Growing Heifers

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DAIRY RESEARCH
AND DEVELOPMENT
CORPORATION

NSW Agriculture

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Edited, designed and desktop published by Ann Munroe, Sydney, and Matthew Stevens, ScienceScape Editing, Sydney

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ISBN 0 7310 9816 1 (Dairylink monographic series)
ISBN 0 7310 9819 6 (Growing Heifers)

Agdex 413/23

Foreword

Dairying is one of the most progressive rural industries in NSW. This is evidenced by substantial changes in herd sizes and increases in production by cows and from farms.

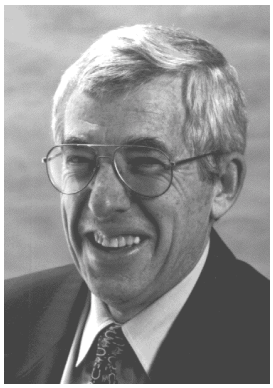
An outcome of these increases is that management has become more complex, requiring greater knowledge and technical skills.

As farmers become more competitive through increases in both production and productivity, they will require even better technical information and management skills. Most important, they will need to know how to use the information in improving whole-farm performance and profits. This statement is supported by results of various Dairy Research and Development Corporation workshops and NSW Dairy Farmers' Association surveys, which have clearly indicated that farmers require technical packages that are current and relevant.

DairyLink is a series of integrated information packages that look at aspects of pasture, herd and feed management, and suggest practical ways of getting the best from your cows and pastures. The DairyLink series is a result of collaboration between NSW Agriculture officers, agribusiness and farmers.

The packages will be the basis of workshops and meetings for NSW dairy farmers.

DairyLink has much to offer the NSW dairy industry in helping improve farm productivity and profitability. We encourage farmers to attend and participate in the DairyLink workshops and meetings.



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Preface

DairyLink is an innovative concept that introduces you to some important technical areas to help improve farm productivity and profits.

The modules in the series are of value to farmers, students, consultants and extension service providers.

DairyLink consists of the following information packages:

Establishing Pastures
Managing Pastures
Growing Heifers
Realistic Rations
Conserving Feed

The modules have been developed as technical manuals and farmer-friendly booklets, and are linked to the Tocal Dairy Home Study course.

I would like to take this opportunity to acknowledge and thank the various technical teams for doing an excellent job. I also appreciate the funding and support provided by DRDC.

Alex Ashwood
DairyLink Series Coordinator

Contents

Introduction

Many aspects of calf rearing and heifer management have changed on dairy farms in the last 5 years.

As production levels have risen, so has the need for well-grown high genetic quality heifers to be calved at 2 years of age. Well grown heifers will increase farm profitability, with higher milk production, better reproductive performance and extended productive life in milking herds.

The purpose of this manual is to describe the steps required for successful management to achieve those targets.

Calves must obtain the best possible start in life. Best management practices for colostrum feeding, nutrition, housing and husbandry are outlined here. The requirements for continued growth in the important post-weaning period are covered, with recommended target weights for mating and pre-calving.

Information on contract calf rearing and heifer growing and backgrounding is provided, as it is recognised that specialists in these fields are providing valuable services to the dairy industry.

There is still much to learn about correct nutrition, management and particularly welfare of the modern dairy heifer.

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Introduction 2

The benefits of good heifer management

The aim of calf rearing should be a healthy, fully weaned calf at its target weight at 12 weeks of age. This should be the first step in your overall plan to calve your heifers at 2 years at desirable bodyweights (see Table 1.1).

Good heifer management increases your profits because:

- first lactation milk production and lifetime milk production are increased
- there is less culling for failure to conceive or poor production
- reproductive performance is better
- fewer replacement heifers need to be reared
- genetic potential is maximised.

Unsatisfactory calf rearing systems result in high labour requirements, lower growth rates, and costly health problems.

The Best Practice Principles chart overleaf shows the inputs, management goals and advantages of good calf rearing.

The importance of reaching target weights

If your 2-year-old heifers reach their target live weights at calving, their milk production and reproductive performance will be maximised. Minimum target live weights for Holsteins are 330 kg at mating and 550 kg at calving (230 kg and 400 kg for Jerseys). For more details see Table 1.1.

The target weights recommended in the table are for animals that will be milked on pastures and fed supplements to produce 6000-8000 L (Holstein-Friesian) or 4500-5000 L (Jersey/Guernsey) of milk for each lactation. These weights can be achieved under normal commercial dairy farm conditions if you have a well planned heifer management program.

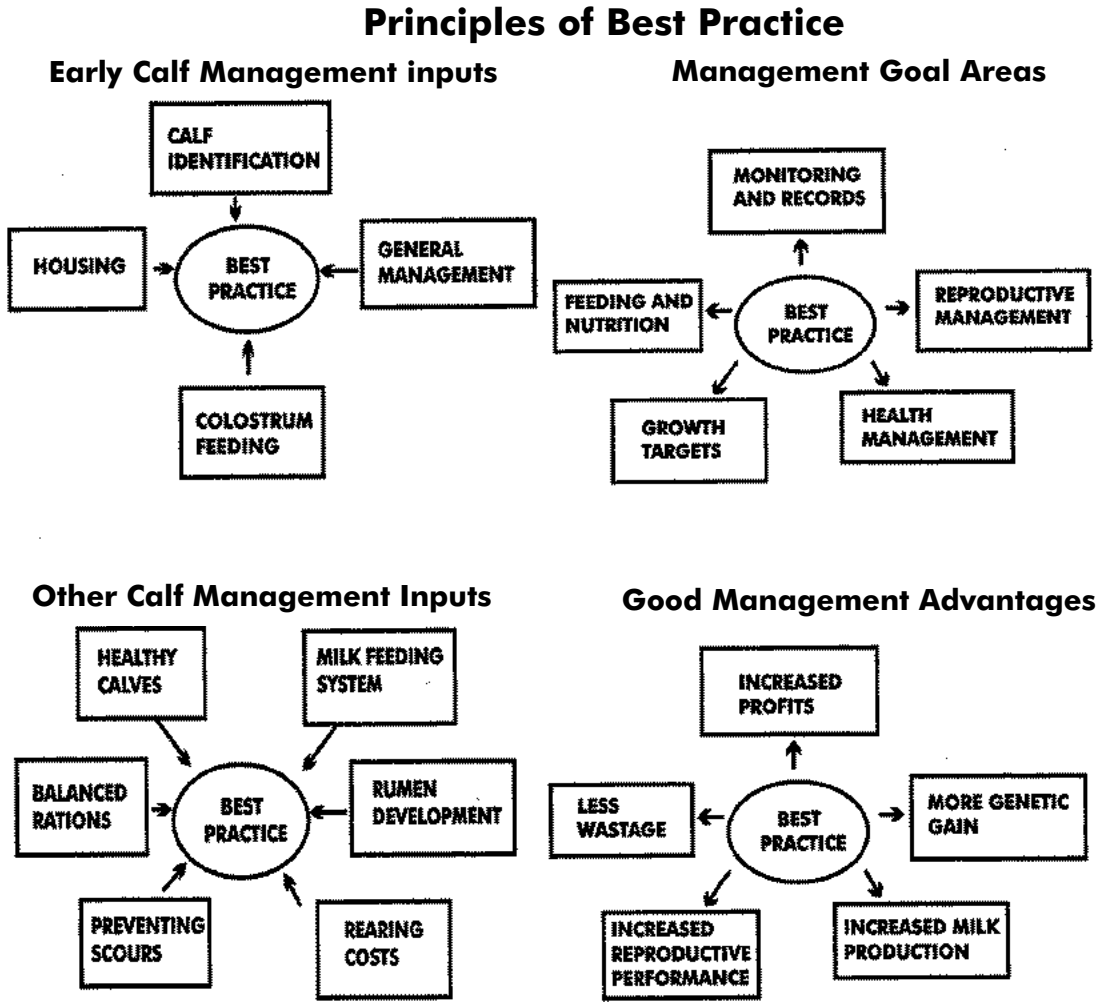
There is a range of target weights for each age group, depending on farmers' goals. There is a large amount of variation within herds and among farms. For Holstein–Friesian x Jersey heifers assume that the live weight targets are half-way between those given for the purebreds.

If you don't manage your heifers properly they will not reach their minimum target weights at critical stages of growth. This means your profits will be reduced, because:

- the heifers will be older at calving, so you will need to run more replacements
- oestrus (which is determined by live weight) will be delayed
- undergrown stock will try to catch up their weights in subsequent lactations at the expense of milk production

Table 1.1: Target live weights (kg) for Holstein–Friesian and Jersey heifers

Age (months)	Jerseys Target live weight	Holstein–Friesian Target live weight
	kg	kg
Birth	20–25	35–45
Weaning (2–3)	70–80	90–100
12	170–180	250–280
15 (mating)	230–280	330–370
24 (pre calving)	400–450	550–600



- selection and the rate of genetic gain will be slower
- late calving heifers may have more calving problems.

Increased milk production

Tasmanian studies have shown that one of the most important benefits of having the correct weight for age at calving is increased milk production (Table 1.2).

Studies in NSW and Victoria have shown similar figures. Two-year-old heifers produced an extra 1000 L in their first lactation if they calved at 525 kg (peaking at 25 L/day), rather than if they calved at 425 kg (peaking at 20 L/day), under similar management.

1000 L x 30 c/litre (average price) = $300 extra per heifer for the first lactation. Subsequent lactations will return higher margins.

Reduced wastage

New Zealand studies have clearly demonstrated the benefits of improved

Table 1.2: Potential production increase with each 1 kg increase in heifer live weight at calving

	Milk (L)	Fat (kg)	Protein (kg)
1st	4.07	0.18	0.18
2nd	8.30	0.26	0.39
3rd lactation	8.44	0.33	0.28
Totals	20.81	0.77	0.85

Source: Department of Primary Industries and Fisheries, Tasmania

Table 1.3: Effect of live weight on percentage of empty heifers and on cull rates

Year	Live weight range in kg (mean)	Empty %	Culled (poor production) %
1988	258–439 (315)	15	13
1990	334–460 (387)	6	4
1991	372–560 (432)	0	0

heifer weights. Table 1.3 shows that as the average live weight increased in 2-year-old heifers, fewer were empty and fewer were culled for poor production.

Better reproductive performance

The onset of puberty and start of cycling are related more to weight than to age. Conception rates are lower in lighter heifers, and they have more calving problems.

Fewer replacements

The number of heifers needed is directly related to the age at first calving and the replacement rate on the farm. For example, assuming an average culling rate of 30% and an average age at first calving of 28 months, Table 1.4 shows that you would need about 77 heifers per 100 cows—77% of your herd size (milking plus dry cow numbers). It appears that many farmers raise too many heifers at a real cost to their overall operations. By reaching target weights on time you can reduce the number of replacements required and the total rearing time.

Bottom line economics

Heifers weighing 100 kg more at 2 years are likely to produce 2500 L more milk over their lifetimes. This would return an additional $750 at 30c/litre (average milk price). They would also return extra money as cull cows (say, 100 kg at 80c/kg live weight = $80) and produce heavier calves.

The additional cost of grain for the extra growth and milk production would be, say, $540 (3 tonnes at $180/tonne). This leaves a $290 profit per cow—and you also get faster genetic gain and have to keep fewer replacements.

Your Heifer Management Program

The management of heifers should be planned from the day they are born. Good record keeping is essential and cannot be over-emphasised.

Table 1.4: Effect of age at first calving and culling rate on numbers of replacements needed to maintain static herd size of 100 head

Cull rate (%)	Age at first calving (months)							
	22	24	26	28	30	32	34	36
20	40	44	48	51	55	59	62	66
22	44	48	52	56	61	65	69	73
24	48	53	57	62	66	70	75	79
26	52	57	62	67	72	76	81	86
28	56	62	67	72	77	82	87	92
30	61	66	72	77	82	88	94	99
32	65	70	76	82	88	94	100	106
34	69	75	81	87	94	100	106	112

Having healthy, contented and well grown heifers can maximise your genetic gains. Photo: D Rosenbaum, Gloucester.

Replacement heifer management program for achieving target weights

Birth–2 weeks: Provide colostrum, dip navel (7% iodine solution), remove surplus teats, identify calf, house properly. Introduce starter meal; dehorn.

6 weeks: Weigh, check feed intake, wean if eating 0.5–0.75 kg a day of a 20% protein concentrate.

8 weeks: Vaccinate for clostridial diseases and leptospirosis.

12 weeks: Check weight and body condition and revaccinate.

6 months: Check weight and body condition and assess.

9 months: Check nutritional needs (good pasture and/or supplements).

12 months: Check your drenching and vaccination program.

14–15 months: Check weight for age; heifers that have reached their targets may be synchronised and mated (preferably with AI and a follow-up bull).

18–20 months: Pregnancy test and check live weight targets.

20–24 months: Check weight and condition score. Drench. Before calving introduce to milking shed and farm routine.

Calving: Check target weights. Revaccinate for clostridia and leptospirosis.

Calf rearing

For successful calf rearing you must identify your targets and prepare a plan. You should plan for:

- setting up a recording system
- adequate housing
- good management
- proper feeding (including colostrum feeding)
- formulating a health check list
- preparing a budget.

Record keeping

Setting up a simple record keeping system is essential. Calves must be correctly identified with devices such as eartags.

Record the following:

- date of birth
- twin/calving difficulty
- cases of illness
- date and type of treatment
- weight at birth and l2 weeks
- if purchased, where and when
- mortalities and cause (if known)
- date of vaccination
- date of deworming.

Records will allow you to compare calf rearing with industry targets. Table 2.1 might help you to assess your costs.

The risks of selling calves with detectable residues are too high not to keep records in an easy and accessible manner.

Table 2.1: Sample chart for recording costs to weaning

Item	Quantity (kg)	Cost($ per day or calf)
Milk/milk replacer		
Pellets		
Straw/hay		
Bedding		
Labour		
Additives		
Health (vaccines, drenches etc)		
Disinfectants		
Sundries (buckets etc)		

Housing

To encourage rumen development and optimum growth rates, calves should have restricted access to pasture. This means calves should be housed for the first 10–12 weeks of life.

Where possible, keep calves in separate pens for the first week. This permits easy monitoring and early detection and treatment of any health problems. Early detection is critical for quick recovery and preventing deaths.

After an initial period of 1–2 weeks, calves can be put into batches of up to eight in each pen. If calves are permanently housed inside they will need to be kept in smaller batches than if they are housed overnight with sheltered outside runs; calves need a pen area of 1.5 m^2 each.

Permanent shedding

Keep the shed dry and draught-free at calf level

Wet windy conditions create stress, which can result in scours and possibly pneumonia. Keep sheds clean, dry and draught-free to above the height of the calf. At the same time make sure there is

good ventilation; if you can smell ammonia, they can get pneumonia.

Deep litter bedding or wooden grating is ideal as flooring. If sawdust is used as bedding it should be fresh, clean and dry.

Wooden grating must be well above the ground and enclosed on the windward side to maintain a draught-free environment.

Maintain hygienic conditions

At the end of each calf rearing season remove the bedding and clean the shed out. If your calf rearing is seasonal, a spell of 3 months combined with effective disinfection will ensure a hygienic environment for the next calves. If your calves are reared continuously, after each batch of calves is put out you will need to clean the shed and all the equipment and surrounds to remove dry manure and feed residues. Sterilise by spraying with an effective disinfectant such as Virkon® or Akricide®. These disinfectants can be misted throughout the shed while calves are still inside; nevertheless, sheds are best disinfected between batches. Allowing extra shed room for the number of calves reared will allow some pens to be rested on a rotational basis.

Never use a high pressure hose to clean the manure out of your sheds if calves are inside; this kind of hosing makes the calves breathe in atomised faeces and bacteria, making them more susceptible to pneumonia.

Overnight shedding with daytime mini-paddocks

This system is effective for batch rearing. It minimises contamination of the shed, while allowing calves to sleep overnight and providing shelter during wet, windy weather. If you use this system, make sure that your calves eat the necessary concentrate ration essential for growth and early rumen development.

It is essential that mini-paddocks have shelter from prevailing winds. This can be provided by specially planted windbreaks or strategically located buildings. Treat calves with an effective drench before changing paddocks.

Train calves to use the shelter by

Ventilation is critical in calf sheds. Photo: R Johnston, Gloucester.

placing the concentrate feeder in or next to the shelter areas.

Outside rearing

If you are planning to rear calves outside, consider shedding them for the first two weeks.

Make sure quality fresh, clean water and straw or hay are always available. Place feeders and straw/hay racks high enough to prevent contamination with faeces. Clean out stale feed daily; this will encourage young calves to have a high intake of concentrate and achieve target live weight gains.

Shed design

A calf shed need not be an expensive structure, but it should be built in a way that makes it easy to clean and keep clean.

The shed should be well ventilated; it should be open from one metre high but draught-free. Preferably it should be open on all sides, or at least open to the north or north-east so that it gets as much sunlight as possible. Lack of ventilation causes an increase in the humidity and temperature inside the shed and creates the perfect environment for bacteria and viruses to breed and survive. These are breathed into the lungs and infection can occur. The build up of gases such as ammonia also damages the lungs and makes them more susceptible to infection.

The type of flooring is important; the floor should be kept clean and dry at all times. The following flooring systems have been successfully used and are worth consideration.

Wooden grating

A wooden grating, consisting of 50 mm x 25 mm timbers spaced 30 mm apart, is placed a minimum of 300 mm above a concrete sloping floor.

This arrangement allows the urine and dung to pass through the grating to the concrete below. Remove the calves from the shed if you are using a high pressure hose. You can also use flood washing to remove dung and straw; a cheap and effective arrangement is a 200 L drum cut sideways and counter-levered to tip when it is full of water.

Wire mesh

Wire mesh suitable for calf shed flooring is available. It is designed specifically for pig pen floors; the openings are 12.5 mm x 150 mm. The mesh is welded to a metal frame and positioned about 300 mm above the concrete floor. It may cause problems with sore joints at the knees and hocks, and it appears that woven mesh is better.

Deep litter

About 300 mm of litter—dry sawdust, wood chips, straw or rice hulls—is placed

Flooring in sheds can be 50 mm x 25 mm timber slats, with a 30 mm spacing to allow manure to drop away from calves. Photo: R Johnston, Gloucester.

in the shed and 'topped-up' progressively throughout the rearing season. Excess dung on the surface must be removed before each topdressing of fresh material.

Note: Do not use green sawdust as it may cause problems with navel infections; straw is safer.

Remove the deep litter from the calf pens at least once a year, and thoroughly clean and disinfect the shed to prevent the carryover of disease.

General management

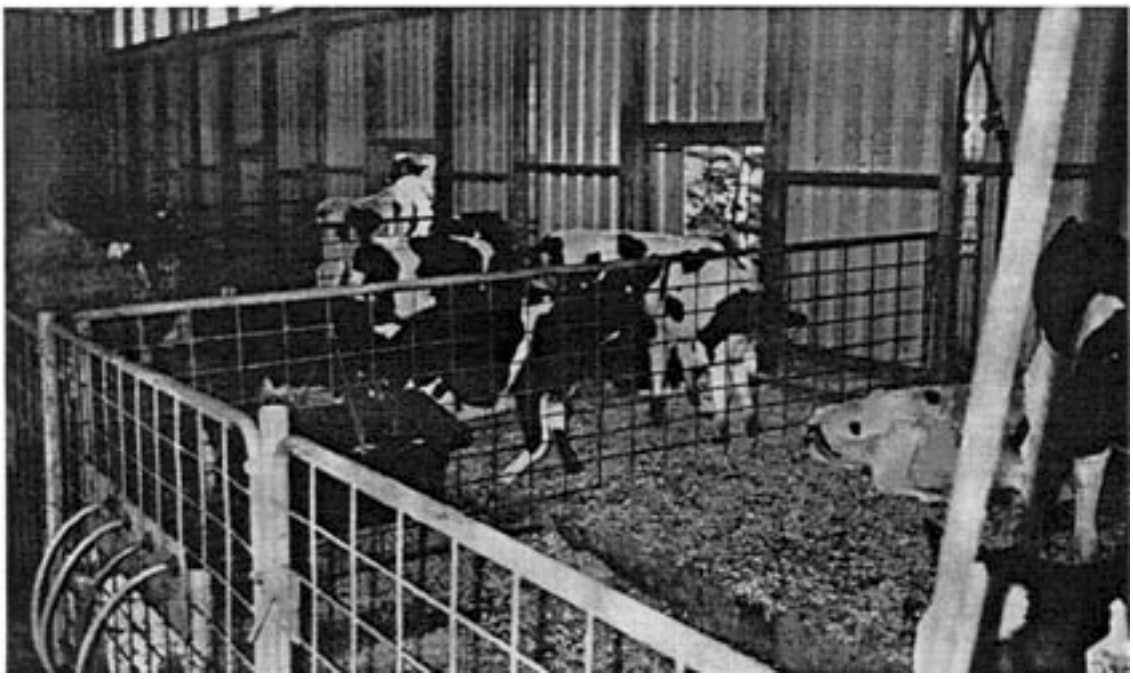
Management factors such as dehorning, drenching, cleaning calf sheds, ensuring a clean water supply and vaccinating must be carefully planned.

Dehorning

Horned animals can cause injury to others in the herd and to people working with them. Dehorning is simple, safe and clean if it is done when animals are young (before 4 months old). Calves are usually dehorned when they are 2–3 weeks old, using one of the following methods:

- a dehorning iron—a hot electric iron held over the hornbud for about 30 seconds. This operation is clean and permanent and highly recommended.
- chemicals—caustic potash (rather than caustic soda) is rubbed over the hornbud. This is easy to do, neat and inexpensive. Calves treated with caustic sticks or caustic paste should be sheltered from rain for at least a day after treatment. Be careful: there is a danger of calves rubbing against each other in cramped areas.
- a scoop (or cup) mechanical dehorner. Calves older than 2 months can be easily dehorned with one of these. This method ensures that all of the growing horn is removed. When heifers are older, the operation is more difficult and the resulting poll is not so neat.

Rice hulls are another alternative as a bedding material. Here, half the area is for bedding (rice hulls), with concrete for feeding and watering. Photo: D Rosenbaum, Gloucester.



Removing supernumerary teats

Supernumerary teats are generally smaller than the other teats, and if they are not removed they can get in the way at milking time.

They can be removed very easily from calves up to 2 months old—hold teats with the fingers and cut them off at the base with sterilised scissors. If they are left on until the cow calves, their removal becomes a job for the vet.

Identification

If you want to run a good herd breeding and a management program you must clearly identify all animals within the herd.

You should put a permanent, distinguishing mark on all calves that are likely to be reared as herd replacements. Do this as early as possible after the calf's birth. Then write the breeding particulars of the calf, together with its identity mark or number, in the herd records.

A number of methods have been used to identify calves, but the most successful have been ear tags, ear tattoos and freeze branding.

Ear tags

Ear tags have been used for many years, with mixed success. The larger plastic tags have the advantage of being relatively easy to read, but tag losses have been high. Pre-numbered brass tags are now a popular means of calf identification, with few losses if they are correctly applied and placed.

Ear tattoos

When ear tattoos are property applied they are a very effective and permanent method of identification. Ideally, they should be coupled with some other more visible form of identification, such as ear tags. The ear tattoo may be difficult to read in a black ear, but using green ink or paste may help overcome the problem.

Freeze branding

Freeze branding using liquid nitrogen, or dry ice and methylated spirits, is popular; the animal suffers little pain and hide damage is minimal. Using dry ice and methylated spirits will produce more white hair and a more reliable result that liquid nitrogen.

White-haired animals will need a longer branding time to kill the hair follicles; the branding leaves a bare patch similar to that left by acid branding. Brands are usually applied to animals heavier than 200 kg or 12–15 months old, as brands on younger animals will distort with growth.

Brands can also be acid, caustic or hot-iron.

Drenching

On many properties severe calf losses from infestation with internal parasites (worms) are common. The trouble is particularly prevalent if calves are confined to small, dirty yards or sheds, or are grazed continuously in small paddocks. Calf paddocks normally become heavily infested with worms after several batches of calves have been reared on the one area in the same season. For treatment, follow the recommendations of your local veterinarian.

Feeding

Colostrum for a super start

Colostrum is simply the first milk produced after calving; it contains antibodies against all the bacteria the cow has come in contact with. The calf is born without protection against infective bacteria and must absorb the antibodies through the wall of the intestine to gain

protection. Colostrum has more than twice the amount of total solids of whole milk and initially about five times the levels of protein and vitamins A, D and E. Within 2 days of calving these levels are about the same as those found in whole milk.

The antibodies in colostrum transfer passive immunity from the mother to the calf. A calf must get adequate colostrum from its mother or from other freshly calved cows in the first 6 hours of life. This is crucial; the alternative is a disease-prone calf.

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

- quickly—as soon as possible (preferably within 6 hours of birth)
- quality—only the best
- quantity—at least 4 L.

Stomach tubing

To reduce losses and sickness, stomach tubing of colostrum is becoming part of Australian calf rearing. The stomach tube is a semi-flexible piece of plastic tubing with a pear-shaped end designed to be inserted easily into the oesophagus but not into the lungs. It is usually attached to a plastic container holding the liquid to be fed.

Four litres of colostrum should be fed to give enough antibodies. Some people prefer to use a nipple bottle rather than stomach tubing, but this takes longer and it is unlikely that a calf would drink 4 L. If calves get the initial 4 L by tube they usually won't need another feed for 24 hours.

Tubing a calf is not a major drama, but the first time it might pay to get some coaching. Preferably have the calf standing. Leaving the head in a position that feels comfortable for you, pass the tube gently over the tongue. At this stage the calf will start chewing and swallowing; the tube can now be passed down into the oesophagus. When the bulge at the end of the tube can be easily felt as it moves down the oesophagus (indicating that the tube is not in the windpipe) feeding can start. When feeding is over remove the tube slowly. Clean and disinfect it, then leave it to drain and dry. Stomach tubes are available from your local veterinarian or farm supply store.

Providing 4 L of colostrum through a stomach tube is a recommended management practice to give calves the 'kick start' they need for life.

For further information on stomach tubing, see the Agriculture Victoria Agnote AG0503, *How to stomach tube a calf*, included in the Further Reading section of this manual.

Colostrum quality

The quality of colostrum can be enhanced by vaccinating cows before calving and again 6 weeks later for *E. coli* and *salmonella* and with 7 in 1. Thereafter, a booster dose about 2 weeks before calving is all that is needed. Milk freshly calved cows as soon as possible, as reabsorption of antibodies begins immediately after calving.

Colostrum quality can be measured using a colostrum tester (Calf Guard®); these are commercially available through all veterinarians or Northfield Laboritories in South Australia. Another way of assessing antibody transfer in the calf is to use a commercial blood testing kit. The level of antibodies in the blood indicates the calf's ability to fight infection; if you find it is low you can give the calf extra colostrum within 36–48 hours of birth.

If you decide to freeze some colostrum, try to collect it from mature cows that are among the lower producers, as they tend to have the highest antibody levels. Young cows have a lower natural

immunity than mature cows. Cows that suffer from sickness or stress at calving will also have lower antibody levels. Frozen colostrum should be thawed in a bucket of warm water. There is still some concern about using microwave ovens for thawing, but if you use the proper defrost setting the antibodies should not be damaged.

Colostrum can be stored in the refrigerator for a week or so without affecting quality. Frozen colostum can be stored for 6–12 months.

The water supply

A liberal supply of fresh, clean drinking water is necessary in any calf rearing program. If your calves are on a once-daily milk feeding program you should check their water twice a day, especially in hot weather.

Milk feeding

Whole milk is the natural food for young calves. It is especially preferred for minimising digestive upsets. However, milk replacer powders are widely used in some cases for reasons of price and disease control and the fact that they can be fortified with vitamins, minerals and ionophores. The milk replacers now on the market vary widely in quality, so this should be checked, either by using your own experience or by adding some junket tablets to test their clotting ability.

There are two types of milk replacers: those that use butterfat as the basic energy source and those containing tallow. Quality butterfat-based products are preferable. If you have to use tallow-based products because the others are too expensive, make sure you choose a high quality one. Table 2.2 lists the desirable characteristics of high quality replacers.

Milk replacement tips

- Some calf rearers have achieved success with a single 3–4 L whole milk feed from the first week, but there is a danger of overfeeding and scours in this approach.
- Tallow-based milk replacer should be fed only once a day, because it takes longer for the clot to be digested, and feeding twice a day can result in scours.
- Feed milk at the same time and temperature each time.
- Make sure there are no sudden changes in the ingredients and amounts being fed.
- Weigh milk powder ingredients before you mix them.
- To mix milk replacer, add the powder to half the desired volume of warm water (at 36°C). Stir vigorously with a wire whisk. Add the remaining volume of warm water.
- Antibiotic-contaminated milk is not suitable for young calves as there may be a problem with residues in meat. Also, problems can arise with antibiotic immunity and death of useful bacteria in the stomach and intestine.
- Calves can be raised successfully on both teat and bucket systems. Choose the one most appropriate to your situation.
- Provide clean water. On each day of the first week turn the water off for 12 hours before milk feeding to make sure the calves will drink their milk.

Table 2.2: Characteristics of high quality milk replacers

17% or higher fat
Minimum 24% protein
Fat particle size under 4 microns if tallow-based
Low temperature drying
Will clot

For once-daily feeding, if you are using milk replacer, see Table 2.3 for the proportions of milk replacer and water to mix up for different ages. If you are using both milk replacer and whole milk, see Table 2.4 for the correct proportions to use at different ages.

If you are using a high quality full-cream milk follow the instructions.

Early weaning to concentrates

Early weaning off milk at 6 weeks of age on to high quality pellets and straw offers many advantages.

These include fewer health problems, the lower cost of the concentrate compared with milk, lower labour costs and greater rumen development.

For more details of early weaning methods see Agnote 2/099 *Early Weaning of Dairy Calves.*

Later weaning direct to pasture

To continue desired growth rates after weaning, calves need to be provided with some form of concentrate until high quality pastures are available.

Starter meals

Calves need high energy and high protein diets; examples of feed mixes are shown in Table 2.5. When you are starting calves on meals, feed only small amounts initially to keep the feed fresh; calves will not eat feed that is contaminated with saliva. One introduction technique is to place some meal in the bucket or trough after milk feeding.

Developing the rumen in concentrate-fed calves

From day 2 in the program, provide free access to a palatable, clean, fresh concentrate supplement.

If you plan a restricted milk feeding program, calves should have access to ad lib pellets from day one to encourage concentrate consumption.

Young calves up to 6 weeks old need a highly palatable concentrate supplement with a minimum of 18% protein and a minimum of 11 MJ of ME/kg of dry matter to provide enough nutrients for early development of the rumen and rapid growth. Feed this supplement until larger breed calves reach 100 kg live weight (at about 12 weeks).

If you are home-mixing your feeds, be sure you get an accurate feed analysis so you can be sure that the protein and energy levels reach those recommended for rapid growth. Home mixes should include a

Clean, fresh straw should be available in early weaned systems. Photo: R Johnston, Gloucester.

Table 2.3: Using milk replacer and feeding once a day

	Large calves 35 kg and over		Small calves under 35 kg	
Day	Replacer	Water	Replacer	Water
1	200 g	2 L	200 g	1.5 L
2	300 g	2 L	200 g	1.5 L
3, 4, 5	350 g	2 L	300 g	1.5 L
6, 7, 8	400 g	2 L	350 g	1.5 L
9, 10, 11, 12	450 g	2 L	400 g	1.5 L
13–weaning	500 g	2 L	450 g	1.5–2 L

Table 2.4: Using whole milk or colostrum with added milk replacer, feeding once a day

	Large calves 35 kg and over		Small calves under 35 kg	
Day	Replacer	Whole milk	Replacer	Whole milk
1	0	2 L	0	1.5 L
2	100 g	2 L	100 g	1.5 L
3, 4, 5	150 g	2 L	150 g	1.5 L
6, 7, 8	200 g	2 L	200 g	1.5 L
9, 10, 11, 12	250 g	2 L	250 g	1.5 L
13–weaning	300 g	2 L	300 g	1.5 L

vitamin and mineral premix. Concentrates should be highly palatable. In some cases molasses can enhance the palatability.

Any changes in feeding management should be phased in gradually. Monensin (Rumensin®) or avoparcin (Avotan®) can be included in all concentrate rations to increase the nutrient absorption of the supplement.

Calves should have access to clean straw from the start of the program. Straw provides a 'scratch factor' that will help develop the rumen while maintaining rumen pH levels, due to the large amount of saliva produced by the chewing. However, do not provide good quality hay on demand—calves will consume too much, reducing their concentrate intake and growth rate. The best practice is to provide the best quality feed at all times, but limit the fibre intake to 10% of the total dry matter intake.

Calves can be weaned from milk when their concentrate intake reaches 0.75 kg per head per day. This should happen when they are 4–6 weeks old.

Table 2.5: Calf starter mixes

Feed	Ration 1 (Parts)	Ration 2 (Parts)	Ration 3 (Parts)
Rolled barley	50	0	58
Rolled oats	20	28	20
Cracked corn	0	40	0
Protein meal	18	20	20
Limestone	1	1	1
Salt	1	1	1

Notes:
Chopped high quality hay (lucerne or oaten) can be included at 10%; avoid chopping finer than 20mm.
Protein supplements fed to calves should contain high quality meals.
Ionophores (such as monesin) should be included only if well mixed into the feed.

Health

General issues

What is a healthy calf?

Normal physiological values for healthy calves are:

	Average	Range
Rectal temperature	38.6° C	38 to 39.3° C
Heart rate (pulse)	70/min	40 to 100/min
Breathing rate	30/min	25 to 40/min

These values apply to normal, healthy calves at rest under mild climatic conditions. The heart rate and breathing rates can vary markedly if the animal is excited or frightened, or if the weather is very hot. Heavy, laboured breathing indicates respiratory problems.

Setting up a disease management plan

To make sure your calves are healthy and reach their target weights you need to have a disease management plan. This should include:

- a program for routine cleaning and disinfecting facilities and equipment
- a twice-daily routine for observing calves for early detection and treatment
- a system for identifying and recording sick calves, and a treatment regime
- hospital pens for sick calves, plus supplementary heating; sick calves should not be completely isolated—if possible they should be within sight and hearing of their mates
- a stock of medication on hand—especially electrolytes and disinfectants
- access to a vet with experience in the treatment of calf diseases
- equipment for stomach tubing for bloat control and electrolyte administration.

Observing calves for illness

Success or failure in rearing calves will depend to a great extent on your attitude to the calves and your ability to react promptly to the calves' numerous signals. If you are feeding once daily you should visit the calf shed or paddock at least twice daily.

Calves charging your knees and running around the pen are healthy. Such calves rest in a curled up position with

Calves reared in small groups can be easily checked for changes in health. Photo: T Hickman, Gloucester.

Simple shade structures will alleviate heat stress in summer. Photo: R Johnston, Gloucester.

feet tucked under them and heads back along the body. They appear relaxed and have regular breathing rhythms. Some healthy calves may also rest flat on their sides.

A calf resting in the corner of its pen with its head turned away from its pen-mates should not be ignored. Get the calf up. If it stretches, it's okay. If it doesn't, it requires further attention. Sick calves lack interest and are listless and apathetic. They do not move when approached and often stand with their ears lowered and head down.

Look quickly over each pen of calves, then be more specific and check any suspect calves' noses for dampness (the nose should be moist), and the ears for temperature. Listen to their breathing, noting any 'rattles' or laboured breathing. Lift their tails and note the state of any faecal residues. Look at their feet and legs for signs of swelling. For the first week to 10 days, check the navel area for signs of inflammation.

Dehydration

If a calf is profoundly dehydrated (body weight reduced by 10—15%) it will need intravenous fluids administered by a veterinarian. Calves less than 8% dehydrated and still drinking can be rehydrated by mouth with electrolyte solutions or by stomach tube. Table 2.6 shows how to assess the degree of dehydration.

The skin fold test simply involves using the fingers to pinch up a fold of skin along the neck. The test indicates the time it takes for the skin to bounce back; normally this is less than half a second. Once you have determined the percentage dehydration you can calculate the fluid requirements. For example, for a 40 kg calf that is 6% dehydrated:

Table 2.6: Measuring dehydration

% dehydrated*	Sunken eyes	Skin fold test
4–6	–	1–2 seconds
6–8	+	2–4 seconds
8–10	++	6–10
10–12	+++	20–45 seconds

* Amount of fluids lost as a percentage of calf's bodyweight

Fluid volume needed for replacement
= 40 x 6% = 2.4 L.
Fluid volume needed for maintenance
= say, 100 mL/kg/day = 4 L.

In this case feed 6.4 L over three feeds in a day. You can monitor the rehydration with the skin fold test.

Electrolyte treatments do not provide enough energy to maintain calves. After 24 hours you can reintroduce milk, but continue the electrolytes for another 48 hours. Separate the milk feeding from electrolyte feeding by 6 hours, and set the first two milk feeds with junket tablets to help the milk digestion.

Antibiotics may be needed, especially if the calf remains dull after rehydration. Antibiotics must be used under veterinary supervision; make sure you keep a record of treatment.

Prolonged use of antibiotics can cause scouring, because it kills the normal bacteria of the bowel. Dosing the calf with plain non-pasteurised yoghurt helps re-establish bowel bacteria.

Probiotics such as Protexin® are now available and can be used instead of yoghurt to introduce beneficial bacteria into the calf's intestines. Because products like Protexin® have to be registered, the numbers of bacteria and their stability have been tested and these products can be expected to give more consistent results than yoghurts.

Disease prevention

Colostrum provides important antibodies against many germs that can affect newborn calves. It is also ideal for older calves, as it has higher levels of nutrients than fresh milk (twice the casein, four times the total protein, and 67 times the antibodies) and can provide a protective local immunity on the surface of the bowel.

Fermented colostrum or milk helps control calf scours. Placing a tub of plain yoghurt in a drum of milk starts the fermentation process, and the milk or colostrum can be topped up daily. Alternatively, probiotics may be added to milk just before feeding to supply beneficial bacteria to the intestines to help prevent scours. Antibiotic-treated milk cannot be used with this method.

Good hygiene is extremely important, as it limits the number of germs coming into contact with the calf. Separate affected animals to prevent spread of the disease within the group. Limit stresses like overcrowding, sudden changes of diet and chills from wet conditions.

Vaccinating mothers can help protect calves from scours. Commercial vaccines are available for preventing *E. coli*, *Salmonella* and clostridial infections.

With any disease, don't hesitate to ask for advice from your private veterinarian, Rural Lands Protection Board district veterinarian or animal health adviser—you can't avoid problems if you don't know about them first!

Taking a calf's temperature

The normal temperature range is 38.0–39.3°C.

Temperatures above 39.5°C generally indicate some infection problem in the calf. Low temperatures can indicate poor circulation and shock—but make allowances for the ambient temperature and shade.

An essential tool for a calf rearer is the thermometer; you can use it to detect fevers and monitor the success of treatments. Two types of thermometers are available.

- mercury bulb thermometer—cheap but easily broken
- electronic thermometer—expensive but long lasting.

You can get thermometers from your veterinarian or chemist.

Technique

Insert the thermometer at least 5–7 cm into the calf's rectum. Make sure the tip of the thermometer touches the lining of the rectum of the calf. If you are using a mercury bulb thermometer, wait at least 60 seconds before you read it. Electronic thermometers will 'beep' when an accurate reading is obtained.

Scour prevention and treatment

No doubt the most common cause of calf death is dehydration caused by scouring. If a bad dose of the scours doesn't kill the calf, the damage done to the villi on the walls of the small intestine that absorb the nutrients can leave the calf unable to use all the food it consumes, and the result is a 'bad-doer'.

Causes of calf scours

Stress. One of the main causes of scours is stress. The calf is put under stress when it is taken from the cow, transported any distance or has its diet changed from ad lib cows' milk to either restricted wholemilk feeding or milk replacer. This stress scour appears 5 to 7 days after the stress occurs.

Excessive milk volume. Another major cause of scours is overfilling of the abomasum (the fourth stomach). When a calf drinks milk, the milk bypasses the first three stomachs and enters the abomasum. Here the milk clots and then passes slowly into the intestines to be absorbed. If the drink of milk is too large, or the calf is under stress, some of the milk overflows or is pushed through into the intestines before it can clot, and scouring will result.

Poor feed quality. Feeding milk products or substitutes that won't clot in the fourth stomach results in scouring or an increased risk of scouring if the calf is under stress. These products include high-heat powders that are incorrectly dried, tallow that is not homogenised properly, milk replacers containing a high percentage of whey, and some milk-based products used to cheapen replacers.

Bacterial infection and dehydration. Bacteria are not considered a major cause of calf scours. However, once a calf starts scouring, the conditions are ripe for an invasion of harmful bacteria, such as salmonella and certain strains of *E. coli*. These bacteria cause major damage to the intestine walls, preventing the calf from being able to absorb nutrients and fluids, and causing fluids to be passed from the body into the intestines and out in the scour. This loss of fluid or rapid dehydration is the major cause of calf deaths.

Bacteria on their own can sometimes cause calf deaths. During the first 8 hours after birth, the walls of the calf's intestines are 'open' to allow antibodies to pass into the bloodstream. If, during this time, the calf takes in any harmful bacteria from contaminated cows' milk or infected surroundings, these bacteria can pass directly into the bloodstream and cause what appears to be sudden death some days later.

Another source of bacterial contamination is the navel cord. If the calf is born on or lies on contaminated ground while the cord is still wet, bacteria can travel up the cord and enter the bloodstream. Depending on the type of bacteria, the result can be rapid death, navel infection, or swollen knees, stiff joints and hair loss.

Preventing and treating scours

The stress scour is difficult to prevent, but can be quite easy to treat. To help prevent stress scours, don't feed the calf for 24 hours after it has been removed from the cow or bought from the saleyards; transport it in a well-covered

vehicle with dry bedding; and don't buy calves that look sick or stressed.

You can give calves a drink of electrolyte replacer when they arrive, but they should be allowed to settle down first, and certainly should not be disturbed after the drink. When a calf develops a stress scour it can be blocked up with kaolin (powdered chalk). This slows the passage of milk to the intestines, so that the scour is controlled before damage occurs. Mix enough kaolin with the milk and the scour is stopped almost immediately; mix too much and the calf becomes constipated. A stress scour can be overcome without taking the calf off milk.

For further infomation on calf scours, see the Agriculture Victoria Agnote AG0578 *Nutritional scours in milk-fed calves: causes and treatment*; there is a copy of this publication in the Further Information section of this manual.

Drenching programs

You must have a strategic drenching program if you want to produce healthy well-grown stock.

Strategic drenching programs are aimed at achieving maximum 'kill rates' of parasites in the animal, as well as minimising build-up of worm eggs and larvae on pastures, in order to minimise re-infection of stock.

Drenching times vary with climate, locality, stocking rate, and a range of other factors, but usually three or four drenches are needed each year. Consult your local animal health adviser or veterinarian for details to suit your situation.

Vaccination programs

Dairy heifers must be fully vaccinated against clostridial diseases and leptospirosis. A combined vaccine is available, and it is usually given any time from 3 months of age onwards. Two doses at an interval of 4–6 weeks are essential, with an annual booster thereafter.

Enzootic bovine leucosis (EBL)

All farmers rearing dairy heifers should consult their local animal health advisors to make sure they have a full understanding of EBL. A knowledge of this disease is particularly important if calves are being reared on whole milk, and when animal husbandry procedures such as vaccination, dehorning, earmarking and tattooing are being done.

In most cases it will be advisable to blood test calves initially, and then retest them after the age of 6 months, to make sure they are EBL–free.

Johne's disease

Johne's disease is a chronic scouring and wasting disease that ends in death. There is no vaccination available, and no successful treatment. Make sure all your calves come from herds that have had no history of Johne's disease.

Up until 12 months of age calves are susceptible to Johne's and should be grazed away from pasture used by mature cattle. The bacteria that cause Johne's are spread in the faeces of cattle over 2 years old.

A blood test is available, but it is not highly accurate in detecting early infection in individual animals. Again, seek advice from your animal health adviser.

A Johne's Disease Markets Assurance Program is now available. This scheme classifies herds not only on the basis of their history, but also on the results of whole-herd blood testing. A series of Tested Negative (TN) status from TN1 to TN3 has been developed to improve herd certification. Farmers should seek advice on the program through the local RLPB or

their vet.

Other common calf infections

Naval infections, joint ill and pneumonia are all common problems in calves. As with scours, prevention is better (and cheaper) than cure. Good hygiene and management are critical in preventing these problems. Treatment is not always successful.

Pestivirus infection

Pestivirus is a common virus that often goes unrecognised in many herds. It can cause scouring, chronic ill thrift and fertility problems. There is no commercial vaccine and no specific treatment is available, but it would be advisable to discuss pestivirus with your veterinarian, particularly if you intend to do artificial insemination or embryo transfers.

A blood test is available to identify heifers that are already immune to the virus.

Bovine ephemeral fever (three day sickness)

Three day sickness is a common summer virus in coastal areas. Younger animals are usually only mildly affected, recover quickly, and acquire a good immunity. Older animals can suffer severe muscle and joint pain and fever, and sometimes secondary complications such as abortion, pneumonia, or even death.

A vaccine is available, and it generally gives good protection against the disease.

Akabane virus

Akabane virus is another coastal summer virus. It causes no observable symptoms, but if the animal is pregnant at the time of infection, major problems can occur in the unborn calf. In some cases, the calf may be born with severe brain damage, while in other cases calves can have severe limb and joint deformities. There is no treatment, and although an effective vaccine has been developed it is not commercially available.

Prevention is aimed at trying to ensure heifers are exposed to the virus before they become pregnant; in this way they develop a strong immunity and suffer no further problems from subsequent exposure to the virus. If you are buying pregnant animals from outside the NSW coastal area (for example, from Victoria or inland NSW), do not introduce these animals to the coastal region during the high risk time for Akabane virus spread (generally January to May).

Budgeting

Calf-rearing costs include disease

prevention and treatment, feed, labour and depreciation on equipment. The greatest single cost will be feed. Losses through death must also be included in any costing.

Costing different feeds for calf rearing

The relative costs of various feeds used in calf rearing, using assumed figures for the dry matter (DM), energy and protein values for ‘typical’ feeds of each type, are presented in Table 11.

Milk or milk replacer can be costed in terms of either cents per kg of dry matter (c/kg DM) or cents per megajoule of metabolisable energy (c/MJ of ME) in the product. The latter is calculated from fat and protein levels in the whole milk or milk replacer.

Costs for solid feeds can be calculated in a similar way to those of liquid feeds once their costs in dollars per tonne and their dry matter or energy contents are known.

You can buy energy- and protein-rich

Table 2.7: Costs for dry matter and energy in various calf feeds

Feed	Dry Matter (%)	Energy (MJ/kg DM)	Protein (% DM)	Cost per unit	Cost of DM (¢/kg)	Cost of energy (¢/MJ)
CONCENTRATES						
Pellets	90	13	18	$300/t	33	2.5
On-farm mix	90	13	18	$200/t	22	1.7
ROUGHAGES						
Lucerne or clover hay	85	9	18	$7.00/bale	33	3.6
Cereal straw	90	7	3	$3.00/bale	16	2.3
Grazed pasture	20	11	14	$60/t DM	6	0.5

feeds already mixed and pelleted as commercial pellets, or you can blend them on-farm from the raw ingredients to form a balanced concentrate mix. Calf rearing pellets often contain vitamin and mineral additives, and have higher digestibility and no dust. However, as shown in calf rearing trials, palatability of feed is the highest priority.

Commercial pellets, despite being more expensive than on-farm mixtures, are usually the preferred solid feed for calf rearers. For the comparison in Table 2.7, commercial pellets have been priced at $300/t. On-farm concentrate mixes have been priced at $200/t; this would be the price for an on-farm mix consisting of 80% rolled wheat (at $140/t) and 20% cottonseed meal (at $350/t), plus $18/t for blending and handling.

A mixture of protein meals is best, as this gives a broad protein base of amino acids.

In terms of energy, whole milk is generally cheaper than milk replacer, but the energy supplied by both is 3–6 times more expensive than the energy supplied by concentrates. The cheapest source of feed energy is grazed pasture; the energy from pasture costs 20% of that from concentrates and only 5% of that in liquid feeds.

Further details on comparing feed costs are contained in the Agriculture Victoria Agnote AG0501 *Comparing the cost of supplements on the basis of their nutritional value*; there is a copy of this publication in the Further Information section of this manual.

Comparing different whole-milk rearing systems

Table 2.8 presents the total costs of rearing calves to 12 weeks of age using 4 different whole milk feeding systems varying in labour requirements and feed inputs.

- The cost of whole milk in the artificial rearing systems is either 20c/L or 30c/L.
- Concentrate pellets cost $300/t.
- Hay costs $140/t.
- Any pasture grazed by calves is not costed.

- Labour is costed at $10/hour; this is based on the cost of hired labour.
- Veterinary treatment and drugs cost $5 per calf.
- Depreciation on equipment is valued at $4 per calf in all 4 systems.
- Other opening costs in the 3 artificial rearing systems, such as milk feeding and cleaning equipment, are costed at $4 per calf.
- Death rates are 3% or $3/calf in all 4 systems.

To allow for the feeding of colostrum during milk feeding, a second set of calculations have been presented in Table 2.8, which assumes that the first 180 L of liquid fed to each calf in the three artificial rearing systems have no cost. Therefore, whole milk requirements are reduced to 380 L/calf in System 1, 154 L milk/calf in System 2 and nil in System 3.

The largest cash cost is clearly for whole milk. When compared with the *ad lib* milk feeding in System 1, calves drank 40% less milk when restricted to twice daily feeding in System 2 and 72% less when weaned early in System 3. This reduced the total rearing costs by $24 and $48 per calf respectively when milk was cheap (20c/L) and $47 and $89 per calf respectively when milk was expensive (30c/L).

Compared with feeding restricted levels of whole milk twice daily, early weaning saved $24 per calf when milk was cheap and $42 per calf when it was expensive. When no colostrum was available, feed (milk, concentrates and hay) accounted for 59–88% of the total rearing costs.

Whole milk supplied by nurse cows in System 4 cost only $10 per calf compared with $31 per calf when milk was priced at 20c/L in the cheapest artificial rearing, System 3. To cost the milk supplied by nurse cows, it was assumed that it all originated from grazed pasture, costing $60/t DM. In year-round calving regions where pasture quality can vary considerably from season to season, additional concentrates may be needed to maintain milk yields in nurse cows. This would increase the cost of supplying that milk to multiple-suckled calves, but the cost would be unlikely to rise to more than 10c/L.

The lower labour costs involved in *ad lib* milk feeding hardly compensated for the high cost of the milk drunk by these calves. The costs for non-feed components ranged from $22 to $43 per calf, this variation being mainly due to the different labour requirements. Labour costs per calf varied from $5 (when fed *ad lib* milk) to $26 (when fed twice daily).

The full costs for rearing calves to 12 weeks can vary from a low of $70 per

Table 2.8: Total costs ($ per calf) for rearing calves to 12 weeks of age using four different whole milk feeding systems with or without colostrum

Whole milk price	Whole-milk feeding system			
	1 Ad lib milk	2 Twice daily milk	3 Early weaning	4 Multiple suckling
No colostrum available				
20c/L	134	110	86	68
30c/L	190	143	101	68
Colostrum available				
20c/L	98	74	70	68
30c/L	136	89	70	68

calf, when early weaning on colostrum, to a high of $190 per calf when feeding expensive, *ad lib* milk. Unless more use is made of colostrum in rearing systems, it is unlikely that calves can be artificially reared to 12 weeks of age for much less than $100 per calf. This contrasts with the $68 required to rear each multiple-suckled calf.

Contract calf rearing

A new service is being offered to dairy farmers, whereby calves are reared off-farm and returned fully weaned.

Calves are transported to the rearer, who provides labour and facilities to early wean calves and develop their rumen capacity before returning them to the owner. Costs for feed, animal health and transport are met by the owner, with an additional charge for labour.

Payment can be based on a live weight gain, for example, meeting a target weight at 10 to 12 weeks, or simply on the successful weaning of a healthy calf.

One contractor in NSW charges $1 a day for labour, with feed, health and transport on top. This equates to about $150 for 10 weeks.

You should investigate the rearer's disease control practices and methods of minimising cross-transfer of EBL before you send calves off-farm for rearing.

Growing heifers from weaning to calving

Growing management

Frequently, calves are reared well up to weaning, then virtually left to look after themselves. Poorly managed weaners are disadvantaged for their entire lives.

Aim to calve heifers at about 85% of the average mature cow bodyweight of the herd. This means that most of their growing is finished and they can cope with changes of grazing pasture and herd pecking order. Feed can then be directed into milk, and higher conception rates are also likely.

Feeding

This section in intended to give you a basic understanding of heifer feeding. For more details, see the DairyLink manual *Realistic Rations.*

You must understand pastures if you are going to do an efficient job of rearing dairy replacements growing at 0.7 kg/day.

Pasture quantity

Pasture quantity (or herbage mass) is expressed in kilograms of dry matter per hectare (kg DM/ha).

Once herbage mass drops below a certain level, animals are physically unable to consume sufficient pasture to maintain their weights. Similarly, above a certain level of herbage mass, animals will not eat more, even if it is available.

For a 200 kg dairy heifer, these limits are about 700 and 2500 kg DM/ha, assuming that the pasture is leafy green material, and that it is a temperate rather than a tropical pasture.

Pasture quality

Digestibility (expressed as a percentage) is a very 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.

Quality is complex and is influenced by:

- **Species.** Legumes usually have higher quality than grasses, and maintaining them in a pasture will maximise animal performance. Temperate species such as ryegrass have higher digestibility than tropical species such as paspalum.
- **Parts of the plant.** The leaf is more digestible than the stem.
- **Stage of growth.** Older plant material is less digestible.

Table 3.1 shows how digestibility changes as plants mature.

There is a strong interaction between digestibility, herbage mass and animal intake. As pasture quality declines, animal performance can be maintained by offering more pasture—that is, decreasing the stocking rate on the pasture so that the animals can be more selective in their grazing.

Table 3.1: Digestibility at different growth stages

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

Note. Once digestibility drops below 60%, no matter how much pasture the animals are offered they will not be able to maintain their target weight gains—and at 50% digestibility, the animals will be losing weight.

Hay and silage

Both hay and silage can be successfully used to maintain growth rates if pasture quantity or quality is low. The feed quality of hay and silage is extremely variable, so testing for quality is recommended. There are several commercial testing services available, so seek professional advice on the availability of tests and how best to use the results.

Balancing rations

If you use low quality roughages you will need to add concentrates to meet nutritional requirements. Stock requirements are outlined in Table 3.2.

Working out the ration involves balancing the difference between the animals' requirements for energy, protein, fibre and minerals and the nutrients available from their feed intake.

For more information on nutrition from weaning to calving, see the Agriculture Victoria Agnote AG0507, *Heifer Nutrition from weaning to first calving*; there is a copy of this publication in the Further Information section of this manual.

Monitoring live weight gains

Under ideal conditions heifers should have a constant weight gain of 0.7 kg/day if they are to reach their desired weight-for-age targets. The only time it might be beneficial to slow this weight gain is during the second 6 months of life, when there is some evidence that with excessive growth rates (over 0.7 kg a day) fatty tissue may be laid down in the udder.

Compensatory growth after setbacks from low feed intake and health problems such as worms can only partly make up for lost gains. If your heifers are well fed and therefore growing well they will be less susceptible to external and internal parasites. They will also suffer less from trace element deficiency problems. Regular monitoring and weighing will help to highlight any problems. Management can then be changed to overcome the problem and minimise the setback.

For these reasons it is important to have an accurate method of assessing live weight. Also, drench doses are all based upon live weight, and an error in live weight estimation could result in either underdosing (ineffective) or overdosing (waste of drench). Under-drenching is the most serious mistake, as it does not eradicate the worm problem and can lead

Table 3.2: Nutritive value of diets recommended for heifers of different ages to grow at 0.7 kg/day (NRC 1989)

	3–6 months	6–12 months	over 12 months
Liveweight (kg)	150	254	400
DM intake (kg/day)	3.7	5.7	8.8
Metabolisable energy (MJ/kg DM)	10.9	10.3	9.5
Crude protein (%)	16	12	12
Calcium (%)	0.52	0.41	0.29
Phosphorus (%)	0.31	0.30	0.23

to a false sense of security as well as creating a possible worm resistance problem.

Assessing live weight

There are various ways you can assess dairy heifer live weights, and they have varying degrees of accuracy. Generally it's a case of getting what you pay for. Target chest girths and wither heights are less accurate than cattle scales, but they are helpful if you don't have scales. Table 3.3 will help you choose.

Visual estimation

Some farmers are very good at guessing the live weights of some of their heifers, but get most wrong. Estimating live weights using eyesight alone is the least reliable method of all.

Girth tape

The girth tape is quite an accurate method of assessing heifer live weight, although accuracy diminishes slightly with older animals. Also, it is hard to restrain older heifers to place the tape in the correct position. This method is clearly the most labour intensive.

Wither height stick

The wither height stick is a cheap form of live weight assessment for dairy heifers. The stick is subject to some reader inaccuracy, but over a group of heifers it will indicate live weights with quite a high degree of accuracy. The withers are the highest part of the heifer's back, behind the neck.

Scales (electronic)

Electronic scales are the most accurate way of assessing heifer liveweight. Good quality scales can store heifer liveweights in a memory to be downloaded to a personal computer.

Regular weighing, three or four times a year, tells you not only when heifers have reached target weights, but also how quickly they are growing at certain times of the year. This will provide a check on the quality of the pastures and tell you if any supplements are required.

Using growth charts

There are a number of different types of growth charts. Overleaf are some growth charts that are a guide to target wither heights at different ages up to 2 years old. One chart gives American recommendations for Friesian and Jersey heifers, and on the other you can compare some different Australian recommendations for Friesians with the American ones. By periodically monitoring your heifers and plotting their wither heights on a chart, you can see how your feeding management is going in relation to the optimum.

Critical periods in live weight gain

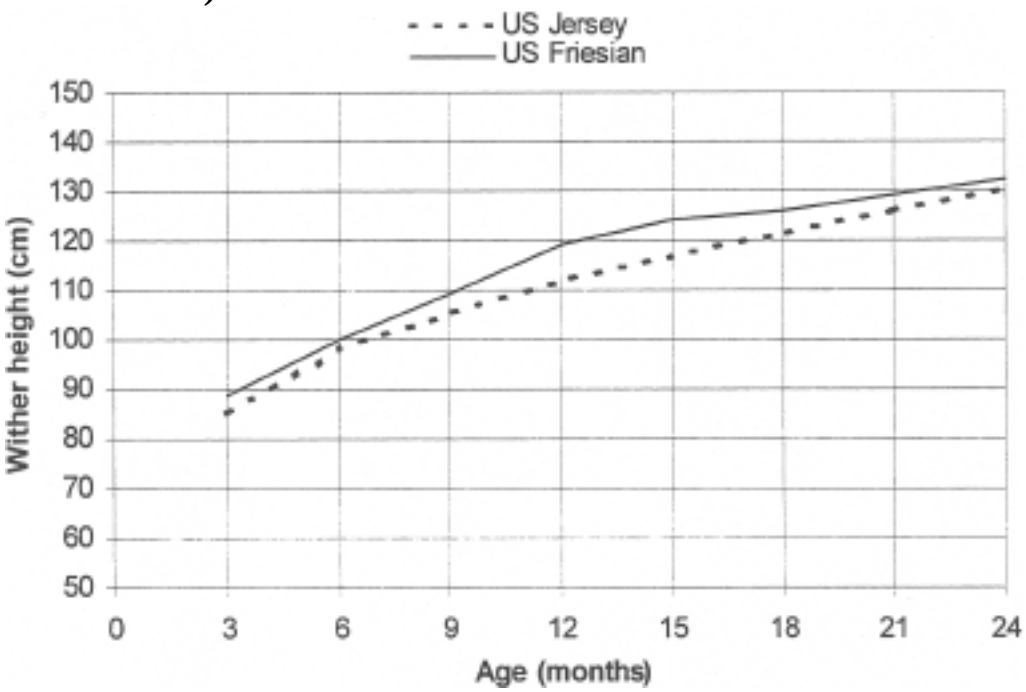
In a well managed heifer replacement program target weights are reached at a

Table 3.3: Accuracy and costs of heifer live weight assessment

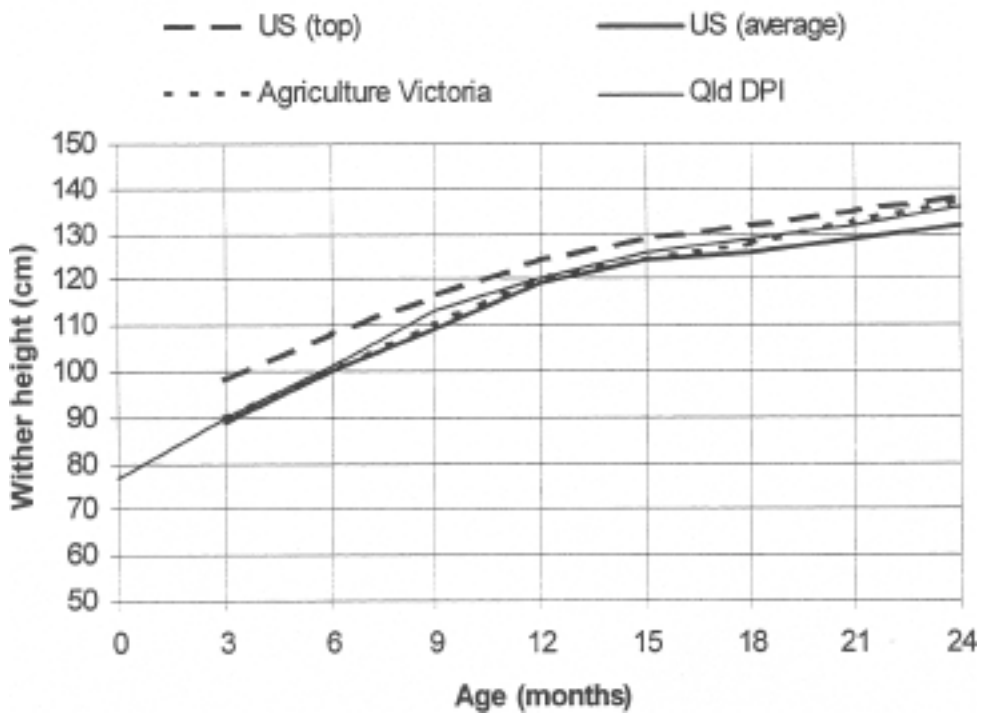
Type	Cost ($)	Accuracy (%)	Age range applicable
Visual assessment	0	35	all
Girth tape	5–10	85 (over group)	0–6 months
Wither height stick	15	85 (over group)	6–24 months
Scales (electronic)	750–1500	95–100	all

Growth charts

Wither heights for age for growing heifers: US recommendations (after J Moran, Agriculture Victoria)



Wither heights for age for growing Friesian heifers: published recommendations (after J Moran, Agriculture Victoria)



steady growth rate. Your management must be especially careful at times that are critical for weight gain, so that this steady growth is not disrupted.

There is a critical period in the developing udder when excessive growth rates can increase the deposition of fatty tissue and reduce lifetime productivity. So far no one knows exactly when this critical period occurs, and exactly what constitutes excessive growth rates, although there are some general guidelines. Some advisers consider that live weight gains should not exceed 0.5 kg/day between 6 and 12 months, whereas others recommend gains of less than 0.7 kg/day between 3 to 8 months. Clearly it is not desirable to feed heifers above maximum growth rates during their second 6 months of life.

Fatty udders are unlikely to be a problem in pasture-grown heifers, particularly in traditional periods of pasture shortage. Balancing dietary nutrients (such as supplying enough bypass protein) may be one way of maintaining high growth rates in heifers without depositing fatty tissue.

Mating

In order to maximise the genetic gain in your herd, your heifers should be mated to the best bull you can find; the best way to do this is to use artificial insemination (AI). Heifers should be mated to easy calving bulls.

To get the best results from AI your heifers must be both at target live weight and increasing liveweight at mating.

Well grown heifers will begin to cycle earlier, will have stronger heats and will have higher conception rates and fewer calving problems than poorly grown heifers. They also tend to have higher conception rates than lactating cows, as they do not have the stress of lactation to contend with.

Some heifers will have shorter standing heat periods than older cows; for this reason, aids to heat detection (such as tail paint or heat-mounting pads secured on the tail head) are recommended.

Drugs used to synchronise heat in heifers

Synchronising heat in your heifers will save you time and give you good control over your breeding program. A number of drugs can be obtained from your vet:

Prostaglandins

These occur naturally in the body, but can also be given as drugs to synchronise heat. They work by causing the corpus luteum (the ‘blister’ that forms on the ovary after the egg is released) to dissolve.

Progesterone (natural) or progestogen (synthetic)

Progesterone is produced by the corpus luteum. It is the hormone that ‘organises’ the whole cycle, and can also be used to synchronise heat.

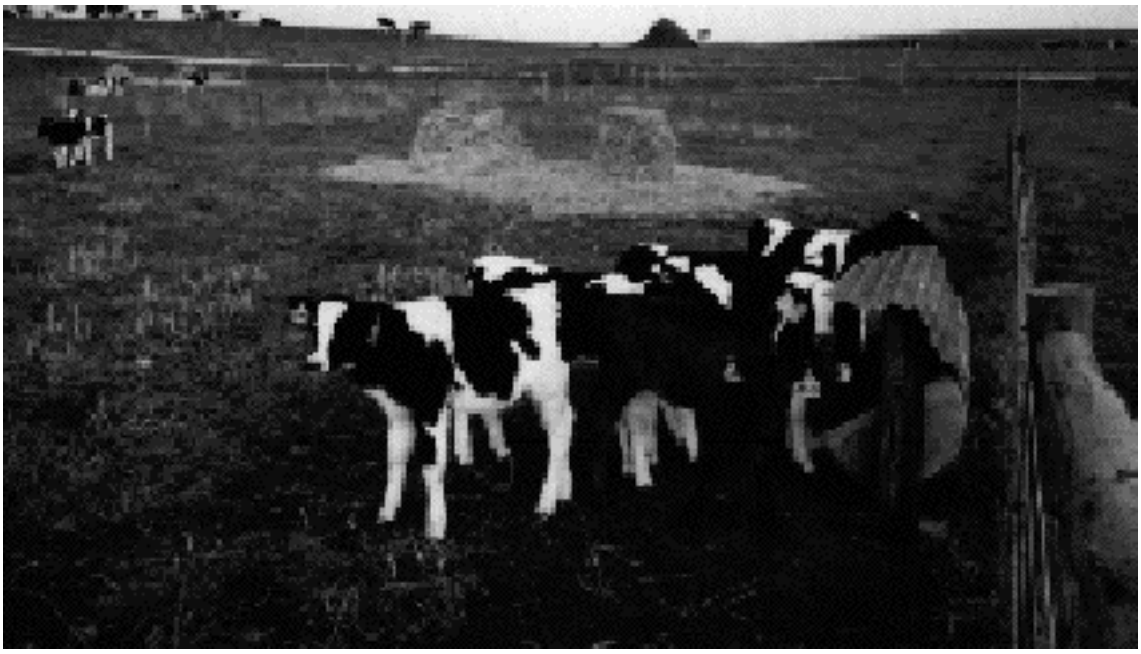
Oestradiol benzoate or oestradiol valerate

Oestrogens have a similar effect to prostaglandins.

Systems used to synchronise heat

No one system is guaranteed to get all your heifers tightly synchronised. All the systems used require multiple handling of heifers.

Some people may prefer natural mating for heifers, especially if they do not have time to spend observing heats and handling stock. Groups of heifers can be run with the milking herd and either



Weaned calves should be allocated to specific calf-raising paddocks. Groups are based on size to avoid 'bullying' around feed areas. Photo: J Irvine, Dungog.

mated with bulls or artificial insemination.

For successful synchronisation you must make sure that the heifers to be mated are cycling before the start of the program. There are a number of systems used commonly.

Progesterone implants

CIDR (controlled internal drug release). A progesterone-releasing implant is placed in the vagina. An oestradiol capsule is also implanted at the same time (to remove any aged eggs). The CIDR implant is removed 10 to 12 days later and the cows are inseminated about 48 hours later. A prostaglandin injection is sometimes given on day 6.

Progestogen ear implants. A progesterone-releasing implant (such as Synchro-mate B®) is implanted in the ear, and an oestrogen–progesterone injection is given at the same time. The implant is removed after 10 days, and the cows are mated 48 hours later.

These products work by lengthening the oestrus cycle while they remain implanted. When they are removed, the blood level of progesterone drops suddenly and another egg begins to develop—the cow begins to come into oestrus.

Prostaglandin injections

Two injections of prostaglandin (such as After weaning, calves should be allocated to specific calf-raising paddocks.

Lutalyse® or Estrumate®) are given, generally 10–12 days apart.

For further information on managing heifers from weaning to calving, see the Agriculture Victoria Agnote AG0506, *Health and mating management of heifers from weaning to calving;* there is a copy of this publication in the Further Information section of this manual.

Contract rearing of dairy replacements

Introduction

Contract rearing of dairy replacements can be an attractive option if you are restricted by farm size and wish to milk more cows. You can free up valuable land, labour and feed resources. You are guaranteed predetermined growth rates, with heifers ready to calve at 2 years and big enough to maximise their genetic potetial.

Payment

The suggested method of payment is for weight gain and is loaded to favour good early growth to the target live weight for high fertility at mating. Suggested target live weights are given in Table 4.1.

Suggested payments

Weaning to mating: $1.00 per kg live weight gain.

Mating to pre-calving: $1.10-$1.20 per kg live weight gain.

Payment schedules will vary from rearer to rearer. Incentives may be paid for agreed growth rates during winter months when supplements are likely to be fed.

The average cost of rearing is $6.00 a week, which includes payment for weight gain, health treatment, mating and weighing. Other costs would include transport and preparation of legal contacts.

An overall minimum cost from 4 months to 23 months would be $530 per heifer.

Drawing up contracts

Before you enter into an arrangement it is important that you draw up a detailed contract with the rearer.

Some of the points that need to be included in this contract are:

- responsibility for
  - —daily management
  - —veterinary attention
  - —mating and pregnancy testing
  - —delivery and collection
- date for delivery and collection
- weighing procedure and frequency
- payment schedule and timing of payments
- penalties for not achieving the target weight
- disease assurance programs
- penalties for deaths and losses.

Both parties must receive an adequate financial return to justify a contract rearing arrangement. From the owner's viewpoint the return from running additional milking cows must more than cover the costs of contract rearing. The contract rearer is interested in the comparison between returns from contract rearing and alternative enterprises.

Table 4.1: Suggested target live weights

	Weaning(12 weeks)	Mating(15 mnths)	Pre-calving(23 mnths)*
Friesian	100 kg	350 kg	530 kg
Jersey	80 kg	280 kg	400 kg

* Heifers are returned to owner at 23 months to settle in to herd.

Other issues

Health and disease transfer

There is a potential for transferring disease on to the rearer's property or neighbouring farms if fences are not secure. All stock (including those owned by the rearer) should be tested negative or clear for EBL and Johne's disease. All bulls should be vaccinated for vibriosis.

Heifers should be vaccinated against the normal clostridial diseases and leptospirosis (give 7 in 1), as the latter can be transferred to humans.

Mating heifers for year-round calving herds

Under year-round calving there will be a need to mate a few heifers on a regular basis. For the rearer this means constantly juggling bulls or using an AI program, as a large number of heifers may be involved.

Problems with contract growing are likely to occur if the rearer and the owner do not fully understand the difficulties associated with heifer mating.

Animal welfare

Make sure you attend to the welfare of your calves and heifers at all times. Below is an extract from the *Australian Model Code of Practice for the Welfare of Animals* (SCA 1992). It was compiled by the Animal Health Committee of the Standing Committee on Agriculture.

3. Artificial Rearing of Calves

3.1 Housing for artificially reared calves should be hygienic, with adequate ventilation, climate control and lighting. Flooring should be well drained with adequate dry lying space for each calf. Flooring and internal surfaces should not cause injury and should allow easy cleaning.

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

3.3 For multiple calf rearing systems, where individual calf pens are used, these should be so made and located to allow each calf to see and hear other cattle (i.e. at least one other individual). 1.5 to 2.0 m^2 of floor area per calf should be provided to permit self-grooming and prevent overcrowding. The total shed volume should provide for at least 5.5 m^3 per calf.

3.4 In cold weather, adequate shelter or housing, and feeds with a high energy content should be provided.

3.5 Calves should receive at least two litres of fresh or preserved colostrum or an approved substitute within the first 12 hours following birth. Thereafter, they should be fed on liquid milk. commercial milk-replacer or colostrum, in sufficient quantities to provide essential requirements for maintenance and growth. High quality pasture, hay or pellets should be available to calves from no later than 3 weeks of age to help in development of their digestive tracts.

Hygienic calf feeding practices, including thorough daily cleansing of all equipment (feeding units, lines, bottles, nipples, troughs, etc.) are essential to protect calf health and welfare and to prevent diarrhoea.

3.6 Milk-replacers based on skim milk should not be fed to calves under three weeks of age, unless they are in a properly balanced formulated mixture of protein, fat and vitamins. Milk replacers should be reconstituted according to manufacturers' instructions. Milk and milk-replacers should be reconstituted according to manufacturers instructions. Milk and milk-replacers should not be fed in excess of body temperature (39^{o}C).

3.7 Calves should be weaned off milk, milk replacer or colostrum on to rations providing all essential requirements, only when their ruminant digestive systems have developed sufficiently to enable them to maintain growth and well-being and not earlier than 6 weeks of age. Restricted rations of the 'white veal' type, i.e. iron-free diets which cause anaemia, are unacceptable.

3.8 Where large numbers of calves are reared, they should be grouped by age and size to reduce competition for food and to allow closer observation and management.

Further information

General reading

Busby, G J, (ed)(undated), *Dairy Heifer Management*, Information series QI 94021, Department of Primary Industries, Queensland

Coomber, R & Phillips, K 1993, *Cattle Breeding and Reproduction*, NSW Agriculture, 1997

Freeman, M 1993, 'The Importance of Liveweight', in *Your Heifers in the Balance*, Department of Primary Industries and Fisheries, Tasmania

Freeman, M & Campbell, R 1993, 'Liveweight and Reproduction', in *Your Heifers in the Balance*, Department of Primary Industry and Fisheries, Tasmania

Mason, W 1996, *Best Practice Dairy Beef Manual*, Meat Research Corporation, Sydney

McLean, D 1995, *Current Australasian Studies on Heifer Growth and its Effect on Milk Production*, Report for Dairy Research and Development Corporation, Primary Industries (South Australia), Flaxley Agricultural Centre

McLean, D & Moran, J, eds (in press), *A Guide to Rearing Dairy Heifers in Australia*, Dairy Research and Development Corporation, Melbourne

Moran, J 1993, *Calf rearing—A Guide to Rearing Calves in Australia*, Department of Agriculture Victoria, Agmedia, Melbourne

SCA 1992, *Australian Model Code of Practice for the Welfare of Animals*

Videos

Caring for Calves

Caring for Heifers

These commercially produced videos are available from Brian Sullivan and Associates. Contact B Sullivan, Australian Dairy Videos, 38 Range Street, Toowoomba, Queensland 4350. Phone (076) 393 176.

Colostrum tester

Other

CalfGuard® is available from Northfield Veterinary Laboratories, 180 Fosters Road, Oakden, South Australia 5086. Phone (08) 266 2266.

NSW Agriculture publications

Fulkerson, W (ed) 1996, *NSW Agriculture Dairy Research Institute Report*, NSW Agriculture 1996

Agnote 2/099 1996, *Early weaning of dairy calves*

Agfact A1.2.2, *Raising dairy calves*

Agriculture Victoria publications

Agnote AG0501 1996, *Comparing the cost of supplements on the basis of their nutritional value*, Agriculture Victoria

Agnote AG0506 1997, *Health and mating management of heifers from weaning to calving,* Agriculture Victoria

Agnote AG0507 1997, *Heifer nutrition from weaning to first calving*, Agriculture Victoria

Agnote AG0503 1996, *How to stomach tube a calf*, Agriculture Victoria

Agnote AG0578 1997, *Nutritional scours in milk-fed calves—causes and treatment*, Agriculture Victoria