treatment or be disposed of humanely.

Documentation for Transport

Calves being road transported must be accompanied by a Travelling Stock Statement. Currently, state and federal regulations have no restrictions on movement of calves over state borders.

For more information on state laws associated with National Livestock Identification Regulations, interested parties may review the website www.mla.com.au or contact the local state department of agriculture.

Health Management

The transport of neonatal calves is an extremely stressful activity and must be undertaken with due concern for the welfare and health of calves. An important factor is that only healthy stock should be transported in dedicated calf transport vehicles.

Neonatal calves are particularly sensitive to conditions of husbandry and transport, and they will suffer stress if the trip is unduly long or if they are roughly handled during transport and delivery. Sick or injured calves, underweight calves, and calves with moist umbilical cords should not leave the farm.

Tagging and record keeping for every calf should occur at the property of purchase and should include relevant history and health treatments.

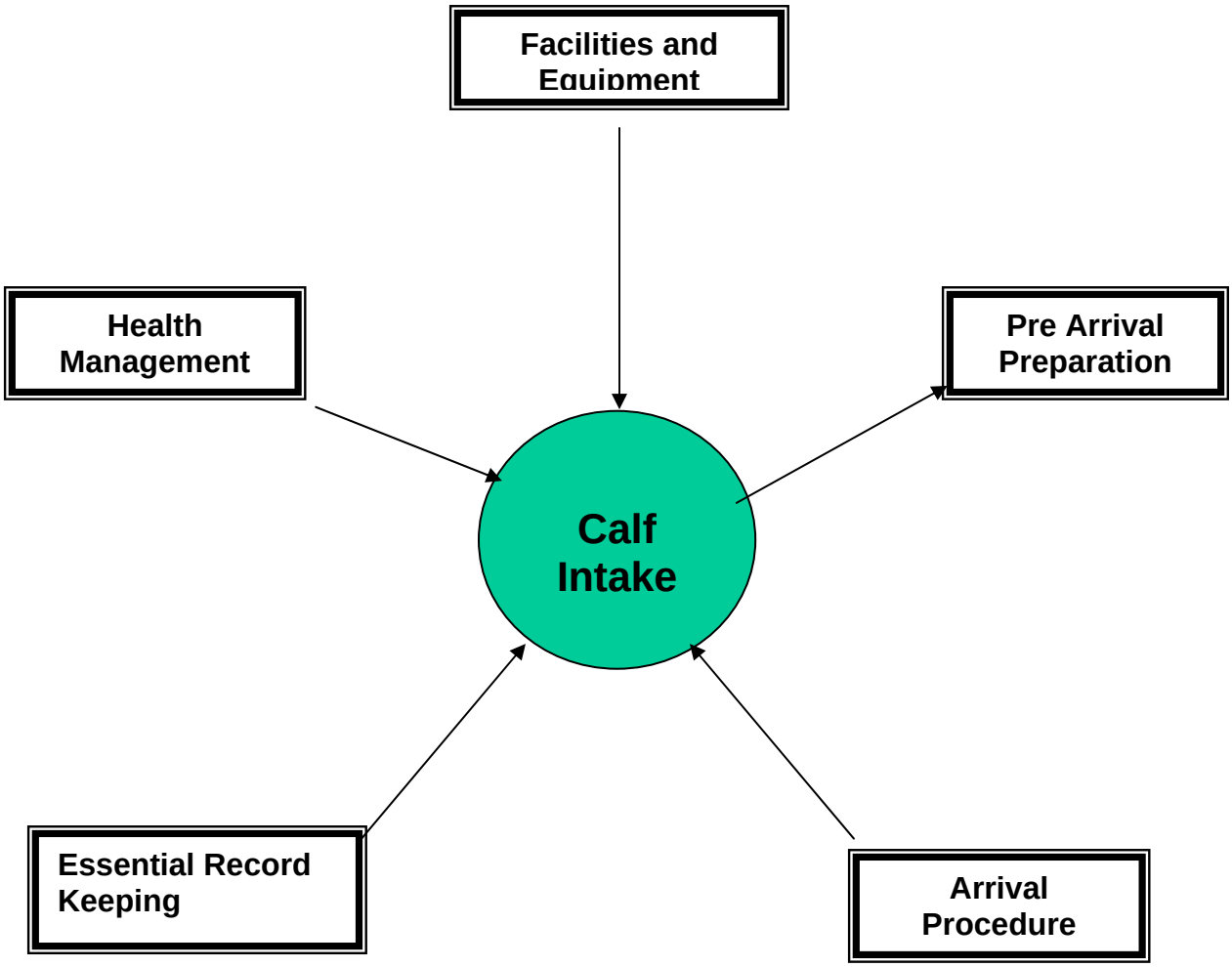
Calf trailers or trucks should have an enclosed front and be cleaned and disinfected after each trip to prevent the build up of manure and harmful bacteria that will compromise the health of susceptible, newborn calves. Also, transport vehicles should only used for calves to avoid exposure to organisms from adult animals, such as the bacteria that cause Johne's disease.

References

1. Grandin, T. (2000) Beef Cattle Behaviour- Handling and Facilities Design, 2nd Edition.

2. Land Transport of Cattle (1999) – Standing Committee on Agriculture and Resource Management Report No. 77. Australian Model Code of Practice for the Welfare of Animals.

Section 5 - Calf Intake – Settling Into The New Environment



Key Actions

☑ Plan in advance. Determine all requirements for calf raising facilities, equipment, feed, and medicine prior to calves arrival.
☑ Provide calf housing with a stress free, draught free, dry, and hygienic environment.
☑ Maintain frequent observation of calves as timely attention to detail is necessary for successful calf rearing.
☑ Treat animal dehydration immediately.
☑ Maintain thorough and essential record keeping so to improve performance and meet buyer's requirements.

Introduction

The key to successful calf rearing is an empathy with calves and timely attention to detail. Successful calf rearers enjoy working with and taking on the function of 'parenting' young calves. Good calf rearers develop a relationship or bond with calves. A consistent daily routine that ensures each calf can be observed for health will help reduce morbidity and mortality. This is best achieved if only one person is responsible for caring and feeding of calves. However in large enterprises employing multiple personnel, then careful recording keeping of daily observations is required to maximize performance and minimize morbidity and mortality.

People who plan to rear calves should be well informed about feeding, housing, and all health aspects before starting. In addition, calf rearers require skills in areas such as:

- Visual assessment of a calf's health.
- Taking a calf's temperature.
- Vaccinating
- Tube feeding
- Evaluating pasture growth and nutritional qualities.

Morbidity and mortality rates have been lower for owner managed calf rearing systems; therefore profit sharing and/or other incentives may improve system performance if hired labour is used. A well developed calf management plan needs to be established that matches the farm design and stated performance goals. A thorough management system will address how calves enter the facility (e.g., in batches or continually), scale of the enterprise, weather conditions, and shelter available at the rearing location.

Training staff for proper care of calves is essential, however no amount of science can substitute for the art of calf caring. Many successful rearers believe **"People rear calves, not systems"**.

Facilities and Equipment

The most important part of calf rearing is the first two to three weeks. Good housing and individual feeding are the best way of getting calves off to a good start. Housing for a calf is a combination of pen, feeding system, and shelter.

Individual pens are the optimal housing environment for a calf as individual pens allow for greater monitoring of health, and controlling of milk, feed, and water consumption. Less experienced calf rearers will have more success with individual pens due to the

ease of calf management. However due to high costs, individual pens are often not used.

If used, individual pens require a minimum size of 1.5 – 2.0 m^2. For calves grouped together, pen size should allow for a minimum of 5.5 m^3 per calf[2]. To provide for adequate drainage, the floor of pens should be sloped at 5%[5].

Calves that are housed together should be in as small as groups as possible and all of similar size. As the calves get progressively older, groups can become larger. For optimal growth, animals should always be grouped in uniform size, weight, and age. Finally, calve pens should allow separation of older stock from newly arrived calves to prevent spread of disease.

A feeding system must incorporate daily labour and calf size. Feed troughs must allow for a minimum length of feeding area of 15 cm / animal. This ensures all animals have access to feed at all time. In addition, both feed and water troughs need to be elevated above the ground to prevent contamination with faeces. For example, a trough height of 46 cm above the ground is recommended for young stock[3].

Shelter for calves must provide a stress free, draught free, and dry environment. The most favourable environmental conditions for a calf are a temperature of 17^o C with a relative humidity of 65%[5]. Adequate lighting is essential so that each calf can be readily observed on a daily basis for overall health, feed intake, and performance. Shelter options tend to be variations on three basic systems of full shelter, outside rearing, and night shelter with day paddocks.

For full shelter, many different types of sheds are suitable. The dimensions of a calf shed should be twice as deep as it is wide or high[5 6]. This allows for adequate ventilation, without undo draught. Control of ventilation needs to be sufficiently flexible to meet changing climatic conditions and prevent condensation. Proper ventilation is essential to prevent pneumonia; therefore calves must be kept dry at all times.

To ensure the calf is kept dry, adequate bedding is also necessary. Bedding material can be saw dust, wood chips, straw, rice hulls, or any other material regularly used in animal enclosures. Bedding must not be dusty or release any noxious odours. A dusty environment can irritate the lungs of a calf and result in pneumonia. The bedding material used must be deep enough to permit adequate drainage, while providing a dry top surface for a calf to lie down. Insufficient depth of bedding is often a common mistake seen in a calf rearing operation. The proper type and amount of bedding in association with good ventilation will ensure no ammonia smell is evident, especially at the level of the calf. High ammonia levels are also a predisposing factor to pneumonia.

A good manure handling system is also needed. Manure provides a home for many disease causing pathogens; therefore manure removal is essential to maintain healthy calves. Using high pressure water to remove manure should not be done while calves are present as the water pressure may re-suspend pathogens in the air which can then affect healthy calves.

Calves require access to sunlight. Sunlight is required for an animal to produce vitamin D, which is necessary for calcium metabolism and the formation of bones. Sunlight also dries out pens, and aids in the disinfection process[5].

In Australia, a calf shed should open to the North or Northeast to allow sunlight to warm and dry the facilities without entry of prevailing wind or rain[5]. Calf hutches are another consideration for rearing calves. The hutch should provide 1.2 m x 2.4 m of shelter attached to a wire pen[1].

Enterprises that rear large number of calves simultaneously in full shelter should consider using independent functional modules of no greater than 100 calves. This reduces overall morbidity and mortality, and is easier to maintain proper ventilation and hygiene. In addition, the smaller module size lowers the opportunity of disease transfer. A modular system allows for **"all in / all out"** calf rearing. Transfer of calves between modules is not permitted. Modules must be cleaned and disinfected between lots of calves[6].

Completely opposite to full sheltering of calves is outside rearing. Before moving to outside rearing, calves should have shedding for the first two weeks. Paddocks must be parasite free and also have shelter from prevailing winds. This can be achieved by specifically planned and strategically located windbreaks made from trees, hedges, fences, and/or buildings. Calves can be trained to use the shelter by placing concentrate feeders within or adjacent to the shelter areas.

For outside rearing, calf coats are an extra alternative. Calves will need to become accustomed to the coats before they settle into the outside routine. In addition, calves often get lice, therefore weekly visual checks under the coat for any infestation is essential.

The third sheltering option is a combination of the above two systems called night shelter with day paddocks. This system is commonly successful for batch rearing when an existing shed is used for a dual purpose. For example, a machinery shed may be used as a calf shed during calving season. Animals are outside during the day; therefore minimal shed contamination occurs. During nights and inclement day weather, calves sleep and stay in a dry, draught free environment. Also, this shelter system allows calves to adjust to outside conditions; therefore it lowers stress that can occur when shedded calves first leave the shed.

Regardless of the sheltering system used to raise calves, calves will ultimately be turned out onto high quality grass paddocks. Paddocks should be parasite free, and calves should be treated with an effective drench before changing paddocks.

Calf raising facilities must be kept in a very good hygienic condition at all times. Thorough cleaning between lots of newly arrived calves is critical to maintain their health and performance. All equipment that comes in contact with the calves must be sterilised between uses. This includes such gear as utensils, medical equipment, and any other equipment used to feed, handle or care for calves. In a specific pen, the same troughs, pails, and other equipment should be used at all times to prevent cross contamination. At the end of each calf rearing season, bedding should be removed and the shed cleaned out. Seasonal calf rearing should allow facilities to be vacated for three months and cleaned with effective viralcidal disinfection such as Vrikon™ to ensure a hygienic environment for the next lot of calves[6].

Finally, a calf rearing facility should also include space for equipment storage, feed storage, medicine storage, and milk replacement preparation. For milk replacers, a hot water supply is necessary. A complete calf facility also includes facilities for unloading and loading calves.

Pre Arrival Preparation

The arrival site must be prepared in advance for each batch of new calves; correct preparation is critical. Preparation includes freshly disinfected pens, adequate feed supplies, and clean water. A quality source of milk should be on hand. In addition, all utensils should be sterilised, and rehydration equipment should be ready for use. As set by a veterinarian, proper veterinary supplies should be on hand to fulfil the disease prevention and treatment regimes. Calves should have been weighted, tagged, and fed before travel so that they can rest on arrival.

Arrival Procedure

Newly arrived calves need to be isolated from the general population for three to six days to minimise the chance of introducing disease. In addition, calves that show signs of sickness need to be immediately moved to hospital pens. Transportation often results in stress and dehydrated animals. Calves should be immediately checked and treated for signs of stress or dehydration.

Dehydration can be categorised into three broad categories of severity as indicated in Table1. Calves will not perform as well as expected if they do not rapidly recover from the stress of transport. Calves showing signs of dehydration must be given electrolyte solutions (for example, Res-Q™, Lectade™, VY-Trate™) to replenish the loss of water. In general, a calf should receive 2 litres of electrolyte solution, twice daily, in place of milk for two days, then alternatively with milk for an additional two days. If the calf will not drink, drenching is required. A McGill calf feeder can be used for this purpose[4].

Table 1 - Outcome of Loss of Body Weight Associated with Scours

Percentage of Body weight Loss	Outcome
5 to 6 %	Appearance of first clinical signs
8 %	Depression, sunken eyes, dry skin, calf lack's the ability to stand
12 %	Death

In severe cases of calf dehydration and with consultation from a veterinarian, an intravenous fluid treatment maybe necessary. Also, a decrease in body temperature is also associated with dehydration; therefore calves must be kept warm.

Whether electrolytes are given with or without milk has been a contentious and debated issue. Regardless of opinion, two facts are clear. First, electrolytes will prevent the milk from clotting; therefore milk and electrolytes should not be given within a close time frame of each other. Second, an extended deficiency of milk will weaken a calf and eventually cause death due to starvation.

When a commercial electrolyte mix is not available, in emergency situations a solution of one tablespoon of baking soda, one tablespoon of salt, and 250 cc of a 50% dextrose solution can be used. Table sugar should not be used in place of dextrose. All ingredients should me mixed with sufficient warm water to make a 4 litre solution. Weakened calves may require the use of stomach tubes to ensure they receive the mix.

Essential Record Keeping

Best practice demands that sufficient records are kept for two main purposes. First, good records assist with continuous improvement in the performance of the dairy beef operation. Second, good records help ensure animals meet the buyer's specifications. In addition, whole life traceability is increasingly becoming a standard requirement.

An historical record of the management, husbandry and growth performance of each animal should be available. Each time an animal is sold, the seller needs to provide the buyer a written "Vendor Declaration" on the health, management treatments, and disease free status of each calf group. Calf rearers should not accept any animals without this documentation as it will be needed at a later date when the animals are sold again.

Upon arrival, the following information is required on each individual calf:

- Date of birth
- Date calf received
- Calf identification and tag number
- Property of origin
- Breed
- Weight of calf
- Purchase price

The dairy beef industry has no set method of keeping records. Therefore, the record management system selected by each farm should reflect the size of operation and be easy to complete. If large numbers of animals are involved, computer record keeping is the most efficient. Table 2 indicates the information that should be tracked per calf. All information collected must have a corresponding animal identification number and date.

Table 2: Information to Collect During Calf Rearing Operations

Performance	**Health**
Nutrition • Feed intake • Milk intake • Hay intake • Other supplement intake	Medical Treatment • Disease • Date drug was administered • Dosage level of drug • Drug administered • Withholding periods of drugs
Weight Gain • Entry weight • Weaning weight	Mortality • Date of death • Cause of death
Economics • Purchase price • Sale price • Feed cost • Labour cost • Fixed costs	

A one-sheet-per-calf recording system easily simplifies record keeping and can be passed to any purchaser. Both completed and blank examples of an individual calf record sheet are shown below as Tables 3 and 4.

Finally, feedback on an animal's final feedlot and carcase performance should be recorded. This will assist in identifying sources of superior cattle and help promote continuous improvement of the calf rearing operation. In addition, any agreements such as contracts should be in writing and stored in a safe place.

Table 3 - Example Record Sheet for an Individual Animal

Calf number:	48 SM	Purchase Cost:	$ 52
Property of origin:	B.Smith	Rearing Cost:	$212
Breed Sire:	Australian Holstein	Final Sale Price:	$390

Date	Day	Nutrition	Observation	Management Practise	Medicine	Wt	Costs
10/Jan	0	Milk + suppl. Indicated below	4% dehydrated	Ear tagged electrolyte		42 kg	Tag 60c
11/Jan	1	200g					
12/Jan	2	300g					
13/Jan	3		Mild dietary Scours	Electrolyte			
14/Jan	4	300 g					
15/Jan	5	350 g					
16/Jan	6	400 g					
17/Jan	7	400 g					
18/Jan	8	400 g					
19/Jan	9	450 g					
20/Jan	10	450 g					
21/Jan	11	450 g					
22/Jan	12	450 g		Marked			
23/Jan	13	500 g					
24/Jan	14		Serve E coli	Electrolyte			
25/Jan	15			Electrolyte			$45
26/Jan	16	250 g					
27/Jan	17	500 g				43 kg	
21/ Feb	42			Dehorned			
				Vaccinated	7-in-1	66 kg	
				Drenched	Specify type		75c
10/ Apr	3 mths	Suppl stopped				103 kg	50c
15/ May	5 mths	silage (3 kg/d)				124 kg	
30/Jul	6.5 mths					188 kg	
12/ Dec	11 mths	hay (2 kg/d)				278 kg	
28/Feb	13.5 mths	Suppl. stopped				318 kg	
30/Apr	16 mths					363 kg	

Sire: SuperCharger XYZ

WT_____= weight

Table 4 - Record Sheet for an Individual Animal

Calf number: _____
Property of origin: _____
Breed Sire: _____
Sire:_____

Purchase Cost: $_____
Rearing Cost: $_____
Final Sale Price: $_____

Date	Day	Nutrition	Observation	Management Practise	Medicine	Wt	Costs

WT = weight

Health Management

Preventing disease in young susceptible neonates involves a complex interaction of factors. As discussed in previous Health Management subsections, calves need to receive adequate colostrum at birth from well managed cows in good condition. These well managed cows have preferably been vaccinated against enterotoxigenic E.coli and salmonella prior to calving, although salmonella vaccination has limited protection. Once into a rearing facility, healthy calves require the provision of adequate nutrition in a clean and comfortable environment that minimises exposure to pathogens. If for any reason these measures are not observed or ignored, a common outcome is disease leading to death.

Disease in unweaned calves commonly occurs in three distinct time periods. The first is the perinatal period from birth to about three days. This first period generally covers deaths due to hypothermia, starvation, and weak calves from prolonged calvings. The second period covers the time from three days to four weeks of age. This second period is the time of calf scours or diarrhoea. The third time period occurs from four weeks of age through to weaning. This third period includes the diseases of pneumonia and diarrhoea[7]. To minimise these common disease setbacks and maintain a low mortality rate in the mob, each time period needs to be managed in an appropriate and efficient manner.

On arrival, calves should not be fed for at least four hours after transportation unless they are stressed or hypothermic from the journey. Rest is probably more important than feeding at this stage. A rest period is best followed with a drink of electrolytes which is then followed by stored colostrum, whole milk, or milk replacer within twenty four hours of arrival.

If the colostrum intake status is unknown or suspected to be inadequate, then calves can be injected or dosed with Vitamin A at 500,000 IU, Vitamin D at 50,000 IU, and Vitamin E at 50 IU. Calves should also be drenched with a solution of naturally occurring lactic acid bacteria (50 – 100 ml natural, plain yoghurt) or a proprietary probiotic.

On arrival, calves should be identified with an ear tag, tattoo, or permanent electronic button. In addition, calves should have weight, rectal temperature, and dehydration status determined and recorded. The degree of dehydration of a calf is expressed as a percentage of body weight as outlined in Table 5.

Table 5: Amount of Fluid Lost as a Percentage of Bodyweight with Corresponding Signs of Dehydration (adapted from Moran 2002)

Dehydration	Signs	Skin Fold Test	Action
5%	Skin "doughy", standing, body surfaces & extremities warm, usually still suckling	1 – 2 seconds	Oral fluids – stomach tube / bottle
8% - 10%	Skin lacks elasticity, eyeballs slightly sunken, weak suck, depressed, body surface warm to cool, extremities cool, sitting	6 – 10 seconds	Requires intravenous rehydration
12% plus	Marked reduction in skin elasticity, recumbent, body surfaces cold, sunken eyes, sporadic twitching	20 – 40 seconds	Requires urgent intravenous therapy

The normal core body temperature of a calf is 39.0 to 39.2°C. The animal conserves heat through metabolism, and it looses heat through radiation, convection, conduction and evaporation[8]. Very young calves are more susceptible to fluctuations in environmental temperature due to their large surface area to mass, and to limited energy reserves. A hypothermic calf will shiver, and its body mobilise its brown fat reserves to lift body temperature unless suffering from starvation. If the animal is suffering starvation, fat reserves available for heat production are limited which inevitably leads to death[7].

Detection of sick calves on entry to the rearing facility or at any time during the rearing process requires that they be isolated in a hospital pen where they can be more easily medicated and monitored for changes in status. Some of the more common signs that signal an ill or stressed calf include:

- Poor appetite.
- Down in an abnormal position / unable to stand.
- Low or high body temperature.
- Kicking at belly.
- Violent shivering.
- Profuse diarrhoea.
- Coughing when not feeding.
- Sunken eyes.
- Nasal discharge.

Any unusual signs or outbreak of calf disease should be promptly assessed, diagnosed and treated to prevent spread of the problem and to minimise cost blowouts. A rearer should seek the advise of a veterinarian at the sign of problems. A veterinarian who is familiar with the rearer's facilities and operations can further assist the health management program.

References:

1. Calf Care. 1990. Calf Care and Raising Young Stock. W. D. Hoard & Sons Co.

2. CSIRO. 2003. Primary Industries Standing Committee Model Code of Practise of the Welfare of Animals. Cattle. SCARM Report 39

3. Dairy Housing and Equipment Handbook. 1985. 4th Ed. Midwest Plan Service.

4. Malmo, J. 2000. Personnel Communication. Maffra Veterinary Centre, Maffra Victoria 3860.

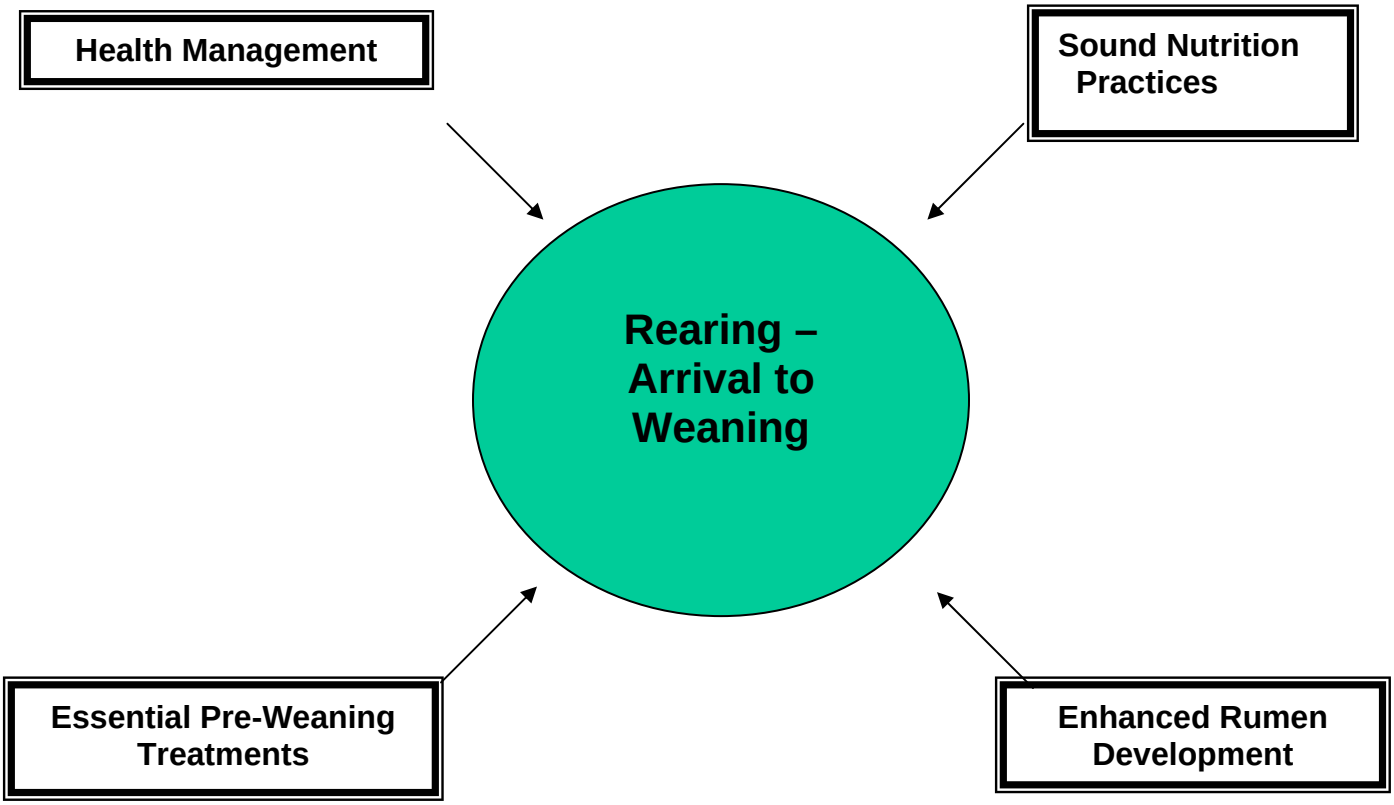
5. Moran, J. 1993. Calf Rearing. Kyabram Research Institute. Department of Agriculture, Victoria.

6. Schouten, B. 1994. Intensive Calf Rearing. Dairy Research Symposium. Vol. 12 National Dairies Ltd.

7. House, J. & Smith, B. 2003. Medicine of the Calf – Including Advanced Fluid Therapy. In Australian & New Zealand Combined Dairy Veterinarians Conference, Taupo, New Zealand Vol 1.

8. Droppo, T. 2003. Management Practices for Raising Dairy Steers – Dairy Factsheet. June 2003. Manitoba Agriculture, Food and Rural Initiatives. http://www.gov.mb.ca/agriculture/livestock/dairy/cda20s06.html

Section 6- Rearing Calves - Arrival to Weaning



Key actions

☑ Achieve early weaning in dairy beef operations by early consumption of solid feed, good nutritional practices, and stress free animal management. Early weaning can only be achieved when the rumen is developed.
☑ Provide high quality milk and feed concentrate (calf starter) for healthy and fast growing calves.
☑ Inspect calves twice daily for early problem detection.
☑ Isolate all unhealthy calves immediately.
☑ Treat dehydration immediately.

Introduction

Success or failure in rearing calves depends greatly on the attitude of the calf rearer and his/her ability to react promptly to a calf's numerous signals. Calves are babies and need to be raised in a stress-free environment. As stated in the previous section, the first two to three weeks in a calf's life have the highest risk for disease or death. This is the time to avoid or reduce any scour and health problems which have high treatment costs, delay rumen development, and reduce growth rates.

Newly arrived calves need to be isolated from the general population for three to six days to minimise the chance of introducing disease. Where possible, new calves should be kept in individual pens as this allows for easy monitoring and early detection of any health problems. Early detection allows for quick treatment which is critical for quick recovery. After the initial period of acclimatisation and training, calves can be put into batches as they are social animals and respond better if reared in visual contact with other calves.

To be successful, calf rearing must achieve early weaning. The two key elements are a milk feeding program to ensure healthy growth, and a program to develop the rumen rapidly through nutrition and feed management. A once daily feeding regime should be followed up with twice daily visits by the rearer to the calf shed or paddock.

Attention to detail is required in the first month of a calf's life to ensure that its needs are met. A calf's stress levels must be minimized, while a high level of balanced nutrition and intense management will ensure the calf grows properly. In a healthy and prospering calf, its rumen will develop quickly and allow early weaning.

Sound Nutrition Practise

Young calves, like all other animals, require five major nutrient components for a balanced diet. These nutrients are:

- Water
- Energy
- Protein
- Vitamins
- Minerals

These nutrients are obtained from water, milk, feed concentrate (calf starter), straw/hay, and pasture.

Calves preform best in a stress free environment; they prefer a consistent routine. If feeding changes are necessary (i.e., changes in feeding time, feed ingredients used, and/or amount fed) then only gradual changes should be done.

At all times, young calves require access to clean fresh water. In the industry, this is a commonly debated topic because calves are also receiving milk. Studies have shown that calves provided free access to water increase their intake of dry feed and increase body weight gain by 37%. The increase in dry feed intake is paramount to early rumen development. Therefore, water along with milk is preferred. Water troughs should be high enough to minimise contamination by manure and be cleaned at least weekly.

The quality of water is also important as it affects calf's health and performance. Salinity and nitrate levels in water are the two major compounds of concern. Table 1 and Table 2 below show how salinity and nitrate levels of water affects livestock.

Table 1 - Total Solids of Water and Effect on Livestock [12]

Total Dissolved Solids (mg/l or PPM)	**Comment**
Less than 1000	Excellent for all classes of livestock.
1000 to 2999	May be satisfactory.
3000 to 4999	May be satisfactory to livestock. However if not accustomed to the water, animals may refuse to drink for a few days.
5000 to 6999	Acceptable for most livestock. Exceptions are pregnant and lactating animals. Water may have a laxative effect.
7000 to 10,000	Only acceptable for low producing ruminants. Not acceptable for young stock.
10,000	Unsatisfactory for all livestock.

Table 2 - Nitrate Levels and Effect on Livestock [12]

Nitrate Content* (PPM nitrate nitrogen)	**Comment**
Less than 100**	Should not harm livestock.
100 to 300	Not harmful to livestock. Potential problems exists when the water and feed nitrate level is combined
Over 300***	Nitrate poisoning in cattle is possible

* Includes nitrite nitrogen.
** Or less than 443 PPM of nitrate, or less than 607 PPM of sodium nitrate.
*** Or over 1329 PPM of nitrate, or over 1821 PPM of sodium nitrate.

During the first month of its life, a calf should consume 4 litres of milk per day, which is 10 -12% of its body weight.[14] Twice a day feeding (i.e., 2 litres per feeding) may be used initially, and should be used **only** for the first five days. Once a day milk feeding should be started as soon as possible as it lowers labour cost and promotes consumption of dry feed which aids faster rumen development.

A white scour indicates a calf is getting milk that is too concentrated in nutrients. If this occurs, the rearer should decrease for a short time the colostrum used or the powder content of the milk replacer. Milk level should be always gradually increased (i.e., both volume and/or concentrate of milk powder) to avoid scouring. Too often calves are not given sufficient milk as they increase body size. **Rearers should not under feed calves.**

A good supply of quality milk or milk replacer is essential to produce a healthy and well grown calf. Buyers of milk replacers should purchase only recognised quality brand-name milk replacers of the same batch number and consider bulk buying. A single batch removes variations that may exist between production batches and provides diet consistency for each group of calves. A quality milk replacer should meet the following specifications as indicated in Table 3.

Table 3 - Milk Replacer Nutrient Specifications [10] [11]

Nutrient	**Comment**
Protein	20 – 28%
Fat	10 – 22 %
Carbohydrate	Lactose or Dextrose
Lecithin	This is a phospholipid that aids in the assimilation of fat
Minerals	Calcium 1.0 % Phosphorus 0.7 % Magnesium 0.07 %
Trace minerals	Copper Cobalt Iodine Iron Manganese Zinc
Vitamins	A D B_{12} K E

Proteins are building blocks of life and are required for health and growth. However, all proteins are not the same quality. Below, Table 4 indicates which proteins are suitable for a calf's milk replacer.

Table 4 - Protein Sources Suitable for Milk Replacers [6]

Optimum	Acceptable	Questionable / Not Recommended
Skim milk powder	Chemically modified soy protein	Fish protein Concentrate
Buttermilk powder	Soy concentrate	Soy flour
Dried whole whey	Soy isolates	Distillers dried solubles
Delactosed whey		Brewers dried yeast
Casein		Oat flour
Milk albumin		Wheat flour

A good quality milk replacer should also clot well. The ability for the milk to clot affects a calf's ability to digest and absorb milk nutrients. Milk replacers that have low levels of the protein casein do not form a clot.

Mixing instructions for a milk replacer must be followed very carefully to achieve required nutrient concentration. To insure correct mixing, milk powder ingredients should be weighed before mixing. In addition, feeding instructions should be followed as specified by the milk replacer. In general, milk should be fed at up to a calf's body temperature of 36^{o}C, but no greater.[10] Calves can be raised successfully on either a teat or bucket rearing systems.

Whole milk can be fed to new calves; however, it is often not available and/or too expensive. When used, whole milk should be fed at 12% of the calf's body weight. Lower volumes will not allow a calf to obtain sufficient nutrients for growth, and higher volumes will decrease starter intake and prolong rumen development.[6]

Waste milk or mastitic milk can be fed to calves; however due to the antibiotics in the milk, these calves can not be fed for the veal or bobby calf market due to the risk of antibiotic contamination of the meat. In addition, certain markets do not want animals that have been exposed to antibiotics; therefore these markets would not be available. In addition, waste milk or mastitic milk also contains more microbial life which at high levels is detrimental to a calf and may increase the risk of disease.[13]

From day three onwards, a calf should have free access to a continuous supply of calf starter in the form of calf pellets or muesli. A palatable starter supplement should be supplied fresh every day. Molasses can be added to the starter to enhance its palatability. Table 5 indicates the minimum nutrient specifications a calf starter must meet.

Table 5 - Nutrient Specifications of Calf Starter [6 11]

Nutrient	Level
ME (Mj/kg)	13 - 14 Mj/kg
Crude Protein	18 – 21 %
Crude Fat	Minimum of 3 % and maximum of 4.5 %
Calcium	0.70 %
Phosphorus	0.45 %

A young calf does not have a functional rumen; therefore no urea should be contained in the calf starter. The starter should also contain a vitamin trace mineral mix specifically made for calves. Consumption of calf starter is necessary to promote development of the rumen and allow for early weaning. To encourage consumption, a rearer may need to place a small portion of feed in the calf's mouth during the first week.

When home mixing a calf starter, an accurate feed analysis should be obtained to ensure protein and energy levels reach those recommended for rapid growth. Home mixes should include a vitamin and mineral premix. A coccidiostat is also recommended to be included in the milk replacer or calf starter. **Rears must review product levels and ensure coccidiostat is not duplicated in both milk replacer and calf starter.**

Enhanced Rumen Development

When a calf is born, its four stomach compartments {(1,2) Recticulo-rumen, (3) Omasum, and (4) Abomasum} are immature. Initially, a calf's digestive system functions similar to that of a baby pig. Early in its life, a calf relies on the digestion of the milk in the true stomach (Abomasum) to supply its nutrient needs.

Through the consumption of dry feed and rough straw or hay over time, the four stomach compartments develop into a functioning rumen that can utilise forage for a calf's nutritional needs. Table 6 indicates the time required for the four compartments to develop and alter in relative size.

Table 6 - Time Effect on the Percentage of Bovine Stomach Tissue Contributed by each Compartment [2]

Weeks	**0**	**4**	**8**	**12**	**16**	**20-26**	**34-38**
Recticulo-rumen	38%	52%	60%	64%	67%	64%	64%
Omasum	13%	12%	13%	14%	18%	22%	25%
Abomasum	49%	36%	27%	22%	15%	14%	11%

Without consumption of a calf starter, a calf's stomach will develop slowly and remain immature; therefore the calf relies on milk for its nutrient requirements. For rumen development, a calf's intake of solid feed is essential. Early weaning is critical to the economics of most dairy beef enterprises, therefore the rumen in a dairy beef calf needs to be developed much more rapidly than normal for other calves.

From the start, calves should have access to good quality, clean, rough straw or hay to promote proper rumen development. The function of textured feed within a starter or through the consumption of straw or hay is to provide a 'scratch factor' that will help stimulate rumen musculature development while still maintaining rumen pH levels. Straw or hay should be free from all mould, as mould produces aflatoxin that can decrease performance, cause disease, and possibly cause death.

Too much dry forage intake at the expense of milk and calf starter is not recommended. Energy provided by dry forages alone is insufficient to meet a calf's needs. A common practise is feeding of straw or hay from a starter feed; however research and commercial practises have shown that correctly chopped dry forages can be included with the calf starter. Care needs to be taken to ensure the total energy level of the calf starter and

roughage combine is still high. In this mix, particle sizes of between 8 to 19 mm of the dry forages are sufficient to promote rumen development.[3]

Prior to weaning, a calf will start to nibble on grass if allowed access to pasture. However the best quality grass cannot supply the sufficient nutrients necessary for optimal growth of a calf, therefore calf starters must still be provided until a calf is at least eight weeks of age.

Health Management

A calf rearer needs to devise and utilize a daily routine that monitors and becomes acquainted with each calf's health and normal behaviour. Changes in a calf's health are often indicated by a change in its behaviour. Knowing a calf's normal behaviour allows a rearer to quickly react to a potential problem before the problem becomes extreme. However while a rearer should respond proactively to changes in behaviour, he/she does not treat every change in behaviour as the start of a major disease outbreak.

A local veterinarian should be consulted to set up a health program specific for each facility and its conditions. The program should include regular drenching of the calves for parasites, and for liver fluke if in a fluke area. Calves should be dehorned between one and three weeks of age and at a suitable time to reduce stress from flies. Healing wounds should be checked regularly and appropriately treated if they become infected. The recommended methods for dehorning are by heat cautery, scoop dehorners, or gouging knife. Calves should be monitored for lice. If apparent, the whole mob should be treated.

A calf should have a temperature in the range 39.0 to 39.2°C, and a resting respiration rate of between 20 to 40 breaths per minute.

A calf rearer must monitor each individual calf twice daily. During the examination of a calf, a rearer should note:

- State of any faecal residues under the calf's tail (eg, dry, wet, runny).
- Condition of the abdomen (eg, hollow, tucked up).
- Animal temperature (eg, normal, low, high).
- Animal respiration (eg, normal, rapid breathing, minimal breathing with hard to see chest movements).

Quick diagnosis and treatment are the best for quick recovery. If abnormal symptoms exist, a sick calf should be moved to an isolation or hospital pen for further examination, treatment, and observation. The following are major health issues that a rearer needs to manage.

Calf Scours/Diarrhoea

Diarrhoea or scours in a neonatal calf is a very common condition during the first six to ten weeks of life. It results from a complex interaction of the calf, rearing management, the calf's total environment, infectious agents, and nutrition. If diarrhoea becomes a problem, samples may need to be submitted for laboratory examination for proper identification of the cause.

Diarrhoea prevents the absorption of nutrients and fluids from the intestines and results in the loss of essential mineral compounds (electrolytes), bicarbonate, sodium chloride, and potassium.[8] Consequently, diarrhoea causes an animal to quickly become dehydrated and appear gaunt with a rough hair coat. A severely affected calf may die. Dehydration also causes the build-up of acid within a calf's body that must be treated.

The control of the underlying factors of scours is vital to effectively prevent continual occurrences of scours. Scours can be classified as two types: (1) non-infectious and (2) infectious. Non-infectious scours are a result of management shortfalls, which increase the stress load on the calf. The most common factors linked with non-infectious scours are indicated in Table 7.

Table 7- Factors Linked to Non-infectious Scours

Factor Type	Factors
Nutritional	Lack of colostrum.
	Nutritional density of milk exceeds digestive capabilities of the calf.
	Vitamin A and E deficiencies.
	Scorched, overheated, or low grade milk or milk powder.
Colostrum	Lack of required quality and quantity colostrum within the first 6 - 12 hours of a calf's life.
Poor Environmental Conditions	Crowding (i.e., too high pen density).
	Wet and/or damp conditions.
	Extreme hot or cold surroundings.
	Poor hygiene.
Poor husbandry	Digression from normal routine.
	Change in milk feeding.
	Overfeeding.

Scours that are caused by an infectious agent can be categorised into three broad groups as indicated in Table 8.

Table 8 - Major Causal Agents of Calf Scours

Infectious Group	Infectious Agent / Organism	Typical Animal Age at Infection
Bacterial	E.coli - Enterotoxigenic	< 4 days
	E.coli - Enterohaemorrhagic	2 to 21 days
	Salmonella spp.	> 1 day
	Clostridium perfringens	< 10 days
Viral	Rotavirus	4 to 14 days
	Coronavirus	4 to 30 days
	BVD virus	
Protozoa	Cryptosporidia	1 to 4 weeks
	Coccidia	> 3 weeks

Poor sanitation is a major cause for the spread of E.coli because the E.coli pathogen is picked up from the environment. Low levels of E.coli are present in both the small and

large intestines. E.coli strains vary in their toxin levels with certain strains producing potent toxins. No colostrum, poor colostrum, and/or poor quality milk replacer are major contributors to E.coli prevalence. Enterotoxigenic E.coli is mainly a problem up to four days of age with one to day duration of yellow/white watery voluminous faeces.[16]

Enterohaemorrhagic E.coli can occur from two to twenty one days, and it can persist for three to eight days. The scour is mucoid without being extremely fluid and it may contain blood. Dehydration is seen in some cases.[21]

Salmonella infection can come from multiple sources including the mother, water supply, feed, colostrum, milk, other calves, birds, cats, rodents, humans, and soil. As a result, poor sanitation contributes to the spread of this infection. In general, Salmonella affects calves during the first seven days of life. Faeces are typically profuse, white to pale yellow in colour, have a foul smell, and may contain small amounts of blood.[1] The infection is also characterised by fibrin in the faeces, elevated body temperature, and depression.[15] The Salmonella bacterium is very resistant and may persist in a calf facility for up to two years.[5] Outbreaks are especially prevalent during periods of bad weather and following transport. Rapid death of a calf will occur if vigorous treatment is not achieved.

Clostridium perfringens Type C associated scours usually affects a calf during the first week of life, but this infection can be apparent in an older animal as well. Generally, a healthier animal is affected. An animal with this infection is commonly found dead the next morning, or lying on its side with a bloated abdomen. This type of scours is rarely seen since the disease progresses so quickly. When seen, the faeces are usually bloody. Final diagnosis is usually based on post mortem findings.[1]

Cryptosporidia and Rotavirus are the most widespread cause of calf scours in Australia.[8] Rotavirus has been found to account for about 49% of calf scours in Victoria.[7] Rotavirus is a very resistant pathogen and can continue to exist in calf facilities from one season to the next.[5] Scours associated with Coronavirus and Rotavirus may also be complicated by secondary bacterial infections. It may occur in calves as young as one to two days old; however it is more common in calves four to fourteen days old and less common in older calves. Overcrowded facilities and lack of quality colostrum are contributing factors. Consuming faecal contaminated material may also infect calves.[1] This last point emphasises the need to isolate sick animals immediately and to keep pens clean.

Cryptosporidia, like Rotavirus, invade the lining of the small and large intestine, causing malabsorption and secondary milk fermentation in one to four week old calves. The scours are mucoid and pasty but may begin as yellow, watery faeces in very young calves. Although the disease has a low mortality rate, it can cause significant weight loss in affected calves.

Scours cannot be totally eliminated from calf rearing operations, even when Best Practice management is followed. However, using Best Practice management will reduce the incidence and severity of scours. A Best Practice management plan includes:

- A clean environment to minimise the faecal-oral cycle. All surfaces that come in contact with a calf including floors, fences, troughs, buckets, teats, etc. should be cleaned and disinfected before entry to a facility and after daily use where practical.
- Insuring adequate colostrum intake to new calves.

- Designation of hospital / isolation pens for sick calves.
- An “all-in” / “all-out” system of rearing.

As previously discussed, a calf must receive at least two litres of colostrum within the first six to twelve hours of life to ensure a healthy start. A calf is born with low reserves of vitamins A, D, and E; therefore it is dependent on colostrum as a rich source of needed vitamins and protein. An injection of the fat-soluble vitamins A, D and E on arrival, may be beneficial in cases where calves have not received sufficient quantities of colostrum after birth. A 1 ml injection of a product such as Duphafral Forte ADETM will deliver sufficient quantities of the key vitamins.

Colostrum is also ideal for an older calf because colostrum has higher nutrients than normal milk (i.e., 2 times higher in casein and 4 times higher in protein) and can provide a protective local immunity in the intestines. A minimum of 500 ml daily will usually be sufficient to prevent problems. Colostrum can also be a very useful feed for calves recovering from scours.

Each calf should be observed regularly for disease with a sick calf identified and its treatment regimens recorded. A calf rearer needs to be proficient in assessing dehydration, stomach tubing a sick animal, and administering medications. Best Practice includes having a treatment plan and medicinal supplies in place to treat scours immediately. Regardless of the cause, treatment procedure for scours should be as follows:

- Immediately isolate the calf in a hospital pen and begin treatment.
- Rehydrate to replenish the water loss. The degree of dehydration can be determined very easily with a skin fold test, which is the time in seconds that the skin on the neck takes to bounce back after being pinched outwards. In a healthy calf, the time is less than half a second.
- Correct electrolyte loss with fluid therapy (i.e., treating scouring calves with soluble sources of energy and electrolytes). This is the most important treatment with ninety percent of calves recovering with this treatment.
- Correct metabolic acidosis.
- On a very sick calf, consult with a veterinarian about possible use of antibiotics.
- Maintain cardiovascular function.
- Provide supportive measures of warmth and comfort. A calf that is sick, dehydrated, and/or in shock will be very cold. The calf will respond to warm and dry blankets and hot water bottles fashioned out of five to twenty litre plastic containers.

Once a calf becomes severely dehydrated (i.e.,10% to15%) or once a calf is unable to stand, it requires intravenous fluid therapy. This action requires the assistance of a veterinarian if death is to be avoided. Severe dehydration most commonly is associated with low blood glucose levels, therefore intravenous therapy will usually consist of saline-based fluids, an alkalising agent, and dextrose.

A calf that is able to stand and is less than 8% dehydrated can be rehydrated orally or by stomach tube with electrolyte solutions. An oral electrolyte solution should contain a balanced source of salt, fluid, and energy. In addition, a sick calf should be given an additional source of energy, such as milk; otherwise it can quickly lose weight. Debate continues over whether or not to restrict the feeding of milk during the treatment of

scours. An accepted solution is to provide electrolyte solution three times daily and milk twice per day, separated by at least two hours. Adding natural yoghurt or junket tablets to the milk twenty four hours prior to feeding to the sick calf can assist milk digestion.

A veterinarian can also advise whether antibiotics would assist. E.coli and salmonella are the only common agents that respond to antibiotics although a secondary infection can occur following infection with many of the agents previously listed. While antibiotics can assist in certain situations, an animal must not be over medicated. An over medicated animal can develop a drug resistant state which creates future problems.

Finally, the cause of scours must be diagnosed. A veterinarian can be consulted for faecal culture and sensitivity results.

Navel Infection

A calf with a wet navel or with indications of navel infection should be not accepted. A naval infection will result in a calf with no appetite, depressed, and an elevated temperature. The navel will be swollen, painful to touch, and may be moist. Infection can spread internally if broad-spectrum antibiotics are not used to treat the problem.[5] Most naval infections are acquired during the first two weeks of life.

Spraying the calf's navel with iodine upon arrival, and housing a calf in clean dry facilities are the best means of preventing a navel infection.

Navel infection must be differentiated from an umbilical hernia that presents as a lump. A hernia can usually be pushed back up into the abdomen through a hole or hernial ring in the abdominal wall. If in doubt, the rearer should consult a veterinarian.

Septic Arthritis

Septic Arthritis is a condition resulting from a primary navel infection, particularly in calves born in a heavily contaminated environment. The risk of infection is increased in calves that have had poor or no passive colostral transfer.

Commonly, a sick calf will have swollen joints, and will be reluctant to rise or walk. The infection spreads in the blood stream, and it can lead to reduced appetite, diarrhoea, and pneumonia. Treatment consists of long-term antibiotics and often joint flushing to remove the destructive inflammatory products.[16]

Bacterial Meningitis

Bacterial Meningitis is a disease that is commonly found in neonatal calves following diarrhoea, septic arthritis, or navel infection. It is an infection of the membranes covering the brain and spinal cord.

Acute bacterial meningitis usually develops suddenly and is characterised by lethargy, inappetence, poor suck reflex, fever, recumbency and depressed mental behaviour. Respiratory rate is usually slow and deep. A sick calf with this disease is often referred to as "stupid".[16] Death is preceded by quadriplegia and convulsions.

The outlook is very poor with most calves dying from the disease, which emphasizes the importance of early diagnosis and treatment. The more common organisms identified are Haemophilus, Streptococcus, and E.coli. Antibiotics to treat to these bacteria must be administered by injection in large doses, rapidly, and for several days. Penicillin and oxytetracycline tend to be the drugs of choice for meningitis but cephalosporins are also used due to their efficiency and penetrative abilities.[17]

Oral and Laryngeal Necrobacillosis

Oral and Laryngeal Necrobacillosis refers to infection of the mouth and larynx at the back of the throat. It is usually associated with unsanitary conditions in undernourished, diseased calves.

Sick calves will be reluctant to suckle or eat, have a high temperature, profuse salivation, bad breath, and may have swollen cheeks or lips and noisy breathing.

Disease outbreaks require vigorous treatment with antibiotics. However more importantly, prevention results from hygienic conditions in the rearing shed.

Pneumonia

Pneumonia occurs most often in an animal from 50 to 140 days, but can also occur in a calf as young as three days of age. The pathogens isolated from a pneumonic animal can either be viral or bacterial in origin. Pneumonia is an inflammation of the respiratory tract, and it is most common with housed calves. Chronic pneumonia that has developed over a period of one to two weeks can damage the lung resulting in the formation of scar tissue and leaving an animal permanently weakened. A calf with sub acute pneumonia may never show outward symptoms of pneumonia prior to death.

Symptoms of pneumonia are a dull look with droopy ears, a rough hair coat, lack of appetite, coughing, rapid breathing, and temperature of 40 to 41°C. An animal may also have discharge from the eyes and nose. Low feed intake and poor growth rates are symptomatic of this condition.[4] Depressed weight gains and loss of performance will be significant not only in recorded cases but also in undiagnosed, untreated calves. Therefore, this disease emphasizes the need to continually monitor and record calf feed intake and growth.

Early diagnosis and prompt treatment is the key to successful management of pneumonia.[8] Animals with the clinical signs of the disease should be isolated immediately and started on a treatment regime of three to five days. A veterinarian should determine the most effective antibiotic to use in the circumstance. Common treatments used are oxytetracycline, trimethoprim and sulphur combinations, and ampicillin.[8] The choice of treatment to use is dependent on the diagnosis, past experience with a given medicine, and drug sensitivity tests.[8] A correct balanced diet is also crucial for recovery and a B12 injection may help to improve feed intake. However, these treatments will not cure the disease unaided by antibiotics.

Housed calves are at highest risk; therefore a facility with proper ventilation is of highest importance in the prevention of pneumonia. Proper ventilation removes high ammonia content, dust, and excess carbon dioxide. The facility should be draught-free with a relative humidity of 70% and a temperature between 13 to 21°C.[17] A facility with solid

walls at least two meters high and with appropriately positioned shutters or blinds to control air movement helps minimise draughts and improve ventilation. Exhaust fans strategically positioned in the shed can also improve poorly ventilated facilities without causing draughts.[18]

Other factors that predispose a calf to the disease are stresses that may occur from sudden changes in weather, scouring, and/or overcrowding.

Vaccinations against respiratory viral agents are available in Australia. A rearer should consult with a veterinarian for appropriate use of these vaccines.

Clostridial Diseases

Clostridial bacteria are widespread in the environment occurring in soil and in intestines of normal healthy cattle, and are of major importance as primary causes of disease. These bacteria rarely act as secondary invaders, and all are potent producers of exotoxins. The toxins of different organisms vary in effect and manner in which they gain entry to the circulatory system.[17] Evidence suggests with all the clostridial diseases that once a disease has occurred it has a much higher incidence of recurrence in the same paddock. Recurrence is most likely due to the increase in the number of spores.[20]

Diagnosis is based on clinical signs and isolation of the organism from the affected tissue. Due to the common occurrence of these organisms, eradication is virtually impossible and necessitates control by a vaccination program. The diseases caused by the clostridial organisms are as follows:

- Enterotoxaemia or pulpy kidney, as it is better known, can cause sudden death in rapidly growing young calf prior to weaning. It more commonly occurs in a weaned calf on a good nutrition. High grain diets and lush pasture promote rapid proliferation of bacteria in the gut of a well-conditioned calf, and production of lethal quantities of toxins. A calf may simply be found dead and its carcass rotting quickly. If a calf is seen prior to death, the calf is typically bellowing with diarrhoea and convulsions which lead to paralysis and death.

- Blackleg is an acute disease resulting in inflammation and gangrene of the muscles. It leads to swelling, lameness, and death. Contaminated feed is the normal source of the disease. The disease is initiated after ingestion of contaminated feed along with the occurrence of fighting or bruising. The disease typically occurs in the warmer months of the year. Bloating and rotting of the carcase occurs rapidly. In addition, muscle mass is typically dark discoloured and swollen.

- Malignant oedema is an acute wound infection similar to blackleg but associated with a penetrating wound accompanied by deep trauma. There is a local lesion at the site of infection with marked redness, swelling and severe pain. The wound becomes “gassy” with a bloody, frothy exudate draining from the injured site. Death usually follows within twenty four to forty eight hours and is accompanied, like other clostridial diseases, with rapid deterioration of the carcass.

- Black disease or infectious necrotic hepatitis is, as the name suggests, a necrotic disease of the liver usually secondary to liver fluke. The disease has a seasonal nature in summer and autumn due to the fluctuation of the liver fluke and host snail population. Infection follows proliferation of the organism in damaged liver tissue, and production of lethal amounts of toxin. Animals can be found dead without having demonstrated any signs of illness. Symptoms when shown are severe depression, reluctance to move, cold skin, and watery faeces. Death will occur in one to two days.

- Tetanus is a highly fatal disease of all domestic animals characterised by tetany and convulsions. The organism produces spores which are capable of surviving for many years in soil and which contaminate penetrating wounds such as those created by castration or dehorning. The signs of the disease are walking problems, prolapse of the third eyelid, swallowing difficulties, rigid paralysis, and death. A young calf shows bloat early as the disease process. Cattle tend to be the least susceptible of the domestic animals to infection.[17]

Routine vaccination programs with “5 in 1” (without Leptospirosis component) or “7 in 1” (with Leptospirosis component) vaccines should be given at four to six weeks of age, four weeks later, and followed by a booster dose at twelve months to protect against the clostridial diseases. Calves fed sufficient early colostrum will be protected against the clostridial organisms until six weeks of age. After that time, they become susceptible to the diseases.

Ringworm

The most common cause of ringworm in cattle is the fungus, Trichophytom verrucosum. The disease infects the hide and results lesions that can occur all over the body, but it mainly occurs on the head, neck, and root of the tail. Following a two to four week incubation period, hair in the infected area breaks off or falls out. By the second to third month, circular patches of roughened scaly skin become visible. Infection can easily be transferred between animals. A veterinarian can confirm diagnosis through microscopic examination of infected hairs.

Ringworm treatment consists of scrubbing clean the infected area with a mild soap and warm water, while being careful not to spread the fungus to healthy skin. Upon cleaning, the crusty lesion is removed and an iodine solution (50:50 iodine/glycerine) applied.[8] Alternatively, animals can be sprayed all over with a fungicidal wash such as Imaverol. This treatment needs to be continued for a three to five day period. **The fungus can be readily passed to humans; therefore persons treating and handling an infected animal must wear gloves.** Healing of the patches can take several weeks and are evidenced by new hair growth.

To prevent ringworm, strict cleanliness is important. Crowded conditions facilitate the spread of the infection, therefore overcrowding should be avoided. Ringworm is commonly seen in animals subject to stress and in hot humid conditions. Therefore, rearers need to raise calves in a low stress environment and provide calves balanced and rising nutrition. In most instances, ringworm infection is self-limiting with duration ranging from one to four months.

Abomasal Bloat

A rapidly developing abdominal distension of the right flank may indicate an abomasal bloat in a calf being fed milk replacer. This condition usually occurs within one hour of feeding due to the accumulation of gas and unclotted milk replacer. Death can progress rapidly unless the distension is released.

Abomasal bloat appears to be associated with certain types of milk replacers, particularly those containing tallow as an energy source. If bloat becomes a problem, it can be prevented by adding 0.1% formalin to the milk replacer.[19]

Slow Drinkers

Some calves are slow drinkers and will not intake their full allocation of milk if being fed on a multiple teat system. These calves should be identified and penned with other similar calves.

Pinkeye (Infectious Keratitis)

Pinkeye or Infectious Keratitis is a bacterial infection of the eye that can occur in cattle of all ages, and it is caused by a bacterium called Moraxella bovis. It usually is seen in calves, most commonly in summer and autumn. The disease has no mortality and cases that lead to permanent blindness or loss of an eye are low. In severe cases, the disease causes blood vessels to form an ulcer in the cornea and/or secondary infection develops. The next step in severe cases is rupture of the eye and permanent blindness. Spread of infection is by means of flies, dust, and long grass contaminated by ocular and nasal discharges from affected cattle. Once conditions suitable to an outbreak of the disease, large numbers of calves in a mob will become infected.[17]

The first sign of infection is a watery, profuse discharge from the eye, which then becomes reddened and painful. This stage of infection can take two to three days before clinical signs of discharge and inflammation are obvious. Early in the disease, a calf will blink and be reluctant to look into sunlight due to the pain of the infection and damage to the cornea. The next stage is the development of an ulcer over another one to two days when small opacity becomes visible in the centre of the cornea. This condition may become elevated and further ulcerated. Spontaneous recovery may occur at this point in time, although usually, the opacity spreads over the entire cornea during the next six to seven days. The ocular discharge becomes purulent and the eye takes on a white to yellowy appearance. The opacity will eventually begin to shrink over four to five weeks, often leaving no mark on the eyeball or at worst, a small white spot.[17]

Treatment involves the use of ophthalmic ointments instilled into conjunctival sacs and gluing of an eye patch over the eye to protect the animal from sunlight, flies, and dust. Several ointments are suitable to treat pinkeye, but the best products are those containing the compound cloxacillin. A veterinarian may help if the eyeball is severely damaged. Veterinary treatment may involve the injection of an antibiotic and anti-inflammatory compound into the conjunctival sac of the affected eye, followed by the suturing together of the eyelids.

Control of pinkeye is extremely difficult to manage because general belief is that cattle carry the infection in their nostrils for up to a year. Older animals are then responsible for

infecting the next batch of young susceptible animals once conditions again favour the spread of the organism in the drier months of the year. The occurrence of the disease is minimized by minimising the time calves are in dry dusty conditions, and using fly sprays as advised.

References

1. Boomer, W. G. 1993. Protocol for Profitable Holstein Beef Production.

2. Church, D. C. 1979. Digestive Physiology and Nutrition of Ruminant. Vol. 1 Oxford Press. Portland

3. Coverdale, J. A., H. D. Taylor, Quigley, J. D. and J. A. Brumm. 2004. Effect of various levels of forage and form of diet on rumen development and growth in calves. J. Dairy Sci. 87:2554 – 2562.

4. Dvorak, N and Staats, G. Fed Holstein Beef Production for Profit. University of Wisconsin Bulletin.

5. Gibney, J. 1995. Disease Issues with Calves. Thinking about Tomorrow Today. Target 10, Northern Victoria

6. Hendrichs, A. J. and Jones, C. M. 2003. Feeding the Newborn Dairy Calf. Pennsylvania State University.

7. Jerrett. 1985. Dairy Cattle Production. J. D. Stewart Memorial Refresher Course for Veterinarians. University of Sydney, NSW

8. Malmo, J. 2000. Personnel Communication. Maffra Veterinary Centre, Maffra Victoria 3860.

9. Merck Veterinary Manual. 1973. 4th Ed. Merck and Co.

10. Moran, J. 1993. Calf Rearing. Kyabram Research Institute. Department of Agriculture, Victoria.

11. NRC. 2001. Nutrient requirements of Dairy Cattle. 7th ed. National Academy Press. Washington D.C.

12. Olson, O. E. and Fox, D. G. Livestock Water Quality. Great Plains Beef Cattle Handbook

13. Quigley, J. 2001. Calf Note #8 – Can I use waste milk for my calves? www.calfnotes.com

14. Schouten, B. 1994. Intensive Calf Rearing. Dairy Research Symposium. Vol. 12 National Dairies Ltd.

15. Texas Agricultural Extension Service. 1991. Calf Scours: Cause, Prevention, Treatment.

16. House, J. & Smith B. 2003. Medicine of the Calf – Including Advanced Fluid Therapy. In Australian & New Zealand Combined Dairy Veterinarians Conference, Taupo, New Zealand Vol 1.

17. Radostits, O.M., Gay, C.C., Blood, D.C., & Hinchcliff K.W. 2000. In Veterinary Medicine. 9th Edition, WB Saunders & Co, London.

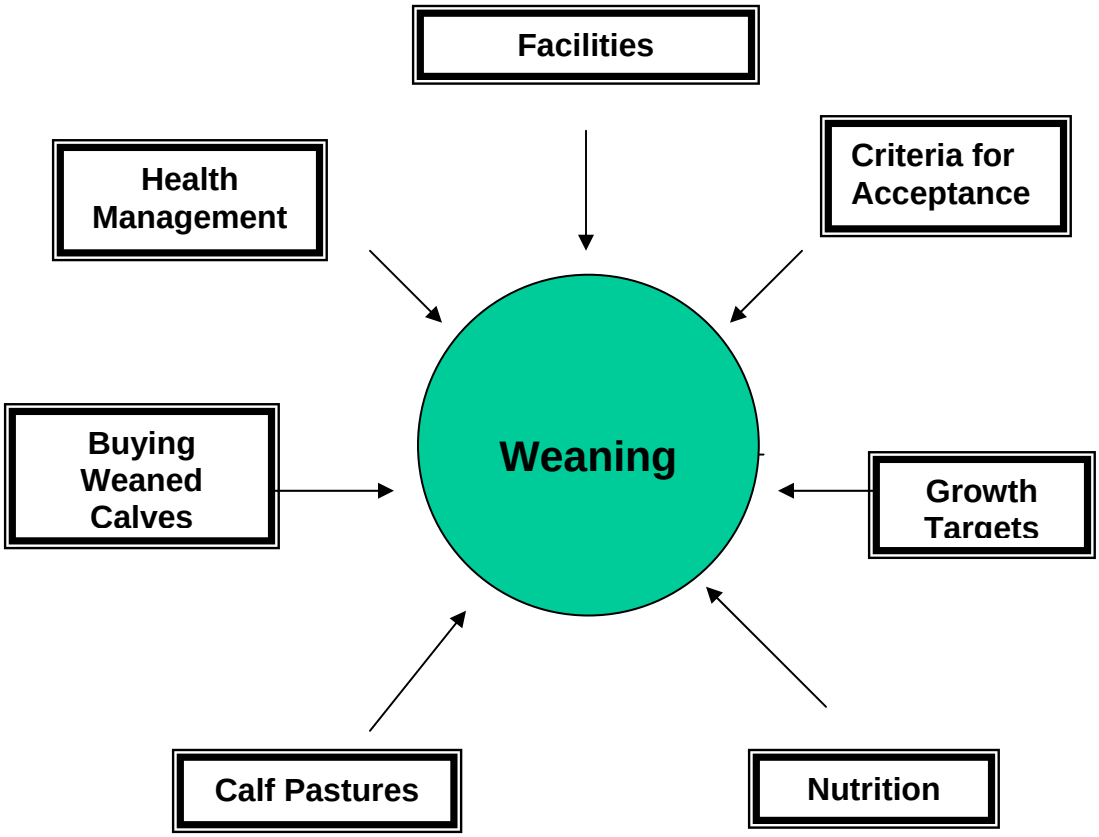
18. Moran, J. 2002. In Calf Rearing – A Practical Guide. 2nd Edition, Landlinks Press, Collingwood, Australia.

19. Blood, D.C. 2000. In Pocket Companion to Veterinary Medicine 9th Edition. WB Saunders & Co, London.

20. Bell, J. 2003. Clostridial Disease and Vaccination of Sheep and Cattle in Australia. In Proceedings of Australian Association of Cattle Veterinarians.

21. Lloyd, JW (2001) Dairy Bull Beef Rearing – A Veterinarians Perspective. In Proceedings of Australian Association of Cattle Veterinarians.

Section 7 - Weaning



Key Actions

☑ Wean calves when they meet criteria that allow them to continue healthy growth.
☑ Wean abruptly when calves and climatic conditions are suitable.
☑ Minimise stress during the weaning process.
☑ Provide high quality weaner feed and high quality pasture during weaning.

Introduction

Weaning a calf is dependent on the calf's rumen being developed sufficiently to obtain the required nutrients necessary for body maintenance and growth. Weaning calves off milk is an important process that can be done in several different ways and at different ages. Depending on management routine and subsequent growth goals, a calf can be weaned from four to twelve weeks of age. Early weaning has gained favour due to reductions in milk, labour, and facility costs.[3]

Abruptly weaning is recommended, as it is less stressful on a calf. The goal of weaning is to have the lowest stress transition as possible that results in a calf that will continue to grow and be healthy without setbacks. This is done by adhering to acceptable parameters associated with the individual calf's performance and the climatic conditions of the day.

Transporting a calf and/or exposing it for the first time to outside conditions should not occur simultaneously with weaning as it applies unnecessary additional stress. Many factors are already changing at the time of weaning such as housing, alteration in group size, alternate food sources, access to quality pasture, and reduced human contact. Managing these changes correctly is important for continued successful performance of each calf.

After weaning, daily observation is necessary to ensure that each calf does not have a major set back. If a calf looses vigour at this time, it is unlikely to meet final weight and age specifications. A calf that suffers a set back in daily gain, loses weight, or shows poor health immediately after weaning indicates its rumen was insufficiently developed for weaning. Therefore, the major goal for rearing calves during their pre weaning period is proper rumen development.

Criteria for Acceptance

A calf may be weaned off whole milk or milk replacer when the calf meets all of the following criteria:

- Has gained between 15 and 20 kg from entry weight.
- Consumes between 0.75 and 1.0 kg calf starter per day for three consecutive days.
- Has good health.
- Is at least four weeks of age.
- Is exposed to good climatic conditions.

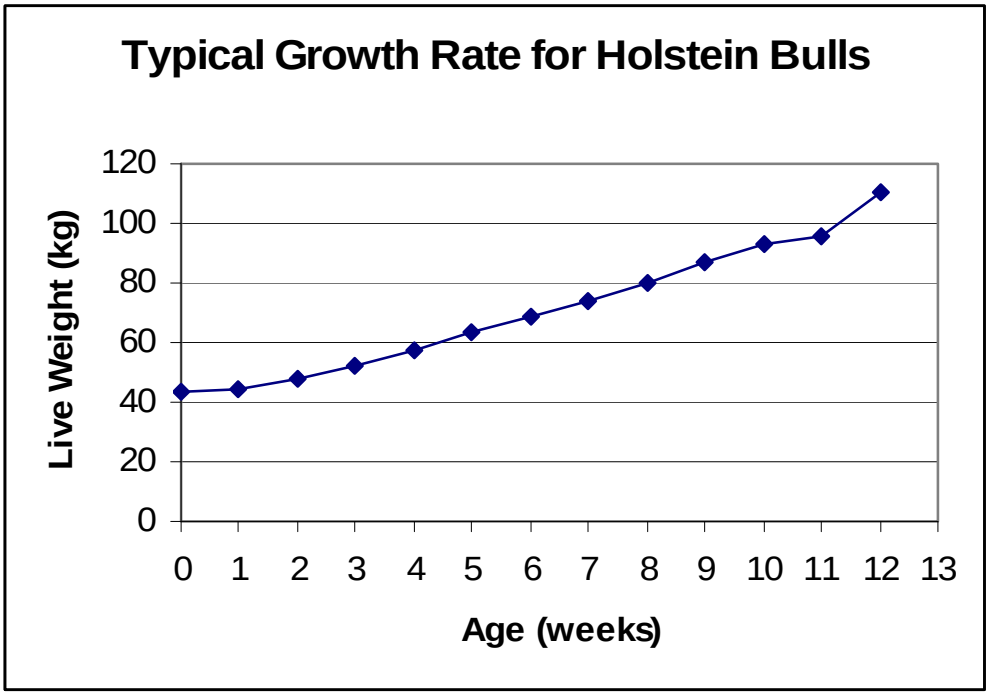
Weaning criteria shown above are for each individual calf, **not** a group average. If calves are weaned by groups, then the group must wait until the slowest calf is ready. Group

weaning is **not** recommended as it slows the growth of healthy and good performing calves, lengthens the total time until calves are weaned, and is typically a costly and inefficient process. As examples, a calf with scours and off feed, or a calf given insufficient water to promote dry feed consumption may not have a rumen developed sufficiently to be weaned at four weeks of age.[8] Therefore as indicated above in the acceptance criteria, each calf should be consuming at lease 0.75 kg/day of calf starter for three consecutive days as this indicatives rumen development sufficient for weaning. In summary, the most cost effective method of weaning is weaning individual calves when each calf meets the criteria.

Growth Targets

Typical growth rates for calves are shown in the Figure 1 below.[5] Calves will grow slowly the first week, and then grow at an increasing rate of approximately 0.4 kg/day until weaning at four to six weeks of age. From weaning to twelve weeks of age, calves need to grow at least 0.5 kg/day; however gains are generally closer to 1.0 kg/day. The goal is to have each calf at 100 kg or greater live weight at twelve weeks of age.

Figure 1



Nutrition

A weaned calf requires high levels of nutrients for growth; therefore only the best quality feed commodities should be fed. At weaning, a calf should remain on the calf starter feed for at least one week and then be gradually switched over to a “weaner” feed. Specifications for a calf weaner feed is shown below in Table 1. A weaner feed eliminates additional stress associated with changing feed. Consumption of weaner feed should be monitored to ensure calf intake has increased above the pre weaning consumption of 0.75 to 1.0 kg/day.

Table 1 - Nutrient Specifications of Calf Weaner Feed[7]

Nutrient	Level
ME (Mj/kg)	13.5 Mj/kg
Crude Protein	16 %
Crude Fat	Minimum of 3 % and maximum of 4.5 %
ADF	8.0%
NDF	18.0%
Calcium	0.60 %
Phosphorus	0.40 %

In addition to the nutrient specifications, the weaner feed should also contain a Coccidiostat medication. This medication helps prevents coccidiosis at the time when newly weaned calves are exposed to more pathogens from greater calf numbers and a new environment.

A weaner feed, like a calf starter feed, should **not** contain urea because a calf's rumen is still not fully developed.[4]

Free choice, abundant, fresh, and clean water is required throughout a calf's life. The quality of water should be the same quality as indicated in Section 6. Without adequate water, dry feed consumption will not meet a calf's needs. Further as temperature increases, so does a calf's need for water. For example, a small calf will drink 2 litres of water a day at 15°C and over 3 litres of water per day when temperatures exceed 30°C.[9]

Calf Pastures

A weaned animal requires the best quality pasture and/or hay available. Even the best quality grass cannot supply all the nutrients necessary for the optimal growth of the calf; therefore the weaner feed needs to be continued until the calf is at least eight weeks of age.

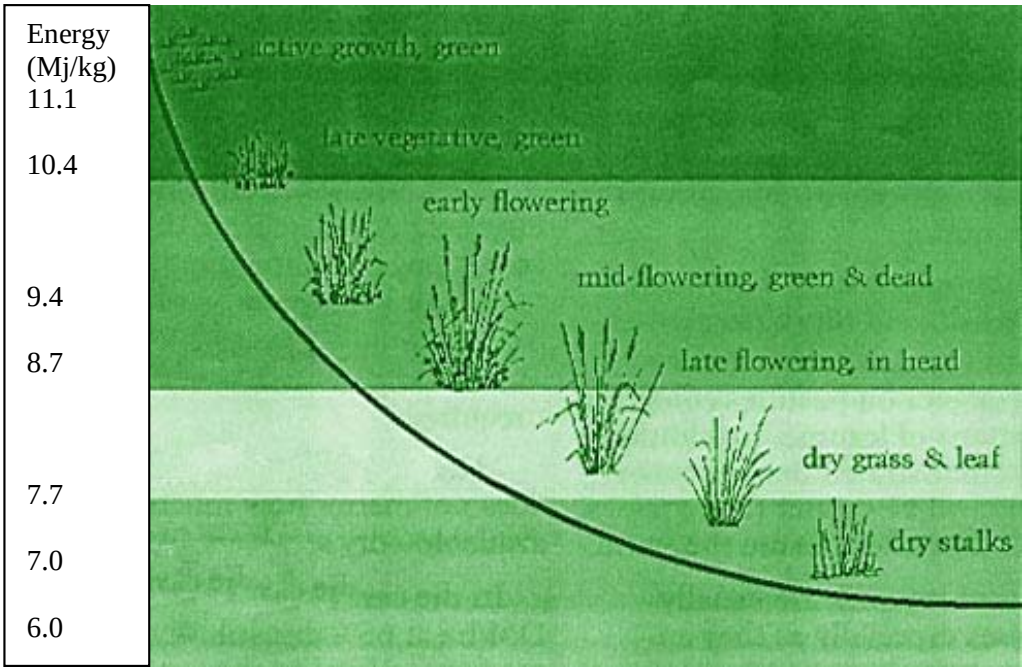
The goal is to get calves to consume as much high quality grass as possible, therefore calves must be "grass adjusted". This adjustment allows a calf's rumen to continue development and it changes the microbial population within the rumen to better suit the digestion of grass. Placing the feed trough away from the water supply encourages grass consumption.

As the grass matures, its nutrient levels diminish. Figure 2 below illustrates how the energy level of the grass decreases as the plant matures. For a young calf, only actively growing green grass provides sufficient energy to compliment the weaner feed for optimal calf growth. Due to declining nutrient levels as grass matures, weaned calves require intensive pasture rotation.

Grass with quality suitable for a weaned calf is short in height, at approximately 10 cm high, with a high leaf to stalk ratio. When the quality of the grass is not sufficient, higher levels of weaner feed may be required to sustain a calf's growth rate of 0.7 kg/day. If the quality of the grass is sufficient but the quantity is too little, then good quality hay may be fed. Good quality hay must have a minimum crude protein level of 14% and be green in

colour.[2] In addition; hay may be necessary to slow down rate of passage of lush grass and therefore allow for increased nutrient absorption.

Figure 2 - Energy Level[6]



To reduce parasites ingested by calves, their pasture needs to be free from worms and other pathogens associated with faecal matter from adult cows. Animal dung contains parasite eggs that hatch into worm larvae that are consumed with the grass, setting up a cycle of worm infestation. These worms can result in poor daily gain and damage hides.[1] Forward planning is required to prepare and have clean pastures available for calves.

Unfortunately, pastures are hardly ever worm free; however management procedures can be put in place to lower worm numbers. For example, spelling a paddock during the hot dry summer for six to eight weeks can lower worm levels. Grazing with sheep for several months is the most effective way of preparing a low-worm to worm-free pasture for dairy beef calves. Grazing with sheep lowers worm numbers as major sheep worms do not infect cattle and vice versa.[6] In addition, sheep can also remove dead material from the pasture so that the dairy beef calves are offered high quality, new growth. If grazing with sheep is not possible or practical, then another method, though less effective, is available. This next best option is to use mature dry cattle over two years old. Young animals are much more susceptible to worm infestation than are older stock.[6]

Monitoring the health and growth of weaned calves is important. This includes accessing the worm load on the paddocks. This is done by counting the number of worm eggs in dung. A veterinarian can provide assistance and advice about faecal egg counts.

To minimize disease, calf pastures should not come in contact with dairy waste or effluent. In addition, to help prevent Johne's disease, calves under six months of age should not be in pastures where adult cattle faeces are present.[10]

After weaning, daily observation is necessary to ensure that each calf does not have a major set back. If a calf loses vigour and/or has a setback at this time, it will be less likely to meet its final weight and age goals.

Buying Weaned Calves

Most dairy beef operations take calves from a source dairy soon after birth and rear them. However, sometimes rearers buy calves at weaning. The younger the calves, the more susceptible they are to stress and health problems associated with relocation. Stress levels will increase with the distance traveled and any adverse weather conditions encountered during transit.

When considering buying weaned calves, the rearer needs to discuss the calf's history with the seller to determine the next best steps. Age and weight of each calf needs to be known. To ensure a smooth transition to the new operation, the calf's current feeding program should be ascertained. Information on the current feeding program should include the type of calf starter used, and amount and type of roughage fed (i.e. pasture or straw). If possible, calves should be continued on the same feed that was used by the previous owner and gradually shifted to a new feed. This eliminates stress of the move and provides nutritional continuity. The health history of each calf should be documented and accompany each animal. The health history should include procedures such as dehorning, vaccination, and medicines used. Knowledge of the previous management system will help determine whether calves need to be taught how to drink from troughs. Finally, calves that have been individually housed in pens, crates or hutches will need to move into smaller groups of four to six head prior to being placed in large groups.

Calves which have come off lush pasture may contain a lot of gut fill; therefore they may not be as heavy and healthy as they appear. With this understanding, a buyer may need a no feed curfew period prior to weighing and/or inspection. Issues such as a curfew must be mutually agreed between seller, buyer and/or agent.

Just like a young calf settling into its new environment as discussed in Section 5, weaned calves that have been purchased and transport require careful attention upon arrival. Although older, these calves should also be monitored twice daily after arrival to ensure health and feeding is maintained.

Health Management

The challenge in health management in the post-weaning period tends to shift from the individual animal to the mob and is primarily concerned with avoiding severe setbacks in growth rates and finishing weights. Routine procedures that create stress should not be undertaken at weaning as these types of procedures can compromise the health of an animal. High stress procedures of dehorning, dramatic feed changes, vaccination, and drenching should not take place for about ten to fourteen days before or after weaning.

At the time of weaning, disease patterns tend to change from scours to problems of the respiratory system and of the small intestine, as the calves move from a shed environment to a pasture based existence. Although calves are moved to pastures, they still require access to shelter and feed concentrates. The major health issues at this

stage are internal and external parasites, which are a problem that requires a systematic drench control program.

If the calves have not been vaccinated at an early age with a “7 in 1” vaccine against the clostridial diseases and leptospirosis, **the vaccine must be administered before the calves are weaned**.

Newly weaned calves must be monitored for concentrate intake, weight gain, and physical health. Calves that show signs of pinkeye, failure to adapt to more extensive grazing, and/or post weaning digestive disorders should be immediately isolated and then treated.

Parasite Control

Gastroenteritis caused by internal parasites is a major problem in weaned calves on pasture. Roundworms and liver fluke are the two most important parasites causing ill thrift, scouring, dehydration, and even death in severe infections.

Calves pick up infective larvae while grazing and these larvae mature in the animal’s gut. The mature parasite eventually lays eggs which leads to further contamination of paddocks. Control of internal parasites depends on grazing management to minimise exposure, and periodic drenching to minimise burdens and reduce contamination of the environment. The constant use of paddocks for rearing calves can lead to a heavy contamination problem, which must be factored into the control program.

In general, parasite control relies on regular drenching every six to eight weeks after weaning, plus strategic paddock rotation where possible. Roundworms, lungworm, sucking lice, and mange are best controlled with a drench containing a macrocyclic lactone, such as the ivermectin or moxidectin type drenches. However, drenching programs will vary slightly between regions depending on local conditions. A local veterinarian can advise on a strategic program for specific circumstances.

The presence of liver fluke in cattle is dependent on a fresh water snail for its lifecycle. Acute fluke, resulting in massive damage to the liver is typically recognised in early summer to late autumn. Chronic fluke is due to adult flukes blocking the bile ducts of the liver, leading to weight loss, anaemia, bottle jaw, and scours. Fluke typically occurs late summer to winter. For those areas where liver fluke occur, animals may be drenched with Triclabendazole.

For more information on parasites, please refer to the Health Management subsection in Section 9.

Coccidiosis

Coccidiosis is contagious inflammation of the intestines caused by protozoa which infects a calf from about three weeks of age. Most animals are exposed to coccidia; however the infection is usually self-limiting. Illness usually occurs in wet, overcrowded, and unhygienic conditions before and after weaning where parasite numbers have built up in the environment.

An animal affected with coccidiosis shows blood stained scouring with a lot of mucous and severe straining.

This disease highlights the need for calf rearing pens to undergo effective disinfection and cleaning **prior** to being used to rear a new batch of calves. A coccidiostat may be needed in the feed to minimise illness caused by the coccidia.

Yersiniosis

Yersinia is a rod shaped bacteria that causes enteritis (inflammation of the intestines) in animals greater than three months of age. This disease is most common in the wetter months of May to December in southern Australia. **In addition, yersinia is a disease which can infect humans**; therefore care must be taken when handling faeces from cattle to avoid infection.

Most cattle exposed to the organism show no apparent illness unless stressed. Stress usually comes from suffering from some other disease such as gastrointestinal worms; however the stress may also come from high stocking density. An affected animal will show depression, dehydration, fever, and recumbence accompanied by profuse, watery diarrhea often containing flecks of blood.[11]

After the yersinia organism is determined from a culture obtained from the faeces, animal treatment is required. Treatment consists of broad spectrum antibiotics such as long acting tetracycline, oral electrolyte fluids, and treatments for other underlying diseases. A severely affected calf needs to be separated and placed in a hospital paddock to enable supplementary feeding with concentrates. This helps to overcome the complicating factors of starvation and exhaustion due to starvation.

Prevention for the mob may consist of drenching all calves with an ivermectin type worm drench, and movement of the mob to a fresh paddock.

Bracken Poisoning

Bracken fern is toxic to cattle. The toxicity of the plant varies with stage of growth, with younger plants being more toxic than the more mature plants. Although the plant is toxic, large amounts of bracken must be eaten before poisoning occurs in an animal. Problems normally occur following drought periods, when an animal is searching for food sources.

Signs of poisoning include weight loss, dry slack skin, high fever, severe diarrhea with blood, bleeding from the orifices, and drooling saliva. Animal death can occur one to three days after symptoms appear. An important issue is that symptoms may take up to six weeks after the last intake of bracken to appear.[11] In addition to symptoms and post mortem findings, complete diagnosis includes definite exposure to the plant in sufficient quantity for poisoning to occur.

Treatment in advanced cases is unlikely to be successful but broad spectrum antibiotics should be administered in an attempt to counteract the secondary infections that arise as a result of bracken fern induced bone marrow depression. Blood transfusions can also be considered if a donor animal is available.

Bracken fern should always be viewed as potentially toxic to calves. To avoid poisoning, calves should not be allowed to graze paddocks contaminated with large amounts of bracken. If exposed, ensure the animals have access to supplementary feed, particularly if the grass is in short supply. Rotational grazing also helps to keep bracken fern levels short, therefore less harmful.

Nitrate/Nitrite Poisoning

Several fodder crops such as brassica, green cereals, sorghum grasses, and capeweed may contain excess amounts of nitrate, and an animal may ingest sufficient amounts to cause gastroenteritis.[11] High nitrate uptake in a crop is increased by heavy use of nitrogenous fertilizers, and following a drought due to the accumulation of nitrate in soil. Nitrite produced in the rumen is absorbed in to the blood stream and converts the oxygen-carrying molecule hemoglobin into methemoglobin, which is unable to bind oxygen. In essence, an affected animal chokes from lack of oxygen.

Nitrate/nitrite poisoning tends to be acute and symptoms can be seen within a few hours of consuming high levels of nitrate. An animal will display laboured breathing with gasping; its mucosal lining of the mouth will become blue; and its pulse will be weak and rapid. An animal may also show muscle tremors, weakness, prostration, coma, and death.[12] The rapid onset of signs and subsequent death are dependent on the dose consumed. If the deceased animal is examined within two hours of death, the blood, mucosae, organs, and possibly the urine are typically coffee brown in colour.

An affected animal should immediately be removed from the suspect source of nitrate, given a specific antidote of methylene blue intravenously in a diluted solution. This compound reverses methemoglobin back to hemoglobin, which allows oxygenation of the blood.

Preventing nitrate/nitrite poisoning is best managed by minimizing the potentially hazardous conditions of plants exposed to prolonged cloudy weather and/or cold temperatures, plants growing in shade, stressed plants (i.e., damaged by hail, storms, trampled), and plants with limited water. If plants are subjected to these conditions, the plants should be tested for nitrate levels prior to feeding.[14]

Rye Grass Staggers

Rye grass staggers is caused by a fungus that contaminates to varying degrees the tissue and seeds of different cultivars of perennial rye grass. The fungus produces a mycotoxin and it is most commonly found in the autumn when the grass is dry, short, and growing very slowly.[11] Sudden rainfall followed by rapid growth of the grass eliminates the disease.

Calves in a mob are usually affected at the same time and display gross lack of coordination, and falling when disturbed. The next stage of symptoms are nodding of the head, convulsions, and flexion of the limbs.

Treatment is simply removing the calves immediately from the affected pasture. Recovery is rapid to spontaneous.[13]

References

1. Gregg, P. 1997. Insect and mite pests of pastures. In: Pasture Production and Management. Inkata press.

2. Moran, J. 1993. Calf Rearing. Kyabram Research Institute. Department of Agriculture, Victoria.

3. Moran, J. 2002. Calf Rearing: A Practical Guide. 2nd ed. Kyabram Research Institute. Department of Agriculture, Victoria.

4. Moss, B. R., Coleman, D. A., and Floyd, J. Feeding and Management of the Dairy Calf: Birth to 6 months. Alabama Cooperative Extension System ANR – 609. www.aces.edu.

5. Muir, P. 2003. Poukawa Calf Rearing/Dairy Beef Project. On – Farm Research. New Zealand

6. Noad, B. 1995. ProGraze. Profitable, Sustainable Grazing. NSW Agriculture & Meat Research Corporation, NSW

7. NRC. 2001. Nutrient Requirements of Dairy Cattle 7th Ed. National Academy Press. Washington D.C.

8. Quigley, J. 2001. When is a calf ready to wean? Calf Note #09. www.calfnotes.com

9. Quigley, J. 2001. Predicting water intake in young calves. Calf Note #68. www.calfnotes.com

10. Taylor, J. 1996. Calf Rearing. Agriculture Notes, State of Victoria, Department of primary industries.

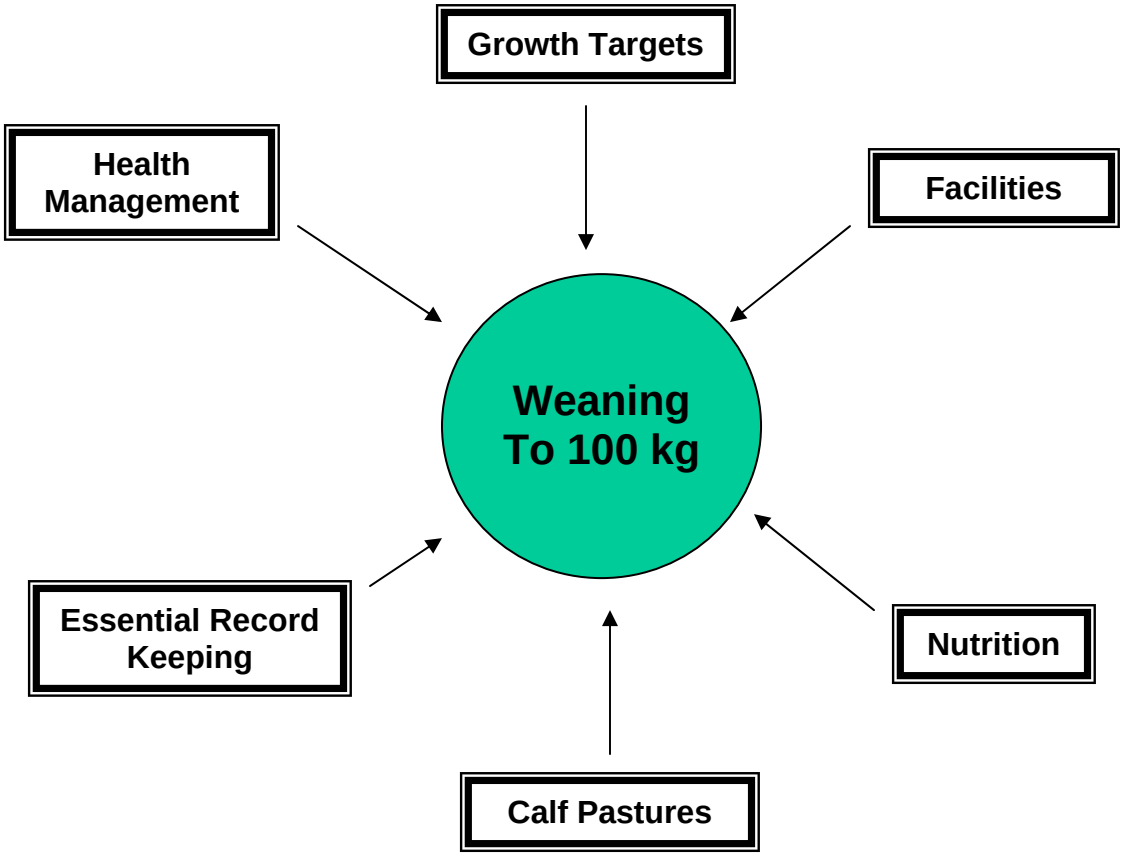
11. Malmo, J. 1993. In Control and Therapy of Diseases of Cattle. Series B, No. 18. Postgraduate Foundation in Veterinary Science.

12. Blood, D.C. 2000. In Pocket Companion to Veterinary Medicine 9th Edition. WB Saunders & Co, London.

13. Radostits, O.M., Gay, C.C., Blood, D.C., & Hinchcliff K.W. 2000. In Veterinary Medicine. 9th Edition, WB Saunders & Co, London.

14. Cope, G. E. Nitrate Poisoning in Beef Cattle. Great Plains Beef Cow-Calf Handbook. GPE- 3452. Cooperative Extension Service – Great Plains States

Section 8 - Grow Out – Weaning to 100 kg



Key actions

☑ Monitor weight gain on a minimum biweekly basis
☑ Inspect calves daily for the first 2 weeks, then twice weekly as they grow.
☑ Ensure the concentrate is rumen friendly to help prevent acidosis.
☑ Provide high quality and digestible pasture.

Introduction

Too frequently after weaning at four to six weeks of age, calves are placed in pastures and left to manage themselves. Calves weaned at four to six weeks of age are too young to receive total nutrition from grass for complete and rapid growth.

With correct nutrition and management, weaned calves can be very efficient at growth. Therefore producers need to capitalize on this potential and shorten the length of time required to finish bulls. **This stage is a transition period** between the intensive pre-weaning to weaning management, and the lower level of management needed for heavier and older bulls. Much like during the weaning period, calves must be treated as individuals during this transition period to ensure no preventable health or growth problems occur. Weight gain is the single best indicator of calf performance; therefore regular weighing and inspection is critical.

Growth Targets

In order for a weaned calf weighing 65 to 70 kilograms at age four to six weeks to grow to 100 kilograms by twelve weeks of age, an average daily gain of approximately 0.5 to 1.0 kilogram per day must occur. This growth range is easy to achieve with correct nutrition that balances food quality and quantity. An unbalanced food ration can result in a growth check in a young animal. For example, a deficiency in energy, protein, copper, and/or cobalt will result in lower growth rates [6] [8] [10]. A growth check that occurs after weaning makes achieving target weights at specified animal age very difficult to impossible.

A common excuse for poor nutrition during this transition period is “calves will make up the weight later as compensatory gain.” However, this excuse is not supported by industry experience that shows the lightest calves at twelve weeks are still generally the lightest when sold at an older age. A calf ability’s to exhibit compensatory gain due to early poor nutrition depends on (1) the severity and duration of poor nutrition, (2) the development stage of the calf, and (3) the re-feeding nutrition and duration[1]. Due to these many factors, compensatory gain at a later age can not be guaranteed. Therefore feed management strategies during this transition period focus on continuous, reliable, and appropriate nutrition to achieve growth targets.

The best single indicator of calf performance is live weight gain. Individual calf recording of weight is the only way to ensure consistent monitoring of growth and health issues. Weighing the calf at weaning and again at twelve weeks of age will give an indication of average performance over this critical transition period. However if a producer only weighs an animal at the beginning and end, then the producer has no information to detect a problem and alter nutrition management prior to calves exiting this stage. As a minimum, weighing should be at weaning, at age eight or nine weeks, and at age twelve

weeks. Early detection of low weight gains allows possible cause of the problem to be ascertained and corrected immediately.

Weighing calves can be done by scales or the use of a tape measure. Electronic scales give the opportunity to link the weight data directly into a computer. Electronic scales virtually eliminate human error in live weight recording and growth calculations; however, these electric scales do require knowledge and confidence in the use of computers.

Assessing weight can also be achieved by measuring a calf using a current heart girth tape measure for Holstein. This will be accurate to within 7% of the actual weight.

Facilities

In addition to scales or heart girth tape measure for accurately weighing calves as discussed in the previous section, suitable handling facilities are required to process calves. Facilities need to be checked for any broken or protruding parts that can potentially harm calves. Current designs of handling facilities take into account animal behavior to allow for easy processing of cattle, thus reducing labor needs and animal stress.

Weaned calves still need protection from extremes of heat and cold. How this is achieved will vary with the particular locality. For example in severe winter conditions, calves may be better managed indoors until twelve weeks of age. In warm dry regions, calves need never be housed, so long as they have access to shelter during inclement weather.

The feeding of concentrate will require the use of self feeders or troughs. Self-feeders have the advantage of not requiring daily attention; however self feeders are not totally reliable at limiting intake which is important to preventing overeating. Self feeders should allow 8 to 10 cm length of feed space per calf[2]. Troughs require filling on a daily basis. Trough space for young calves should be 46 to 56 cm which allows all calves to eat at once[2]. This design eliminates dominating calves from overeating, and allows weaker calves the ability to get their daily required intake of concentrate. A third feeding option is feeding concentrate on the ground under an electric wire to prevent animals from walking in the feed. This option is possible as a short term alternative, however due to high wastage of feed it is not considered a long term solution.

Nutrition

Proper weaning will allow calves to start consuming grass, however their rumen is still limited in capacity. Therefore, calves must also be fed high quality concentrate to ensure appropriate growth (see nutrient specification of calf weaner feed in Section 7). In addition, depending on the quality of pasture, conserved high quality forage may also be required. At weaning, feed concentrate will make up 70% of a calf's energy needs. Over time, this reliance on concentrate can be lessoned.

Protein needs of calves decrease after weaning to approximately 18% Crude Protein, depending on growth rate. **For calves at this stage of growth, urea should not be used as a source of crude protein** as calves require high quality protein and greater by-pass protein[5 6].

When starting a dairy beef operation, commercially formulated calf pellets or mueslies should be used until producers have the experience to consistently raise calves to meet target weights. After this time, producers may possibly reduce feed costs by purchasing raw ingredients and making home feed supplements. To ensure a home mix meets the nutritional requirements of calves, producers should seek the advice of a fully qualified nutritionist. Also, nutritional quality of ingredients can change with time. Therefore, home mixes require periodic testing and adjustment as necessary to ensure the home mix is fulfilling a calf's needs.

The feed concentrate used should balance and compliment the nutrition provided by pasture. Concentrates should not completely substitute for pasture because pasture is the lowest cost nutrition available. In addition and at all times, the concentrate mix must be "rumen - friendly". Concentrates need to be formulated which do not cause drastic drops in rumen pH which would result in acidosis, commonly called grain poisoning.

Grain poisoning, or acidosis, is a metabolic condition in cattle that usually occurs when producers are trying to achieve the best performance possible. Although normally associated with feedlot situations, acidosis can occur in younger calves when brassicas or when concentrate/pasture scenarios are fed. This condition can also occur at any time with poor feed management practices.

Cattle are grazing animals accustomed to continual access to feed. Having consistent feed in constant supply is essential to maintain the calves' health and performance. When feeding cattle, producers are feeding two types of animals/organisms: (1) the rumen microbes and (2) the calves. What and how cattle are fed greatly influences the rumen microbes. If the microbe's survival is jeopardized, then the digesta available to calves are diminished and calves performance and health suffers. To optimize animal performance, the nutritional concerns of the rumen microbes must be addressed first, then the animal. The rumen microbes need a constant supply of the same feed type to maintain their viability. When deprived of a consistent food source, some microbes will enter a dormant phase and other will not survive. When feed is reinstated, 1 to 48 hours is required to regenerate the microbial population to normal levels. Feed type and timing of feed delivery is essential to maintain the rumen microbes and this requires that calves do not run out of feed or have their type of feed changed abruptly.

Altering the feed type available to calves must be done with the rumen microbes in mind or acidosis will be an issue. Different microbes use different feed as a nutrient source. For example, the bacterial species *Bacteroides succinogenes* is known as a cellulolytic species. These bacteria utilize the cellulose fraction of the fibrous ingredients within a feed. These bacteria are predominant in the rumen when calves are fed grass, hay, silage, or straw. The bacteria *Streptococcus bovis* is an amyolytic bacterium, which digest the starch portion of concentrates such as grains and pellets. An abrupt feed change from a fibrous to a concentrate type ration does not allow sufficient time to alter the microbial population to suit the new foodstuff. This results in the lowering of the pH of the rumen to the extent that certain microbes die. Dead microbes result in no digestible food for the calves. In addition, acids produced in the rumen enter the calves' blood stream causing impaired renal and blood function. Oxygen transport by the blood is impaired, arterial damage occurs, and liver abscesses form. Continuation of these physiological effects lead to animals' death, and this can occur quite abruptly.

Chronic acidosis is almost impossible to detect in an animal, but it decreases performance. Acute acidosis is detectable and must be treated immediately. When cases of acute acidosis exist, usually a majority of animals are chronically acidotic. Buffers and drugs can be used to help prevent the drop in rumen pH and the physiological consequences of acidosis, however good feed management is paramount and the primary means of prevention. The inclusion of additives to control acidosis should not be relied on solely as they are costly and not “fool proof”. In addition, certain additives may be beneficial with respect to acidosis, but their long term use has a negative impact on overall animal performance.

Grains that release starch at a slower rate, such as corn, are better in supplement situations since the pH of the rumen does not drop dramatically. If a producer uses commodities with rapidly releasing starches, such as wheat, the commodity should be limited in quantity and be processed very coarsely.

The proper use of fat supplies in quality and quantity also increases energy in the concentrate without the negative effect on rumen pH. Proper protein levels within the supplement also encourage feed intake and therefore help to increase consumption of quality pastures and help to limit acidosis.

A producer should always watch for the visual signs of acute acidosis which are:

- Loose faeces with bubbles.
- Dried faeces having a light covering of white, similar to powder sugar.
- Animals that do not chew their cud.
- Animals with listless, depressed appearances.
- Animals that walk around stiff and “toe-ie”.
- Lowering of feed consumption.
- Animals with curled up toes (which indicates acidosis occurred 3 to 4 months earlier).
- Animals that have died.

If acidosis is indicated, quick treatment is essential and consists of:

- Decrease concentrate portion of feed.
- Increase palatable forage.
- Reintroduce concentrate feed slowly, maintaining firm faeces consistency.
- For acute cases, a drench of rumen fluid to effected animals can re-establish the microbial population. If no rumen fluid is available from a nearby research station, then faeces from a healthy animal with no possibility of Johne ’s disease can be used as a drench.
- Intravenous administration of electrolytes and bicarbonate buffers may help, but must be monitored closely as alkalosis could occur.

Preventing acidosis should always be the major objective. Management procedures to implement are:

- Change feed types slowly.
- Gradually build up concentrate levels in a ration.
- Limit the level of brassicas and/or concentrates to less than 75% of the daily feed intake.
- Never let animals run out of feed, especially high concentrate feeds.

- Never feed starving cattle concentrate or brassicas. Ensure animals always have adequate pasture or roughage prior to giving a concentrate.
- Monitor feed intake daily.
- Always ensure access to fresh water.
- Ensure grain processing is appropriate for each type of grain used.
- Monitor faeces and animal condition daily.
- Do not rely on feed additives to control acidosis, only use them strategically.

Feed supplements that are rumen-friendly include silage, legume/grass hay, grain legumes such as lupins, and white (or whole) cottonseed. The use of whole grains will also decrease the chance of acidosis, but at the same time decrease feed efficiency. The presence of ionophores and bicarbonate in the ration also lessons the risk of acidosis[7].

Following weaning, concentrate intakes by calves will increase rapidly. Calves raised entirely on concentrates will consume 2 kg/day by six weeks and 3 kg/day by ten weeks of age. However from an economic perspective, raising calves only on concentrates is expensive, it does not prepare calves for grazing, and should be avoided if at all possible.

The amount of concentrate fed needs to reflect the calves' needs and the pasture available. The amount will change with pasture conditions and calves growth. For example, the Poukawa research station feeds 1.5 kilo/ day of pellets at weaning at week five, drops pellets to 1 kilo/day by week eight, and further drops pellets to 0.5 kilo/day at weeks ten to twelve[6]. Once again, calf growth rate is the best indicator that nutrition is correct.

Calf Pastures

Optimal economics will usually dictate a pasture combined with a concentrate supplement is the best ration for this growth stage of calves. Good quality pasture is essential if it is to form the basis of calves' diets; however pasture supply and quality are highly seasonal in most areas. Therefore the timing of weaning and the seasonal supply of pasture needs to be considered when preparing and implementing a nutritional plan and alternatives.

At all times, calves need to have unlimited access to clean fresh drinking water. Lack of adequate quality water will result in a decrease in feed intake and lower growth performance.

Weaned calves should be offered fresh paddocks only where previous grazing or conservation management has been directed towards minimizing worm levels and optimizing pasture quality (as discussed in Section 7).

Pasture is considered a cheap source of nutrition, but it is not free. Pasture cost should be calculated into the dairy beef operation. To calculate pasture cost the following items should be included[4 9]:

- Seed, fertilizer, and chemicals
- Interest paid on land mortgages
- Land

    - Cost to lease
    - Capitol works (i.e. laser grading etc)
- Labor
    - Pasture renovation
    - Fencing
    - Irrigation
    - Grazing management
- Irrigation
    - Electricity
    - Depreciation on equipment and repair
    - Fitting and pipe
- Tractor and Machinery
    - Depreciation
    - Maintenance and fuel
- Fencing
    - Depreciation and repair

Combining these pasture costs with the dry matter production per hectares per annum will give a producer an understanding and estimate of the cost for a kilogram of dry matter of pasture.

Economics should indicate pasture is the cheapest source of feed. However for the young weaned calf, the pasture must by of high quality, highly digestible, and available in abundant quantities. To achieve high quality and low cost pastures, producers must understand pastures and manage them through different seasons. Producers that match pastures and livestock are high encouraged to take a PROGRAZE™ course or courses offered by the Department of Primary Industries. For example, the DPI of Victoria (contact www.dpi.vic.gov.au) has two courses: (1) Feeding Pastures for Profits and (2) Feeding Dairy Cows which includes a section of grazing.

Pasture quantity (or herbage mass) is expressed in kilograms of dry matter (DM) per hectare. Once pasture quantity drops below a critical level, animals are physically unable to consume sufficient pasture to maintain their body weight. Similarly, above a certain level of pasture quantity, animals will not eat more even if it is available.

Digestibility (expressed as a percentage factor) is the most useful measure of pasture quality. It is strongly related to the energy and protein content of a pasture, as well as to the speed with which the plant material will pass through the animal. However, quality is far more complex than quantity, and it is influenced by many factors such as:

- Plant species
- Part of plant consumed
- Growth stage of plant
- Management influences on plant
- Climatic influences on plant

The species of plant influences its nutrient profile. For example, legumes usually are of higher quality than grasses. Legumes generally have 11 MJ/kg energy and 22% crude protein as compared to grasses at 10.5 MJ/kg energy and 18% crude protein. Maintaining legumes in a proper balance in a pasture will maximize animal performance.

Temperate species such as ryegrass have higher digestibility than tropical species such as paspalum.

The part of the plant consumed also influences its nutritional values. The leaf is more digestible than stem because the stem contains more structural carbohydrates such as lignin which are not digestible by rumen microbes nor calves.

As a plant matures, it becomes less digestible as indicated in Table 1. The amount of structural carbohydrate increases and the level of energy and protein decreases. For example, a young rye grass may have an energy value of10.8 MJ/kg and crude protein of 15.2%, however after rye grass has gone to seed the energy level drops to 8.2 MJ/kg and crude protein to 5.5%.

Table 1 - Growth Stage and Plant Digestibility

Growth Stage	Digestibility
Active growth, green	75 - 85%
Head emergence	65 - 70%
Late flowering	55 - 60%
Dead, dry material	40 - 55%

Digestibility, pasture quantity, and animal intake have a strong interaction. As pasture quality declines, animal performance can be maintained by offering more pasture. For example, decreasing the stocking rate on the pasture so that the animals can be more selective in their grazing. This is also the time that strategic use of a small quantity of complimentary supplement is beneficial.

Once pasture digestibility drops to 80% for young calves (less than 100 kilograms in weight), calves will be unable to maintain target weight gains regardless of amount of pasture available. Below the 80% level, young bull less than 100 kilos in weight will lose weight. Therefore in these pasture circumstances, other sources of nutrition must included in calves daily feed intake.

At times, sufficient high quality pasture does not exist to compliment the concentrate. When this occurs, conserved forages can be used; however it must be of high quality. If conserved forage is being purchases, then it's nutrient profile should be tested. This practice is now becoming common in the industry. Conserved forage should have a minimum ME of 11 MJ/kg and crude protein of 14%. Normally, only high quality Lucerne, legume, or pasture hay/silage will meet these criteria. High quality silage can be used, however due to its high moisture level; calves may not be able to consume sufficient quantities to meet their nutritional needs.

Essential Record Keeping

Following weaning, producers should inspect calves daily, then twice weekly as they get older. The best single indicator of a calf's performance is live weight gain.

Record keeping is essential at all stages of life for each individual calf. Records need to show (1) weight, (2) what has been fed and when, (3) the feed management practices

used, and (4) all medical treatments given as part of routine management and as one-off treatments for disease. These records should be maintained up-to-date and be provided to buyers. Producers that track feed intake and performance on a continuous basis will have more accurate predictions of costs and expected performances in years to come.

Health Management

Very few health problems should occur after weaning if the rearing phase has been successful. However, the health status of weaned calves should be routinely monitored, daily initially then at least twice each week. Monitoring can coincide with other management operations such as when calves gather for concentrate feeding.

Any sick or suspect calf should be identified (i.e. with ear tag or spray paint). The calf should be isolated from its herd mates and its temperature checked with daily observations and/or treatment until its health improves.

Drenching and vaccination procedures should be maintained according to regional recommendations. This will ensure that sub clinical parasite burdens do not limit performance.

Major interactions exist between each calf's health and its environment; therefore no single "fool proof" recipe for health management exists. However discussed below are the common diseases for calves at this stage of growth.

Colds and Pneumonia

In cold wet areas, calves should be given access to shelter such as a tree belt if continually outside, or a shed to minimize the likelihood of stress-induced diseases.

Muddy paddocks can lead to a build up of disease organisms as well as cold stresses that predispose stock to disease. If kept continually indoors during this stage of growth, ventilation must be adequate to minimize the risk of pneumonia.

Bloat

When calves are provided clover-based pastures for the first time, they should be inspected at least daily for early signs of pasture bloat. Bloat in grazing calves is caused by the production of stable foam in the rumen that traps normal gases produced by the fermentation process of the rumen. Bloat results in distension of the left flank of the animal. If it becomes severe, it causes difficulties in swallowing and breathing, discomfort, distension of the right side, and eventually death from respiratory and cardiac failure. Foam build up in the rumen is associated with the ingestion of legumes such as lush, immature, rapidly growing clovers or Lucerne.

Treatment for bloat is urgent and requires a drench of at least 200ml of vegetable or mineral oil to break down the foam layer in the rumen. If the calf's condition is severe and it is unable to swallow, then a wide bore trochar can be stabbed into the rumen on the left side to allow oil to be drenched directly into the rumen and allow gas to escape. Extreme cases of bloat in which the calf is down and gasping for air are an absolute emergency and can require a vertical stab wound in the left flank to allow gas to escape.

Bloat control can be managed through the use of oil drenches and/or antibloat capsules. Antibloat capsules are a slow release device, which after drenching, sits in the rumen releasing the compound, monensin.

Photosensitization

Photosensitization is a condition seen in individual animals on lush pasture. Lightly pigmented skin such as the white sections of a Holstein calf on the back, flanks, and face become hyperactive to sunlight due to the circulation of photodynamic agents. The condition occurs primarily when these agents are present in consumed plants such as St John's wort and Brassica plants. The condition is secondary to hepatic malfunction and the subsequent accumulation of breakdown products from chlorophyll that is digested in the rumen[3]. Hepatic damage can follow; (1) use of drugs such as corticosteroids, (2) the ingestion of plants containing hepatotoxins such as Lantana and Lupins, or (3) ingestion of perennial ryegrass infected with the fungus, *Pithomyces chartarum*.

An animal's skin becomes reddened, thickened, and itchy followed by crusting and deep fissure formation. Layers of skin may then die and slough leaving crusty, oozing scabs.

For treatment, an animal should be moved to a shaded area or shed to reduce exposure to sunlight and its diet changed. Antibiotics to cover secondary infection of the lesions may be necessary and can be combined with antihistamines if the disease is caught in the early stages of the process.

Johne 's disease

Johne 's disease (pronounced Yo-nee's) (JD) is a chronic infection in the gut of ruminants. Cattle, sheep, goats, deer, and alpacas can all be affected. Two major strains of JD are recognized, bovine (BJD) and ovine. "Cross-over" between the species is normally not seen.

Cattle up to 12 months of age are most susceptible to infection, particularly calves less than 3 months old. Infected calves have no symptoms. After a long incubation period (usually at least three to four years), the disease 'breaks out', causing diarrhea, poor feed absorption, wasting, and death. It is a disease that is often stress related; it has no treatment.

In most infected herds, the number of animals inflicted with JD is low and the clinical signs tend to appear in older animals. Prior to animals showing signs of the disease, large numbers of the disease organism will be shed in the faeces.

Johne's disease is most prevalent in the dairy industry, especially in Tasmania and Victoria where over 30% of dairy herds and up to 2% of beef herds are infected. While the proportion of infected beef herds is thought to be low, many more herds are likely to be infected but not identified. Beef herds have a low incidence of JD; therefore the entrance of dairy animals into the beef industry has caused some concern. Even if the infection rate in purchased calves is high, the long incubation of the disease means that cases of disease are unlikely to be seen in a dairy beef operation.

Some feedlots will not accept cattle from herds with either a history of JD or an unknown status. Best Practice is about meeting customers' needs; they are unlikely to remain customers if producers supply infected cattle.

Infected calves show no symptoms; therefore the only way to lower the risk of purchasing infected calves is for a producer to require a BJD Vendor Declaration. The safest herds to buy from are herds in the Market Assurance Program (MAP) for JD or herds in the Test and Cull Program (TCP) that have a test negative status. Producers can avoid purchasing calves from herds that are non-assessed. The JD Market Assurance Program aims to provide producers with sources of cattle with low risk JD.

Another way that producers can find and purchase calves with low risk JD is through the JD calf accreditation program (JDCAP). JDCAP is an industry-driven and voluntary calf rearing program designed to minimize the risk of spreading BJD. The program should be present from adult cattle to replacement calves reared within a herd.

For further information or a copy of a vendor declaration, producers may contact a local veterinarian or the Department of Agriculture.

References

1. Doyle, F. and Leeson S. 2005. Compensatory Growth in Farm Animals. University of Guelph www.novusint.com/public/library/TechPaper.asp?id=1

2. Illinoi Dairy Net. 2005. Knipe, R. K., Ballard, E., Fischer, D., Seibert, D., and Shue, D. Dairy Beef Feeding as an Alternative Enterprise. University of Illinois at Urbana-Champaign. www.traill.uiuc.edu/dairynet

3. Jackson, PG & Cockcroft PD (2002) *In* Clinical Examination of Farm Animals. Blackwell Publishing Company, Oxford

4. Kellaway, R. C. 1991. Nutritional management of dairy farms. In: Dairy Production Symposium, Proceedings No. 162. Post - graduate committee in Veterinary Science, University of Sydney, pg 227 – 245

5. Moran, J. 2002. Calf Rearing. A Practical Guide 2nd ed. Land Links Press. Vic. Australia.

6. Muir, P. 2003. Poukawa Calf Rearing/Dairy Beef Project. On – Farm Research. New Zealand

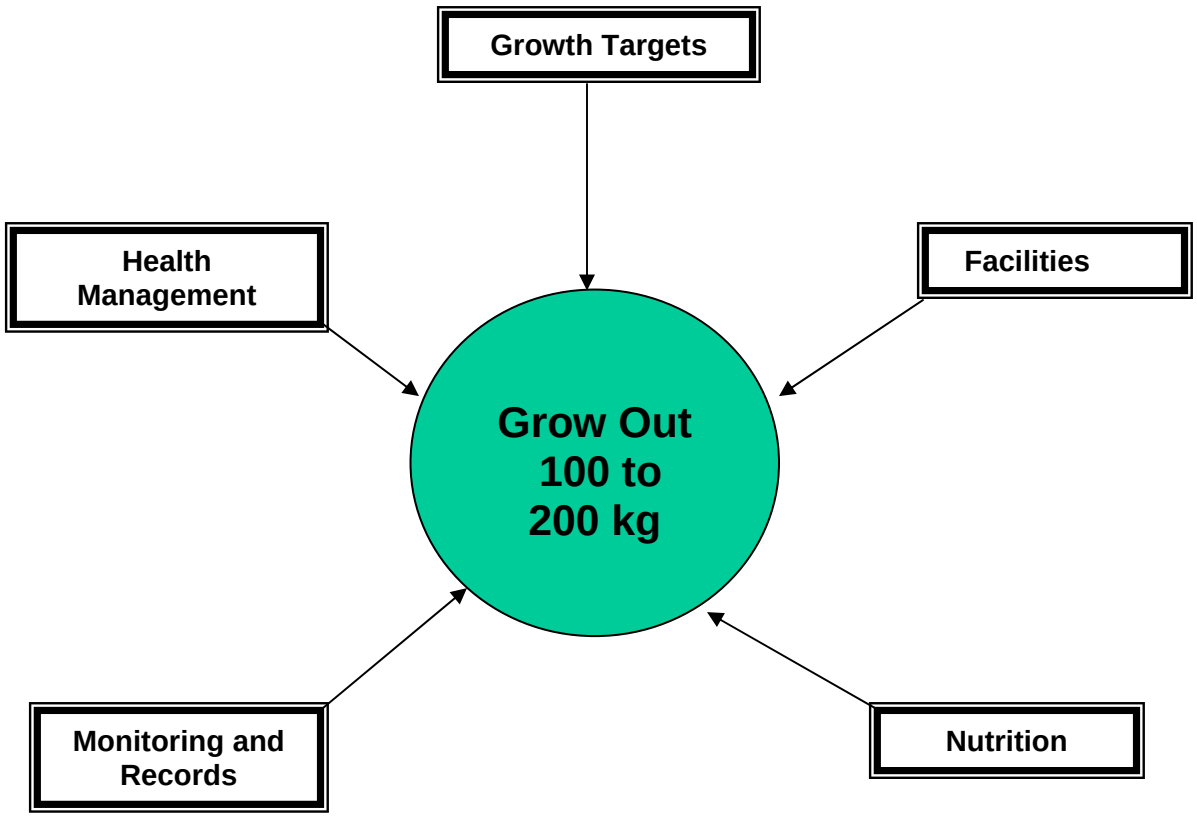
7. Owens, F. N., Secrust, D. S., Hill, W. J., and Gill, D. R. 1998. Acidosis in Cattle: A Review. J. Anim. Sci. 76:275-286.

8. Smith, R. M. 1997. Cobalt. In Handbook of Nutritionally Essential Mineral Elements. Ed B. O"Dell and R. Sunde. 357–387, Mercel Dekker Inc N. Y.

9. Target 10. www.target10.com.au Manuals section, Grazing Dairy Pastures

10. Underwood, E. J. 1981. The Mineral Nutrition of Livestock, 2nd ed Slough England, Co

Section 9 - Grow Out – 100 kg to 200 kg



Key actions

☑ Monitor weight gain.
☑ Monitor pasture / grass quality and quantity.
☑ Fill nutritional gaps in pasture when necessary to achieve target growth rates.
☑ Follow calves scheduled health program and continue routine inspection.

Introduction

A 100 to 200 kilogram calf is still an immature ruminant with high nutritional needs. With the exception of very high nutrition pastures, which are uncommon and seasonally dependent, a 100 to 200 kilogram calf is not able to utilize pasture for its full nutritional needs. Commonly after the stressful time of weaning has passed, these slightly older and heavier animals are left with little supervision and nil/minimal feed supplement. This management practice ultimately results in poor animal growth and health. For calves to flourish, they continue to require balanced nutrition, strict health protocol, and active monitoring of animals and their pasture(s). In addition, pasture quality and quantity changes with the seasons and rainfall. Supplemental feed should be included and changed as necessary to provide good nutritional balance.

Growth Targets

By twelve weeks (three months) of age, calves should be 100 kilograms and have learned to forage for most of their nutritional needs. These slightly older calves do not require the same degree of individual attention that was so critical for younger calves; however their ongoing performance must be monitored to ensure calves meet age-weight specifications. Growth rates can be highly variable depending on quality and quantity of grass and feed supplement. Calves at this age can loose weight on low quality grass or gain 1.5 kg/day or better with high quality and balanced nutrition.

In the past, Holstein bulls did not meet market weights of 550 to 600 kilograms until they were over three years of age. This growth rate is now considered very slow, does not capitalize on the early growth potential, and results in a prolonged feeding period. For a producer, a prolonged feeding period typically strains cash flow because capital invested is not gaining interest and/or loans are accruing interest payments. The final result is an increased cost of gain and lower profit margin when the animal is sold.

Over the years, producers have learned that strategic feeding that is balanced to pasture quality and quantity can greatly decrease the time taken for a bull to reach target weight. Figure 1 indicates three typical growth patterns that can be achieved. The slow growth rate of 0.62 kg/day over an entire year is a typical average for both New Zealand and Australia. With strategic feeding when required, a moderate average growth rate of 0.83 kg/day or greater can be achieved. An accelerated growth can result in growth rates averaging over the period of 1.0 kg/day. The target growth rate will depend on the cost of gain and the expected return on investment.

Table 1 - Growth Rates for Holstein Bulls

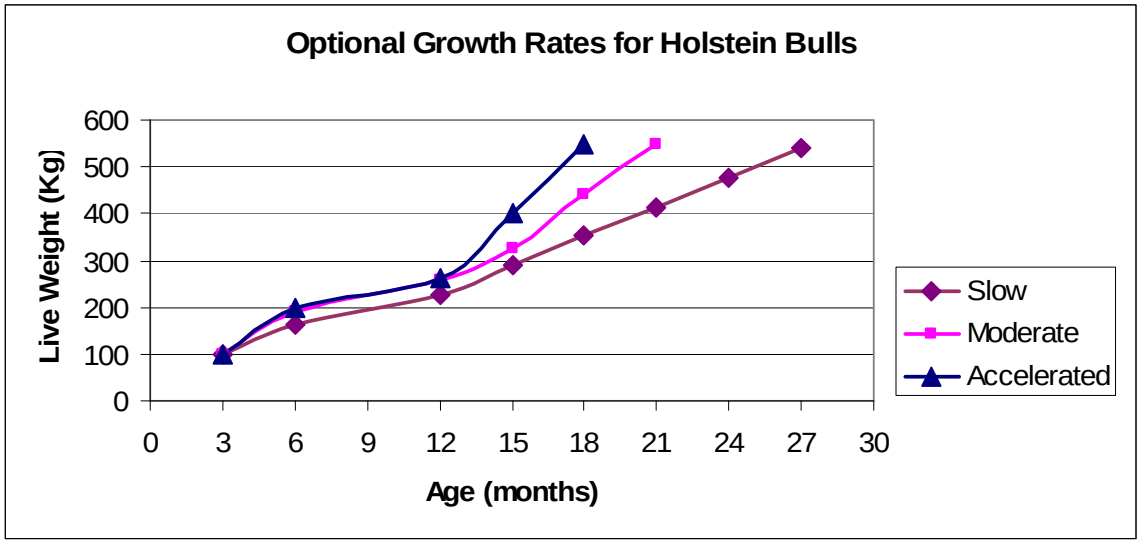


Table 1 above is for Holstein bulls. The growth rates for Holstein steers are typically 10% less than that for bulls.

Facilities

Relying on grass for the majority of the calves nutrient needs requires that pastures are adequately fenced. Within a large pasture, temporary electrical fencing can be used to ensure grass is used efficiently. Appendix 2 describes Technograzing which maximizes pasture utilization through a combination of permanent and temporary fencing.

Seasonal changes and rainfall variation will change the growth and quality patterns of pastures. To maintain nutritional balance, supplemental feeding will be needed at deficient times. Supplemental feeding requires planning to ensure that facilities exist to meet these demands. For pellets and/or grain mixes, adequate storage is required along with necessary troughs or self feeders. If fodder crops are used, machinery is required to prepare the soil, plant and fertilize the crop, and spray for pests. If a fodder crop is taken to storage such as silage or hay, then extra machinery and facilities are required for crop harvest and processing, transport to storage, storage, and ultimate feed out.

Growth can not be achieved without adequate feed intake. Since feed intake is associated with the amount of water consumed, facilities need to exist to ensure all calves have unlimited access to fresh clean water at all times.

Proper handling facilities are required to be able to safely treat bulls for any health issues, and for maintaining the normal health program. Good handling facilities require less labor and time to handle cattle, and give the added safety for both operators and animals. To monitor growth performance, scales need to be an integral part of all handling facilities. Scales should be calibrated regularly to ensure accurate readings.

Usually calves at this age will be free grazing without constructed shelters. However extreme weather conditions may require some protection for animals. Paddocks with sufficient trees to provide shade and wind protection are recommended.

Nutrition

As stated in the subsection of “Growth Targets”, the nutritional requirements of a bull calf at twelve weeks of age will vary depending on the growth rate desired. In general, energy requirements need to be approximately 8.65 Mj/kg to 10.6 Mj/kg for gains of 0.6 kg/day to 1.0 kg/day. Protein requirements are also high because a bull calf is putting on muscle mass. Protein requirements should range from 12 – 16% for a growth rate of 0.6 kg/day to 1 kg/day. When the bulls are gaining in stature but have a pot belly appearance, this situation generally indicates a lack of protein to meet nutritional needs.

To meet nutritional needs, high quality pasture with a good balance of grass and legume is required. If possible, calves should be rotated to give access to clean, fresh pasture. When pastures are limited in quantity or quality, high quality hay and silage can be used. Please note that quality of hay and silage is extremely variable, therefore testing at commercial feed testing services is recommended.

Fodder crops are also an option to make up for gaps in pastures. Lucerne, cereals, brassicas, forage sorghums, and millet are examples of fodder crops that could be used to grow out dairy beef calves. Young calves (3 to 6 months) need about two weeks to adjust to these crops, while older bulls (greater than 6 months) generally require one week to adapt. Fodder crops like pastures are not free. A producer needs careful budgeting to ensure these crops are a cost effective option.

Brassicas have high energy levels and should not make up over 75% of the bull’s feed. A producer must monitor and strive to maintain solid feces from the animals. A runny feces may indicate too high of a moisture level in the crop resulting in valuable nutrients not being absorbed but passed through the animal. When this occurs, producers feed more dry forages to help slow down rate of passage. Runny feces can also be an indication of acidosis. For treatment of acidosis, please see section **eight.**

Normally, calves below 200 kilograms cannot consume sufficient high quality pasture to meet their nutrient requirements for rapid growth. Therefore, they require an energy dense feed to make up the nutritional gap. A high quality grain mix or pellet given at minimal levels can compliment the grass to achieve the target growth rates. Feed supplements should be provided in small quantities and carefully managed to prevent acidosis.

A bull calf requires adequate minerals and vitamins. This can be achieved through the feed supplement, or by supplying mineral blocks. Mineral drenches are also an alternative. These are given each time calves are brought in for routine health management.

The producer needs to arrange mob size to suit paddock area and availability of pasture. Cattle are grouped in weight increments of 50 kilos to prevent animals growing at below the target rates. As bulls increase in age and weight, their mob size needs to be reduced to prevent behavioral problems. In general, bulls that are kept content with adequate

food in quality and quantity exhibit very little behavioral problems. Generally if bulls are fighting it is time to split the group in two.

Monitoring and Records

Regular observation of calves during this growth phase is important to detect any nutritional gaps that require supplementary feed. Constant observations also allow detection of health problems. Cattle should be weighed periodically to ensure growth targets are being met. As practiced in the other stages of the bull's growth, record keeping on individual bulls is essential for traceability. Detailed and accurate record keeping also allows performance parameters to be monitored against management decision, thereby allowing for improvement of management and feeding practice over time.

Health Management

While 100 to 200 kilogram calves are not as susceptible to health and dietary problems as when they were younger, health management remains important if calves are to continue to meet weight gain targets. Consistent weight gain depends on animals being free from parasites, especially worms and lice. Depending on local seasonal conditions and recommendations, animals are drenched or treated according to the manufacturer specifications. Below are the more common parasites to treat.

Internal Parasites

The gastrointestinal parasites (i.e., Ostertagia, Trichostrongylus, Cooperia and Haemonchus) are ingested by weaned calves up to fifteen months of age when grazing pasture that has been infected with the parasitic larvae. This infection can occur at any time, but especially over winter and early spring when peak larvae occurs.

High rainfall and high stocking rates are further important factors that exacerbate the damage done by internal parasites. Roundworms damage the lining of the intestine, depress appetite, and interfere with the absorption of nutrients. "Wormy" calves develop weight loss, scours, and bottle jaw. In some cases, calves die from the damage and dehydration induced by the parasites.

Minimizing worm burdens is achieved by decreasing stocking rates, strategic drenching on a regular basis after weaning, and grazing on lower risk pastures. Frequency of drenching is best established by monitoring feacal worm egg counts. A veterinarian can be consulted on this matter. Grazing management can insure that stock are grazed on pastures with low risk / low larvae contamination. This can be achieved by using new pasture or fodder crops, or using pasture previously grazed by sheep for at least 6 months. Pasture grazed by mature, dry cattle can also reduce worm count as can rotational or strip grazing to reduce opportunity for worm larvae to hatch from dung of infested animals.

Liver Fluke

Liver fluke is a common parasite of cattle in south-eastern Australia, particularly in the irrigated areas. The life cycle of the parasite involves a water snail with contamination of pasture reduced in the colder months of winter. Acute signs of liver fluke are bottle jaw,

scouring, weight loss, and death. Weaners are particularly sensitive to fluke if a control program is not put in place. Chronic signs relate to ill thrift and include lower growth rates and lower feed conversion efficiencies in growing cattle.

Strategic drenching with Triclabendazole, a broad spectrum fasciolicide, is effective against all stages of fluke. Drenching should be undertaken in late autumn and early winter to kill all fluke picked up over the summer and autumn. An early spring treatment is necessary to remove adult infections missed by autumn/winter treatment. Restricting animal access to irrigation canals, swampy areas, springs, and watercourses are important ways to minimizing exposure and damage from liver fluke.

Lungworm

Lungworm is due to the invasion of the bronchi of calves by the parasite Dictyocaulus viviparous. Lungworm infection leads to parasitic pneumonia. It is primarily seen in calves less than tem months of age. This infection is not common at present due to the effectiveness of modern worm drenches against this parasite. The signs of lungworm include shallow, rapid breathing, a frequent cough particularly when the calves are being moved, and a slight temperature increase. Even while infected, calves generally remain bright, alert, and continue to eat.

The parasite is destroyed by the injectable drenches containing either ivermectin or moxidectin. It will be controlled if a regular drenching program is maintained for each batch of growing calves.

External Parasites

Lice infestation generally occurs on animals in poor condition, poorly fed, and/or suffering debilitating disease. The clinical signs are often most apparent in winter as hot temperatures of summer prevent egg laying and kill many mature lice. Two broad categories of lice infect cattle, sucking lice (Lignognathus & Haematopinus) and biting lice (Damalinia). Infected animals have a dry scaly coat, and patchy loss of hair. Infestation results in itchiness. The itchiness leads to animal rubbing, restlessness, and weight loss. Weight loss usually exacerbated by a malnourished state from an underlying condition such as internal worms. Transmission occurs between animals through direct contact. Lice are most commonly found around the lips, the sides of the neck, and tail end of a calf[1].

Treatment for lice is typically one of the “pour on” or injectable drenches containing ivermectin or moxidectin, the same preparations used routinely in drenching programs for internal parasites. These treatments are effective against sucking lice but are not efficient for biting lice. If biting lice are a problem, a spray or dip containing the very potent compound, chlorfenvinphos, may be used. Please note that this compound is highly toxic and it should not be used without minimizing human exposure and preventing animal entry into watercourses. Producers should consult with a veterinarian if unsure of the type of infestation affecting animals.

The presence of ticks in Northern Australia can cause worry, hide damage, and anemia. They are specific to that region. Treatment is an acaricide spray or dip, or an ivermectin or moxidectin drench.

Flies, mosquitoes, and various mange mites cause demodectic, sarcoptic and chorioptic mange and result in the formation of papules and scabs. Treatment is with an ivermectin or a moxidectin drench. Severe cases of mange will require a second dose two weeks after the first. Protection from flies and mosquitoes is best managed at the appropriate time of the year with a pour-on fly spray which will last on the animal for a number of weeks when applied as a stripe along the animal's backline.

Leptospirosis

Leptospires are bacterial organisms that enter the animal through skin or mucosal abrasions. Once in an animal's body, the disease localizes in the kidney. This disease results in a high fever, depression, anemia, and red urine in calves. The disease is spread in the urine of infected animals. **It can cause disease in humans as well as cattle.**

Disease control is strictly by vaccination and is part of the "7 in 1" vaccine that should be administered to calves prior to weaning.

Clostridial Diseases

Three main clostridial diseases are of concern.

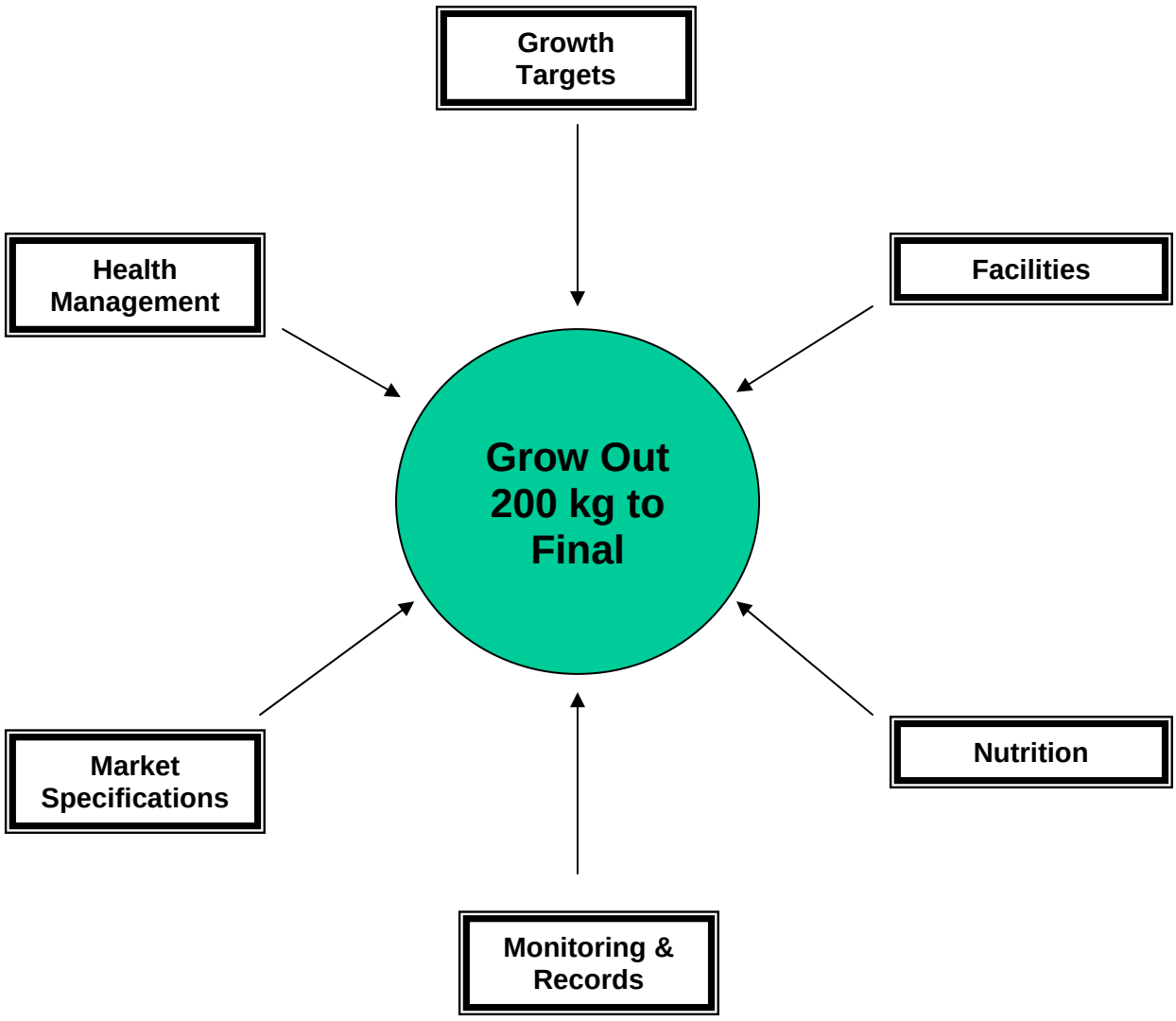
- Enterotoxaemia (pulpy kidney) causes sudden death. It is most likely to affect weaned calves that are grazing lush pasture.
- Tetanus most likely follows a wound such as marking.
- Blackleg most likely causes sudden death.

These diseases are all prevented by vaccination with "7 in 1" vaccine which should be given at four to six weeks of age (prior to weaning), boosted four weeks later, and given again at twelve months of age. Please read the "Health Management" subsection of "Section 6 Rearing Calves – Arrival to Weaning" for a complete description.

References

1. Malmo, J (1993) In Control and Therapy of Diseases of Cattle. Series B, No. 18. Postgraduate Foundation in Veterinary Science.

Section 10 - Grow Out – 200 kg to Final Market Specifications



Key actions

☑ Monitor each animal's individual weight gain at least every there to four months or strategically when conditions change.
☑ Inspect bulls, pasture quality, and pasture quantity weekly.
☑ Alter feed management weekly to adjust to current pasture conditions. This may involve adding or changing supplementary feed.
☑ Know final market specifications. Communicate with buyer(s) the progress of animals to final market specifications and a target sale date.
☑ Maintain health program of bulls. Document all treatments given.

Introduction

Once a bull calf reaches 200 kg at approximately six months of age, its rumen is fully developed. Therefore, producers need to emphasize good pasture management to provide optimal and vital nutrition for continued animal growth. Depending on the target market, bulls may be fed until they are 400 kg at fifteen to eighteen months of age, and then sold for finishing at a feedlot. Alternatively, bulls may be finished in pasture at 550 to 600 kg. Producers must know their target market in order to cost effectively plan feed, manage pasture, maintain a good health program, and successfully raise dairy beef bulls.

Growth Targets

As indicated in the previous section, bulls grow at various rates depending on nutrition provided. The desired growth rate will be related to the cost of gain, return on investment, market specifications, and delivery date. Knowing how cattle are performing and when they are likely to reach final sale weight is critical to meet buyer's specifications.

On average pasture quality and quantity, producers can relatively simply achieve growth rates of 0.7 kg/day. However during late summer and early autumn, most pastures in Australia will not be of high enough quality to meet the target weight gains. Therefore, supplementary feed will be required.

If bulls are to be taken to the finishing weight of 550 to 600 kg with minimal fat cover, the last stage of growth from 400 kg to finishing can be difficult. Often, producers are frustrated by bulls continuing to eat but not growing to finishing weight and condition. This is normally due to a lack of required energy in the total feed ration. To achieve finishing weight, a bull will require high quality pasture of unlimited quantity and possible feed supplement to provide all energy required for continued growth.

Facilities

No new or additional facilities are required for bulls at this stage of growth unless the bulls are moved to a feedlot operation. However, facilities will need to be structured for larger animals to insure efficient and safe handling of animals. Facilities should always be maintained to minimize animal injuries and disease.

If bulls are to be moved to a feedlot operation, then feedlot facilities required for dairy beef bulls are the same as those used in normal cattle feedlots. If a producer is

interested in a feedlot operation, then they should visit ongoing feedlots and/or enroll in a good feedlot course such at the Feedlot Management course (ANPR440 -540) at the University of New England Armidale, New South Wales.

Nutrition

As a bull ages, its energy requirements per kilogram of intake for a given daily gain are similar to those discussed in Section 9 which are 8.65 Mj/kg to 10.6 Mj/kg for gains of 0.6 kg/day to 1.0 kg/day. However as the bull matures, its protein levels tend to decrease slightly from that discussed in Section 9. For larger animals, protein requirements should range from 12 to 14% for a growth rate of 0.6 kg/day to1 kg/day. Commercial dairy feedlots overseas have achieved performance enhancement with higher protein levels.

To obtain elevated gain rates of above 1.0 kg/day, then nutrient levels of the total feed consumed must be greatly increased. This is normally accomplished in a feedlot. In addition to increased nutrient content within the feed, a growing bull will increase his daily consumption as he grows. Normally, a healthy growing bull will consume 2.5% to 3.0% of their body weight in dry feed. Optimum feedlot nutrition and feed management is a precise science that is best determined by a qualified and experienced nutritionist.

In most cases, pasture will be the majority of a bull's feed; therefore a producer must plan for fodder use. This planning is commonly called **fodder budgeting** and it is essential to predict the quantity of feed required. Due to seasonal conditions, supplementary feed may be required to fill gaps in pasture quantity and/or quality in order to meet target weights. Developing a fodder budget requires knowledge of both pasture assessment (i.e., quantity and quality) and livestock requirements. The best way to acquire these skills is through a PROGRAZER^{TM} course. The result of a fodder budget may indicate a pasture surplus or shortfall, which then allows a producer to develop appropriate feed strategies in advance. A fodder budget can be used to answer the two common questions covered below.

Question #1: How many days will a paddock last by feeding a specific stock density?[2]		
Step	**Description**	**Amount**
	Part 1: Available Pasture	
A	Current Herbage Mass	kg DM/ha
B	Minimum Allowed Herbage Mass	kg DM/ha
C	Current Available Pasture {= Step A – Step B}	kg DM/ha
	Part 2: Livestock Requirements	
D	Stock Density	head/ha
E	Daily Animal Requirement	kg DM/head/day
F	Daily Livestock Requirement {= Step D * Step E}	kg DM/ha/day
G	Wastage {Note, a common estimate is 15%}	%
H	Daily Livestock Usage {=Step F/(1-Step G)}	kg DM/ha/day
	Part 3: Pasture Growth	
I	Pasture Growth Rate	kg DM/ha/day
	Part 4: Pasture Balance	
J	Daily Pasture Change {= Step I – Step H}	kg DM/ha/day
K	If Step J is positive, available pasture (Step C) accumulates { = Step J }	kg DM/ha/day
L	If F is negative, the number of days the paddock will last {= (Step C / Step J) * -1 }	days

Question #2: How much stock do I need to graze a paddock to a specific residual herbage mass over a given number of days? [2]		
Step	**Description**	**Amount**
	Part 1: Available Pasture	
A	Current Herbage Mass	kg DM/ha
B	Minimum Allowed Herbage Mass	kg DM/ha
C	Current Available Pasture {= Step A – Step B}	kg DM/ha
D	Time Available	days
E	Pasture Growth Rate	kg DM/ha/day
F	Pasture Growth over Time {=Step D * Step E}	kg DM/ha
G	Total Pasture Available over Time {=Step C + Step F}	kg DM/ha
	Part 2: Livestock Requirements	
H	Daily Animal Requirement	kg DM/head/day
I	Wastage {Note, a common estimate is 15%}	%
J	Daily Animal Usage {=Step H / (1-Step I) }	kg DM/head/day
K	Total Animal Usage {=Step J * Step D}	kg DM/head
	Part 3: Number of Stock Needed	
L	Stock Density {=Step G / Step K}	head/ha
M	Paddock Area	ha
N	Total Stock {= Step L * Step M}	head

Monitoring and Records

Each bull should be weighed every three to four months to monitor weight gains and to predict the target delivery date. For example, fixed times for weighing may be at the change of seasons. In addition, strategic weighing may be needed if seasonal conditions are deteriorating, or if cattle appear to be growing at a faster rate than target.

As indicated in other sections, record keeping for each bull throughout its life is essential. Records should document weights, feed practices, health treatments, and other key issues. The consumers now demand traceability of meat and therefore processors require this information. Therefore, buyers will seek producers who have complete and accurate records. In addition, on going performance monitoring and record keeping is vital for producers so they are able to estimate when bulls will meet the target specifications.

Market Specifications

A producer needs to precisely understand the market specifications that he/she is selling bulls to. An example of specifications for live export trade is given in Appendix 3. Alternatively, bulls may be fed for entry into a feedlot or directly to slaughter. Whatever the end point specifications, good and continuous communication with the intended buyer is essential practice to insure best prices.

Sale and delivery arrangements should be made well in advance to ensure that the sale coincides with the buyers' requirements. In particular, **delivery** weight specifications required by the buyer need to be ascertained. Producers must account for weight loses during curfew and transit which averages between 5 and 8% of live weight. Without proper planning and allowances, animals may be above or below the target weight at time of delivery.

A bull's age is another important market specification. Age influences a bull's future performance potential and meat quality. Dentition is commonly used as an indicator of age, however actual birth dates are becoming more prevalent in required records. Producers need to ensure bulls meet the age specifications to avoid rejection by the buyer.

Health Management

Careful and regular observation of cattle will indicate general animal health. Below are health issues to be aware of for the older bull. Issues associated with the feedlot environment are also included.

Bovine Respiratory Disease

Management of cattle in a feedlot is a complex and costly undertaking with Bovine Respiratory Disease (BRD) the major reason for morbidity and mortality in feedlot cattle in Australia. Data suggests this disease causes 50% to 90% of all sickness and deaths. It is also most common in the first four weeks after entry to the feedlot.

BRD generally begins as a viral infection caused by Infectious Rhinotracheitis virus (IBRV), Parainfluenza 3 virus (PI3), Pestivirus (Bovine Viral Diarrhoea virus - BVDV), and/or Bovine Respiratory Syncitial virus (BRSV). Frequently, secondary bacterial invasion occurs with a severe pneumonia. The commonly involved secondary bacterial organisms are Mannheimia haemolytica, Mannheimia multocida, and Haemophilus somnus. These agents are normally found in the nose, mouth, and throat of healthy animals. They only lead to disease when the host animal is stressed, has a respiratory virus infection, or has nutritional deficiencies[1].

As cattle arrive at a feedlot, they are commonly mixed with cattle from a number of other sources. This mixing exposes the cattle to viruses and bacteria that they have not previously encountered. In addition to disease exposure, cattle may be stressed from travel, exposure to a new environment, handling, and potential feed changes. Dairy bulls are particularly prone to behavioral issues when mixed with other bulls. An all out all out system is generally preferred. All these factors predispose animals to respiratory disease. The signs of disease are depression, lethargy, dullness, dropping of the head, lack of appetite, coughing, discharge from the mouth, eyes and nose, fever, and rapid shallow breathing. All cases including the less severe will have decreased weight gain and feed conversion efficiency.

Animals that have a fever should be treated immediately. Those that are recumbent, and/or have paleness of the membranes, thick discharge from the nose and eyes, and an elevated heart rate will most likely have bacterial infection.[3] Repeat injections of broad-spectrum antibiotics such as Oxytetracycline, Trimethoprim-sulphadiazine, and Ceftiofur are commonly used for at least three to five days depending on response to treatment. Due to urgency of treatment needed, selection of a specific antibiotic is usually based on previous successful usage on the property or local area, rather than the culture of swabs. Animals that are not as severely affected most likely have viral infections which will likely lead to secondary bacterial infection. These less severely affected animals should also be treated with antibiotics to prevent rapid and serious deterioration. Early treatment reduces mortality and culling of chronically diseased animals.

Management programs to reduce the incidence of BRD are aimed at enhancing an animal's immune system or avoiding activities that suppresses an animal's immune system. Best Practice measures, which are actively promoted, include[1]:

- Avoid stress of castration, dehorning, branding, and vaccination by performing these procedures at least a month before weaning.
- Wean animals into suitable yards with good balanced nutrition to condition the bull to accept confinement, improve socialization skills, and stimulate faster adaptation to pen conditions once they enter a feedlot.
- Administer commercial vaccines for respiratory viruses before the animals enter a feedlot. Rhinogard (an intranasal vaccine against IBR), Bovillis (containing field isolates of Mannheimia haemolytica), and Pestigard (a vaccine for Bovine Pestivirus) will boost an animal's immune system.
- Control parasites at weaning and during the growing.

Lactic Acidosis

Lactic acidosis is a condition resulting from excess production of lactic acid in the rumen after the excessive consumption of readily fermentable carbohydrates. An overgrowth of rumen bacteria; Streptococcus bovis and Lactobacilli, results in increased lactic acid. The increased acid content reduces pH of the rumen to 5 or less; the rumen's normal value is 6 to 7. At the same time of pH reduction, fluid flows into the rumen due to the osmotic attraction of carbohydrates in the feed. This second reaction results in animal dehydration.

Symptoms of systemic acidosis are poor feed intake and shock. An animal will have a stilted gait, and watery smelly feces with shreds of mucus. If untreated, the animal's rumen with shutdown and the animal can collapse and die in twenty four hours. The consequences of a sub clinical attack are laminitis, liver abscess, ruminal inflammation, and subsequent feedlot bloat.

Recommended treatments for sick animals have been indicated in Section 8. The main priority is to restore rumen pH and rumen microflora population.

Best Practice methods to prevent lactic acidosis that are aimed at controlling concentrate intake. The methods include:

- Bring cattle onto full concentrate feed slowly.
- Add to the feed ration a buffer such as Sodium Bicarbonate at approximately 1%.
- If feed changes are necessary, change rations gradually.
- Avoid fluctuating feed intakes.

Laminitis and Lameness

Laminitis appears to be related to the occurrence of lactic acidosis, which results in a drop in rumen pH and leads to changes in rumen microflora. The microflora then releases compounds which are believed to constrict small blood vessels in the foot. The final result is permanent damage to the hoof. An animal with this condition has a stiff gait and difficult walking. This in turn reduces the animal's feed intake. Salvage slaughter of an affected animal is the usual outcome.

Lameness due to footrot is a condition caused by bacterial invasion of the softer skin of the foot at the back of the heel or more commonly between the claws. This usually occurs in wet muddy yards following foot trauma from stones or foreign bodies such as sticks. An affected animal will be lame with swelling and redness of the back of the heel. In addition, the animal may have draining lesions between the toes and a strong smell from the lesions. This condition responds to systemic antibiotics such as penicillin, and to footbaths made up of 10% solutions of zinc or copper sulphate.

Control of these conditions is directed at preventing trauma to the feet. Best Practice is to keep pens as dry as possible through using mounds and pen pad integrity, and avoiding potholes and pools of water. In addition, the pen should free of stones and other objects that could cause trauma to the feet.

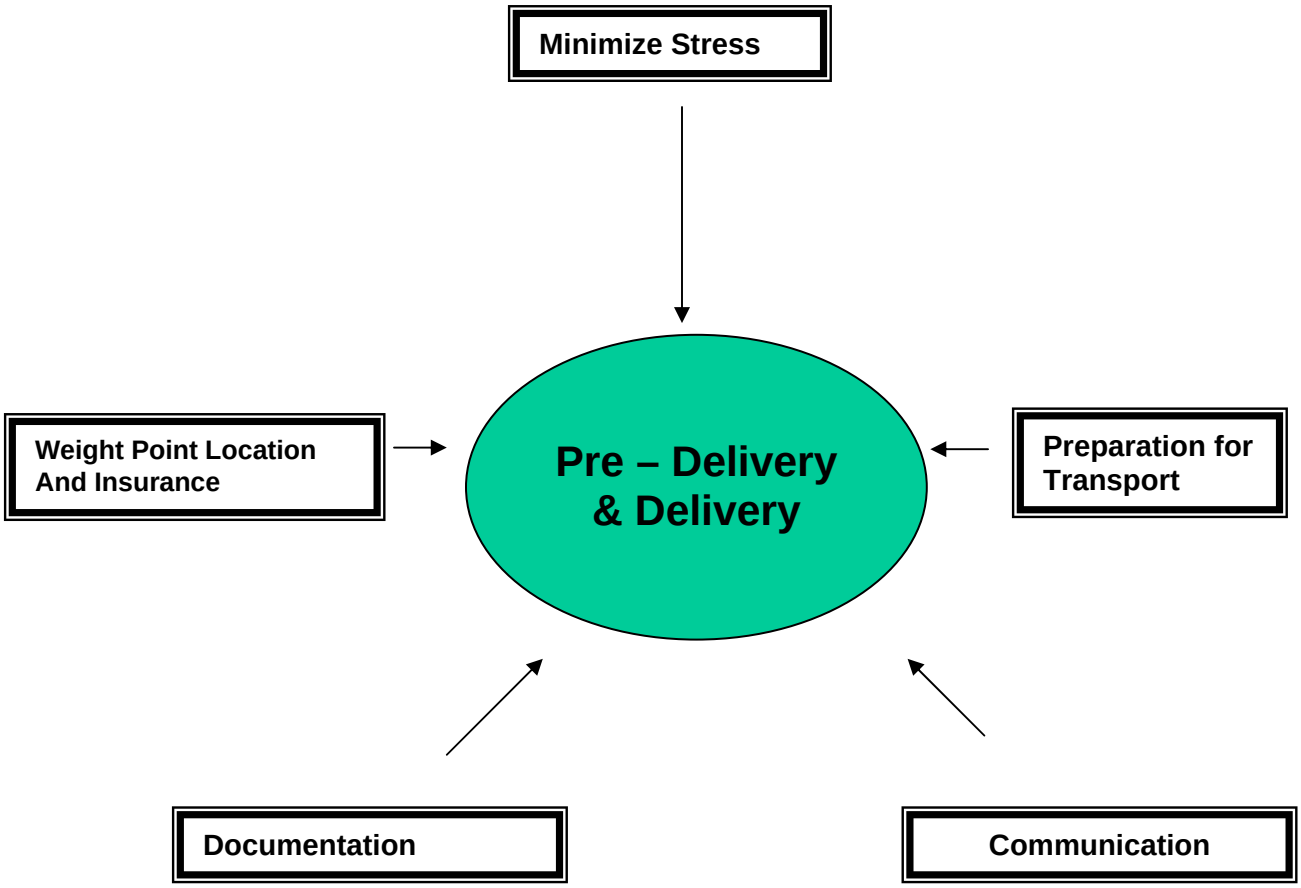
References

1. Green, P. 2000. The Predisposing Causes of Respiratory Disease. In Proceedings of Australian Association of Cattle Veterinarians.

2. Noad, B. 1998. Prograze. Appendix 7 NSW Agriculture and Meat Research Corporation

3. Radostits, O.M., Gay, C.C., Blood, D.C., & Hinchcliff K.W. 2000. In Veterinary Medicine. 9th Edition, WB Saunders & Co, London.

Section 11 - Pre-Delivery & Delivery of Larger Animals



Key Actions

☑ Select cattle with good temperaments, structurally sound, and fit for transport.
☑ Adhere to drug and chemical withholding periods for treated cattle.
☑ Minimize stress to animals by using good facilities that facilitate quiet, smooth flow of livestock, and by **not** mixing animals prior to transport.
☑ Ensure animals have good nutrition prior to transport so that their energy levels are elevated.
☑ Avoid mustering and trucking during weather extremes (i.e., hot or cold).
☑ Muster, place in holding pens with water, and provide feed consistent with buyer requirements for curfews and animal welfare codes of practice.
☑ Communicate and liaise closely between seller, agent, and buyer to ensure the consignment meets specifications.
☑ Select a reputable carrier that checks cattle at regular intervals during transportation and uses non-bruise crates and well maintained transport equipment.

Introduction

This section discusses the movement of cattle generally 12 months of age or older (i.e., not young calves as discussed in Section 4). Just like young calves, older cattle also require good handling and transport procedures to ensure they perform well upon arrival. The starting location is normally a pasture based farm. The arrival location may be another pasture based farm, an interim sale yard, a feedlot, a boat for international shipment, or an abattoir.

To minimize problems and stress to animals, the pre-delivery and delivery process of cattle involves careful planning and very close communication between the seller, transport operator, agent, and buyer. For example, cattle that are heavily dehydrated take longer to get on feed and have less meat yield at slaughter. Stressed animals contribute to dark cutters and decrease the immune response in cattle on feed. Bruising and abrasion damages hides and carcasses, and decreases total value. To achieve a problem free and low stress environment, handlers focus on providing good animal welfare. Key steps to this are good feed and water practices, smooth loading, and fast delivery of animals.

Good animal management prior to and during delivery is vital to optimize per head profitability. The consumer wants a consistent quality end product that can only be achieved when all segments of the industry, including transportation, do their job properly.

Minimise Stress

A stressed animal does not generate maximum returns. Every effort must be made to ensure stress is minimised from the pre-delivery phase through to delivery of animals to their final destination. Stress affects an animal's welfare and causes carcass weight loss as stressed animals get sick and sick animals don't eat. Poor practices that contribute to stress include:

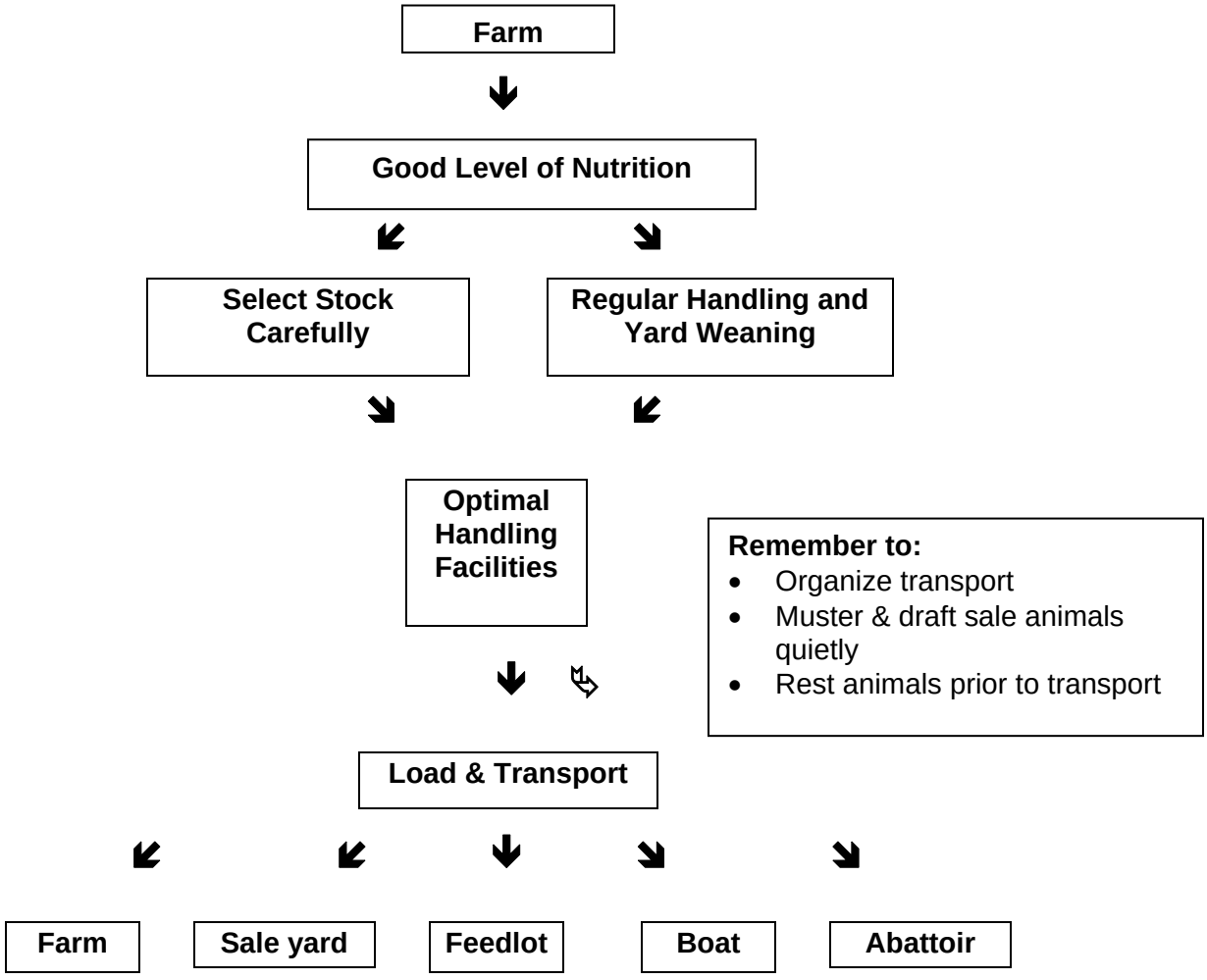
- Rough treatment and handling of animals.
- Removal of horns.
- Mixing unfamiliar stock prior to mustering, drafting, transport, and slaughter.

- Over-crowding or isolation.
- Use of dogs on cattle that have not been trained with dogs.
- Deprivation of feed and water for long periods of time.
- Poor handling facilities.
- Poor loading and unloading procedures.
- Transport during extremes of weather (e.g. hot or cold).

Animal stress can be minimised through improved animal handling and management techniques that avoid the poor practices listed above. Other good practices include dehorning calves at weaning or using polled animal breeds, using well designed loading facilities that facilitate the quiet, smooth flow of stock, and eliminating protruding or sharp edges within the confines of the yards.

Preparation for Transport

To improve the preparation of livestock for delivery, steps in the following flow chart should be addressed:



The ideal situation is to have cattle with good consistent nutrition at all times *(Handbook for the Preparation of Livestock for Transport)*[2]. Whilst this is not always possible, increased amounts of energy reserves will decrease the adverse affects of stress during transportation and will reduce the chances of dark cutting in slaughter cattle. The aim is to maintain a constant daily minimum weight gain of at least 0.6-0.7 kg/day. Live weight gain should continue at least until the animals leave the farm. Therefore, cattle about to be transported should have access to good high energy pasture or supplement as necessary. Also, using additional electrolytes prior to transport and upon arrival have been found to lesson dark cutters. In some instances, the use of additional electrolytes has decreased yield loss resulting from transport.

Cattle that are selected for transport should be quiet and relaxed. Any animals which are aggressive should be culled because they are a danger to themselves and handlers. Animals that are lame, structurally unsound, or unfit for travel should not be presented for transport. The driver of the truck is responsible for the care, health, and welfare of the cattle during transport (unless accompanied by the owner or an agent) and may decide **not** to load such animals.

Regular handling of cattle lowers stress as the animals are accustomed to humans and gentle handling techniques.

For cattle going to a destination other than another pasture based farm, yard weaning helps eliminate stress and allows animals to perform better upon arrival. Cattle going from pastures to yards/ships have to cope with an enormous amount of change to their daily routine and environment. Many animals take a week or more to start feeding properly. The best way to overcome stress is for the animals to be trained at the farm of origin to eat from a bunk and drink from a trough.

Finally, drug and chemical treatments have a greater efficacy if done on the farm of origin. For example, the value of pre-boosting animals before they leave is being recognized by many in industry. Buyers may insist on pre-treatments such as vaccination to boost the immune system prior to delivery as well as yard training.

Good yard design is essential for the efficient handling of livestock. Open plan yards designs incorporating curved races are preferred. Well designed facilities should have the following characteristics[1]:

- Well drained with adequate shelter and shade.
- Loading ramps should be concrete, stepped, and have a level landing platform at the top of the ramp. All facilities should have grooves in the cement to prevent cattle from slipping.
- Forcing yard should have non slip surfaces.
- Yards should have no sharp protruding edges, broken rails, or broken gates.

For more information on yard design, readers may visit www.grandin.com.

Cattle being transported should have a quiet rest period before being trucked. A rest period after mustering and handling is essential. Animals should be left alone and disturbed as little as possible during this period. The SCARM Codes of Animal Welfare state that cattle, which had considerable physical exertion during mustering, should have feed, water, and rest for at least 6 hours followed by another 6 hours of restricted or no

feed and water in a location close to the loading facility. Deprivation from food and water will compound the stress associated with transportation[3].

Once animals are rested and fed, they should not be offered large amounts of water and food for another 6 hours prior to loading. If cattle are full of water when they are loaded on the truck, the environment inside the crate becomes very wet and slippery which results in animal bruising as they may fall on rough roads, going around corners, and during fast starts or stops, etc.

In addition, the codes of practice recommend that cattle should be offered feed and water if the period with no water will be longer than 36 hours. Therefore, cattle should not be on a truck for longer than 30 hours. If the duration of the trip is longer than 30 hours; cattle should be unloaded, fed, and watered.

A reputable carrier should be selected for transporting cattle. The carrier should use non-bruise crates and well maintained transport equipment to reduce the incidence of bruising, injury and stress to cattle during transportation.

The truck driver has responsibilities that are part of their code of practice. Truck drivers should check the cattle 30 minutes after the commencement of the journey and at least once every 3 hours to ensure that animals are traveling satisfactorily. If cattle are being trucked in a mountainous environment, drivers should check cattle at least twice in a three hour period. Higher frequency of checks are required if the road is winding and/or with steep climbs or descents. Hills and winding roads are tiring on the animals compared to that of a flat road as the animals fatigue and tend to lose their footing and fall over. This is even a bigger issue during wet weather or if the truck is full of urine and wet faeces. Drivers should also check the cattle as soon as the vehicle stops and prior to departure for meal breaks and/or refueling.

Drivers should check for protruding heads or limbs out the side of the crate as this is normally the result of an animal lying on its side and unable to get up. The truck driver needs to do everything possible for the animal to get back on its feet. If the animal is unable to stand, then the load should be taken to the nearest sale yards and unloaded. If the downed animal is still unable to stand up once all animals have been unloaded, a veterinarian should be contacted to have the animal treated as required or disposed of humanely.

Transport operators should ensure that animals reach their destination as quickly as possible and in a condition that is not significantly less than the condition they were in when they were loaded onto the truck. If injury or illness should occur during transport, immediately upon arrival cattle should either be given the appropriate veterinary treatment or disposed of humanely.

Cattle from areas that are susceptible to pests such as ticks and diseases such as Bovine Johnes Disease may have restrictions on transportation. To avoid extended transportation delays, the Department of Primary Industries should be contacted to check for other cattle transportation restrictions. Transport operators should also maintain latest knowledge on necessary treatments and/or restrictions for either intrastate or interstate movement of cattle.

Upon arrival at their destination, cattle should be quickly and carefully unloaded. All cattle must be offered water as soon as possible after their arrival. Receiving and unloading personnel need to insure unloaded cattle are placed in yards with water. Even if going directly to slaughter, cattle should receive water after arrival.

Animals transported to a new farm, feedlot or boat should be returned to feed as soon as possible. If the destination has same feed ration as the feed ration at origin and if the cattle have been off feed for a short period of time (i.e. approximately less than 6 – 10 hours), then the cattle may immediately return to the same ration. If cattle have been off feed for a longer or unknown period of time or if the original feed ration is not available, then new arrived cattle will need to be started on a low starch high nutrition ration. Research and commercial use in many feedlots have indicated that animals recover quicker when placed on this type of ration instead of hay only. The ration also needs to be low in soluble starch to minimize acidosis.

Communication

As stated above, seller, carrier, agent, and buyer need to liaise closely and maintain good communications. The buyer needs to know cattle numbers, estimated weight, type of cattle, date and time of delivery, and the final destination. Good communication minimizes confusion at delivery which results in less handling delays, lower stress, less sickness, and greater performance of the animals that arrive at a new location.

Cattle that make up the consignment should be of specified breed, and within the dentition (i.e., age) specifications and weight ranges the buyer has specified. Buyers have specific requirements; therefore, sellers, agents, and buyers need to maintain regular and direct contact to ensure these requirements are understood and met. If possible, a buyer inspection prior to loading may be arranged to guarantee that all cattle transported meet specifications and are accepted at delivery. If cattle have not been inspected by the buyer prior to loading, then the seller is responsible for all costs associated with any animals that are rejected and may have to accept discounted prices.

Communication is the key to avoid any confusion between seller, agent, and buyer of cattle. It helps to avoid rejection and discounting of animals at the point of delivery.

Documentation

Traceability of animals is essential; therefore detailed records of all health management treatments and husbandry practices must be maintained throughout the lives of all cattle.

Accurate records of the routine health treatments are essential. Sellers must understand the withholding periods of drugs and chemicals used on cattle to be transported, and schedule transport accordingly. Withholding periods vary with different drugs and chemicals. For each drug or chemical, the withholding periods will vary whether the final animal product is meat or milk. Withholding periods are documented on the product label and should always be read and followed.

Sellers should check with buyers to ensure that appropriate documentation is received at destination with the cattle. Buyers, such as abattoirs and feedlots, will generally **not** accept delivery of a consignment until they receive a copy of the appropriate documentation and cattle are tail tagged. The necessary paperwork that is required to

accompany cattle to their next destination is the Livestock Production Assurance – National Vendor Declaration (LPA – NVD) Waybill. The LPA – NVD is a set of food safety guidelines that underpin the revised NVD Waybill. This helps producers produce livestock that meet a minimum food safety standard. The LPA has five guidelines as follows[4]:

1. **Property risk assessment** – Ensures livestock are not exposed to areas on the property of origin that may be contaminated with persistent chemicals.
2. **Safe and responsible animal treatments** – Refers to withholding periods on the packet of animal health treatments.
3. **Stock foods, fodder crops, grain and pasture treatments** – Ensures livestock are not exposed to feeds that may be contaminated with unacceptable animal products or chemical residues.
4. **Preparation of livestock for dispatch** – Ensures the consignment lot is fit for travel, not unduly stressed, and contamination is minimized during on-farm assembly and transport to final destination.
5. **Livestock transactions and movement** – Ensures the movement of livestock can be traced if required.

This document must be filled out by the seller, agent, and carrier. If this documentation is not available as it should be, then the carrier is required to fill out a Transported Stock Statement (TSS). The LPA-NVD has replaced the TSS.

Weigh Point Location & Insurance

Another important issue to address is for the seller and buyer to negotiate the weigh point for the cattle. This might be on-farm, a registered weighbridge, feedlot, or over the hooks if the consignment is going to slaughter. For example if based on-farm weight, seller and buyer will typically agree on a feed and water curfew period before weighing (e.g., 6 hours and immediately prior to loading) and the estimated body weight loss during transport (e.g., 5%).

A final issue is transit insurance which is highly recommended. This is arranged through the transport company, insurance agent, or insurance broker prior to animal transport to ensure livestock are covered by insurance during the loading, transport, and unloading periods.

References

1. Grandin, T. (2000) Beef Cattle Behaviour- Handling and Facilities Design, 2nd Edition.

2. Handbook for the Preparation of Livestock for Transport – prepared by NSW Meat Industry Authority

3. Land Transport of Cattle (1999) – Standing Committee on Agriculture and Resource Management Report No. 77. Australian Model Code of Practice for the Welfare of Animals.

4. The revised LPA - NVD Waybill – your questions answered (www.mla.com.au/lpa)

Biographies

Dr. Theresa M Craig (PhD)

Theresa is a PhD who has provided nutrition and production consulting to the beef cattle and dairy industries for the past 16 years. She has worldwide experience, and owns and manages her consulting/research business, TARA – Technical Assistance and Research Analysis Pty. Ltd. Theresa has unique experience for the Australian Dairy Beef industry; her worldwide experience has helped the fledgling Australian industry develop into a profit making business.

Theresa has spent her lifetime in the agricultural industry. She grew up on a family feedlot and ranching operation in Alberta, Canada. Between high school and University, she worked for Canadian Charolais Association. She obtained a Bachelors of Science in Animal Production from Texas A&M University, and then conducted her doctorial (PhD) work on nutrition and growth at both Texas A&M and the University of Missouri.

While completing her PhD, Theresa was joint owner and manager of a Dairy Beef operation in Mexico. Calves were under her management from 3 days of age to slaughter at 450 kg for the five star restaurants. Following completion of her PhD, Theresa worked in various countries. She worked in Portugal as a consultant for a major feed manufacturing company. This was followed by work again in Mexico as a nutritional consultant. In 1995, Theresa migrated to Australia and worked for Rhone- Poulenc Animal Nutrition (now Adessio) as their Ruminant Product Manager. In 1997, Theresa opened her own consulting service that has clients throughout Australia. From 1998 to the present time, Theresa has also been a key lecturer of the CRC feedlot management course for the University of New England, Armidale, NSW.

Clifton C Hefner

Clif was born and raised on a small family rice farm and cattle ranch in South Eastern Texas, USA. He obtained BS in Petroleum Engineering from the University of Texas and spent the next 27 years of his career working worldwide in the oil and gas industry as an engineer, economist, manager, and consultant. During his career, Clif became known for his technical writing and editing. He has authored and edited a number of company proprietary training manuals, broad based technical reports, and multi-disciplined government submissions. In recent years, Clif joined TARA – Technical Assistance and Research Analysis Pty. Ltd. and his primary role continues to be consulting to the oil and gas industry. Due to his farming and ranching background as additional secondary roles, Clif provides programming support, research assistance, objectivity, and technical writing editing to TARA's agricultural and other clients.

Scott McDouall

Scott is originally from a beef cattle property at Upper Horton in North West New South Wales, where his family still runs a composite herd on 5000 acres. After completing a Bachelor of Business (Agriculture/Commerce) degree at The University of Sydney, Faculty of Rural Management, Orange NSW in 2000, Scott accepted a position with

Elders Limited. For the next 2 years, Scott worked across Australia in various Elders operations. He gained experience in the agency business with emphasis on livestock, live export, breeding programs, feedlots, and custom feeding.

In November 2002, Scott accepted a position with Elders International Australia Limited based in Warrnambool, Victoria managing their dairy bull operations. Scott began to work closely with rearers, agistors, growers, feedlotters, and processors involved in the Dairy Bull industry.

Scott continues to manage Elders investment in Dairy Bulls. Recently, he has been involved in developing and managing Elders backgrounding operation for Charlton Feedlot in Victoria.

Sharon Pettiford

Sharon was born on an extensive sheep and cattle grazing property, 80 km northwest of Coonamble, NSW. She is currently undertaking a Masters Degree in Rural Science, researching animal welfare and livestock transport.

After completing school in Bathurst, Sharon worked in shearing sheds for 12 months prior to commencing a degree in Rural Science at the University of New England. Sharon worked at the Agricultural Business Research Institute with a stint in Thailand working for the Department of Livestock Development. She returned to Coonamble in June 1998 where she remained for 2 years working in an animal health position before taking a position in Armidale with the Cattle and Beef Quality CRC as a Technology Transfer Specialist in July 2000.

Sharon has a road train license, and has been working in the livestock transport industry as a driver for the past 4 years on a casual basis. On most weekends, she is trucking sheep or cattle around NSW or Queensland, between saleyards, feedlots and abattoirs. She is the Secretary of the New South Wales Livestock Transporters Association.

Sharon was recently awarded a Meat and Livestock Australia (MLA) scholarship to study her Masters with CSIRO at the University of New England. Over the next 2 years, she will be investigating objective measures of animal welfare in cattle during livestock transport. This research will be vital in establishing indices of animal welfare to demonstrate and validate the high standards of Australian transportation of livestock to both domestic and export customers.

Dr Michael Pyman BSc(Hons) BVSc(Hons) MVS MACVSc

Michael undertook a BSc(Hons) degree in Microbiology at Monash University before completing his Veterinary Science degree at the University of Melbourne in 1975. After graduation his first position was as an associate in a mixed animal practice in the Western District town of Casterton, Victoria.

At the end of 1977, Michael accepted a position in a South Gippsland dairy practice based in Korumburra where he was a partner up to the end of 1998. His primary role in

the practice involved the development and delivery of herd health programs concentrating on reproduction, mastitis, and nutrition of dairy cows.

Michael completed an MVS (Dairy Medicine & Production) postgraduate degree in 1995 and was an Academic Associate of the veterinary school for a number of years during that period. He was appointed to the position of Senior Lecturer, Cattle Medicine and Production, Department of Veterinary Science, University of Melbourne in 1998. Michael is a member of the Australian College of Veterinary Scientists (Epidemiology) having completed the entrance requirements in 1999. In 2003, he commenced a PhD with the Dairy Fertility Unit, University of Melbourne on the effect of crossbreeding on production, health, and reproductive performance of Victorian dairy cows.

Jack Speirs

Jack and Suzie Speirs, and their family operate a sustainable farming enterprise along the Wando River in the Western District of Victoria. The Speirs farm enterprise has been shared with the greater community for many field days, tours, and events demonstrating innovative research. This has achieved a change in community attitudes, adoption of more sustainable farming practices, improved natural resource management, and consequently a healthy and vibrant community. Jack believes that community involvement in rural areas plays an integral role in the social health of our society.

Jack is a Contributing Member to the following organizations:

- Chairperson BESTWOOL 2010 Management Committee
- Member of Industry Environmental Management Systems Advisory Group for Federal Minister for Agriculture, Fisheries and Forestry
- Producer Member of Southern Beef Program for Meat and Livestock Australia
- Producer Advocate for More Beef from Pastures Program MLA
- Management Committee National Mentor Program
- Pastures and Animals Harvest Team Sustainable Grazing Systems (SGS) for Australia (2002-2003)
- Meat and Livestock Australia Regional Steering Committee of S.G.S. for Victoria and South Australia (1996-2003)
- Chairperson of the Organizing Committee of the 1999 S.G.S. National Producer Forum

Through the years, Jacks's awards and achievements have included:

- First Victorian recipient of the prestigious McKell Medal awarded by the Australian, State and Territory Governments to an individual to publicly recognize excellence and achievement in Natural Resource Management in Australia. (2004)
- Glenelg Hopkins Catchments Management Individual Environmental Award (2004)
- Jack was awarded a scholarship from Meat and Livestock Australia to participate in Course 9 of the Australian Rural Leadership Program (2002-2003).