

Rearing the 2025 heifer

Management and feeding of dairy herd replacements



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Contents

Introduction	05
Managing the newly born heifer calf (0-3 months)	06
Colostrum	07
Top tips for colostrum	07
Pre-wean nutrition	08
Whole milk and milk replacer	08
Top tips for whole milk and CMR	09
Concentrate	10
Water	10
Forage	11
Top tips for rumen development in the pre-wean period	11
Housing and hygiene	11
Ventilation	12
Flooring and drainage	13
Pens	13
Hygiene	14
Calf health	15
Scour	15
Pneumonia	16
Symptoms	16
Treatment	17
Top tips for prevention of disease	17
Antibiotic usage	18
Routine management procedures	18
Key messages (0-3 months)	19
Managing the post-wean heifer (4-12 months)	20
Post-wean nutrition and growth	21
Grazing the young heifer	22
Top tips for grazing	23
Worm control	23

Key messages (4-12 months)	25
Managing the breeding heifer (13-15 months)	25
Importance of being at target growth and body condition score	26
Intakes and nutrition	27
At grass	27
Sire selection and replacements	28
Simple steps when selecting sires for your system	29
Heat detection and accurate heat recording	29
Things to remember when selecting heat detection aids	30
AI programmes and sexed semen	30
Take home messages for AI programmes and serving	32
Genomics	33
Housing and good animal handling	33
Cubicle size and dimensions	33
Managing the in-calf heifer (16-24 months)	34
Diet for appropriate growth and BCS	35
The BovIS Growth rate calculator	35
Second grazing season	36
Pre-calving minerals	36
Housing	37
Feed space	37
Ventilation	37
Cubicles	37
Integration of heifers into milking herd	38
Vaccination	39
Footbathing	39
Preparation before calving	39
Summary	40
Acknowledgments	43

Introduction

Rearing dairy heifer replacements represents significant expense within a dairy business. Analysis of 2021/22 CAFRE benchmarking data has indicated that the average cost associated with rearing a dairy heifer is around £2,000 with a difference of £1,388 between the top and bottom benchmarked herds. With rising costs of feed, fertiliser and electric set to continue on farms, the need to keep all costs as low as possible is paramount. Costs can be reduced by using accelerated growth programmes to ensure these heifers calve down between 560kg and 590kg live weight at two years old or less. In order to reach this target, there are a number of measures which can be adopted on your farm to achieve net gains. Being able to target growth is the first step to managing heifer rearing costs effectively.

The rearing period is the financially non-productive part of the animals life and it has a direct effect on both the total cost of rearing and the time taken for each individual heifer to pay this investment. Rearing a heifer contributes to 20% of the production costs in a dairy business and it takes on average one and a half lactations for the heifer to repay her investment in the rearing period. Calving at 24 months or before has been shown to be the optimum for economic and lifetime performance but only be achieved if heifers meet key targets at critical stages in the rearing phase. Every day over 24 months that your heifers have not produced a calf incurs a cost of £2.87.

Delayed age at first calving increases costs

- **Increased rearing costs per heifer:** if age at first calving increases from 25 to 28 months, costs go up by 11%, roughly £2,000 to £2,258.30. (Based on CAFRE benchmarking data).
- **Increasing the number of heifers reared:** if the replacement rate is 25% in a herd of 100 cows, a total of 55 heifers are required on the farm at one time. However if the age at first calving is 28 months the same 100 cow herd will need 62 heifers.

Benefits to calving between 22-24 months

- Heifers start producing milk earlier and create cash flow earlier.
- Better lifetime and profitability.
- Lower culling rates.

The cost of rearing heifers is considerable and well reared heifers that have been fed to meet their target weight gain are a significant investment.

Managing the newly born heifer calf (0-3 months)

Life stage	Focus areas	Growth target (kg/day)	Target % mature weight by end of life stage
0-3 months	Colostrum, milk feeding, rumen development, weaning	0.7-0.8	17%
4-12 months	Growth targets, grazing	0.7-0.8	50%
13-15 months	Heat checks and mating	0.7-0.8	55%
16-24 months	Monitor growth and BCS, mixing heifers into milking herd, pre-calving minerals	0.7-0.8	90%

Target body weight for each life stage (based on mature weight of 650kg). In addition to weighing calves at birth, you should measure as regularly as possible at:

- Weaning.
- One-two weeks post weaning.
- 6 months of age.
- 12 months of age.
- At breeding.

Weighing at 6 and 12 months gives time to make sure any corrective actions can be taken prior to breeding.

Age (Months)	Stage	Body weight	Mature weight %
0	Birth	40	6
1		52	8
2	Weaning	75	12
3	Post-weaning	110	17
6		175	27

Age (Months)	Stage	Body weight	Mature weight %
9	Puberty	260	40
12		325	50
14	Pre-breeding	358	55
24	Pre-calving	585	90
MW	Adulthood	650	100

Colostrum

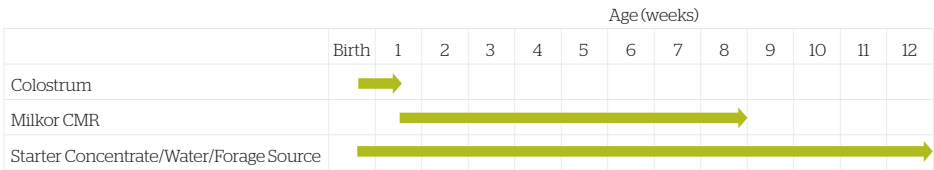
Calves are born without a functioning immune system and rely on antibodies only found in colostrum to prevent disease in the first weeks of life. It is essential that a calf receives around 3-4 litres of good quality colostrum as soon as possible after birth, ideally within 2 hours. Another similar sized feed can be provided 6-12 hours later. Colostrum from Johne's positive cows should not be fed and use of pooled colostrum should be avoided to limit disease spread.

Good quality colostrum should contain at least 50 g/L immunoglobulin G (IgG), which can be tested using a Brix refractometer where a reading of 22% is equivalent to 50 g/L IgG. Any colostrum containing <20g/L should not be used. Colostrum/transition milk should be fed for the first few days of life to provide local immunity against pathogens in the gut. The amount of IgG transferred to the calf can be checked with a blood sample carried out by your veterinarian in the first 10 days of life. This is called a Zinc Sulphate Turbidity test (ZST) and ZST levels below 20g/l indicate inadequate immune status which means colostrum quality and quantity may not have been on target.

Top tips for colostrum

- Quickly - Collect and administer colostrum as soon as possible after birth, preferably within 2 hours of life and no later than 6 hours of life.
- Quantity - Calves should be fed 3-4L colostrum at birth equivalent to 10% birth weight within their first feed.
- Quality - Test the colostrum prior to feeding to check antibody concentration is at least 50g/L IgG 22% from refractometer.
- Ensure high standards of hygiene are maintained at all times through calf handling and colostrum management.
- Colostrum should be stored in the fridge prior to use and fed at body temperature (around 38-40°C).
- Emergency colostrum - ensure you have a store of high quality frozen colostrum from cows within your own herd. This should be taken from cows with high health status, particularly from cows with no evidence of having Johne's Disease (*those with negative status via blood or milk sampling and showing low risk*).
- Frozen colostrum can be thawed in the refrigerator overnight and then warmed in a water bath of no more than 50°C so the colostrum reaches ~40°C. Do not thaw or heat the colostrum in a microwave as this will destroy the antibodies.

Pre-wean nutrition



Whole milk and milk replacer

Energy requirements in the first few weeks of life are largely met by whole milk or calf milk replacer (CMR). In order to meet basic energy requirements and facilitate growth, the volume of whole milk or CMR provided should equate to around 15% of birth weight e.g. a 40 kg calf should be fed a daily amount of at least 6 litres of milk or CMR at a rate of up to 150 g/L. Feeding a minimum of 900g milk powder, in the form of an accelerated milk feeding programme, per day can help calves to achieve growth rates of 0.6-0.8 kg/day. Higher live weight gains can be achieved by providing calves with increased levels of milk or milk replacer during the pre-wean period e.g. 9L/day. This live-weight advantage is beneficial in heifers as it can reduce age of puberty and help to achieve a first calving age of 24 months. However, if feeding a higher level of milk replacer, it is very important to wean calves gradually to ensure sufficient starter intake prior to weaning as this will ensure appropriate rumen development and avoid any post wean weight loss. Frequency of feeds can be altered to best suit your system, however, it is important to remember that calves under 28 days of age should be provided with at least two liquid milk feeds per day. Whole milk can offer a higher energy content than CMR, however, it does carry a higher risk of disease transfer e.g. Johne's and BVD. CMR offers a consistent feed, provided it is mixed correctly, but it can contain plant-based protein products which can have a lower digestibility in calves under 3 weeks old. Milk protein sources in CMR are either skim or whey powders, which have been shown to promote equivalent growth.

Many CMR options are available. The constituents usually listed on the CMR packaging are crude protein, crude fat, ash and fibre. CMR generally contains 20-26% protein and 16-20% fat, however the fat content can be as high as 25% in some CMRs. Ash content is an indicator of mineral content and should be below 8%. Fibre indicates protein quality with products with less than 0.15% fibre containing milk or egg proteins and those with over 0.20% containing plant proteins.

In colder weather, younger calves need to use more energy to keep warm, so providing some extra milk or CMR as well as lots of dry bedding can help to prevent any impacts to growth or health. As a general rule, for calves under 3-4 weeks of age can be provided with an extra 50g of CMR or 0.33 litres of whole milk per day for each 5°C drop below 15°C is recommended.

Calves should be weaned gradually over a period of 10-14 days to encourage solid feed intake as this will reduce stress and help to prevent any growth checks at weaning. This can be done by reducing milk volume of milk provided, reducing the milk feeding frequency, reducing the concentration at which CMR is diluted or a combination of the above. Having a weaning strategy in place is key to ensuring successful transition to the post wean diet.

Remember that feeding equipment should be thoroughly cleaned after each use as any bacteria on feeding equipment will go straight to the calf's gut and can result in increased likelihood of scour.

Top tips for whole milk and CMR

- Make sure whole milk is from healthy, disease-free cows and do not feed waste milk to calves.
- Feed 15% of calf body weight - e.g. for a 40kg calf on CMR 6l/day mixed at 150g/litre.
- Feed whole milk or CMR at body temperature at the same time each day - calves need consistency.
- Select a CMR and feeding level based on growth and health targets for your calves and suitability for your system.
- Ensure that you weigh your milk powder mix correctly according to manufacturer's instructions - it should have a smooth and creamy texture.
- Feed with a teat - this helps calves to satisfy their urge to suckle.
- Clean all utensils and feeding buckets after each feed and let them dry before the next use.
- If using an automatic feeder carry out regular performance checks to ensure the powder is weighed out correctly and that there is no damage to the teat.
- Wean calves gradually over 10-14 days to encourage solid feed intake and reduce stress.

Concentrate

At birth the rumen is underdeveloped and cannot digest feedstuffs, but if stimulated in early life the transition from pre-ruminant to ruminant will be smoother. Provision of concentrate feed and water is vital for the growth and multiplication of rumen microbes, as well as the rumen musculature and papillae. It is important that any starter provided to calves is palatable and of high quality, with an energy content of no less than 12 MJ/kg on a dry matter basis and a crude protein content of 16-18%. Calves will usually only consume small amounts of starter in the first 3 weeks of life. It is important to provide small amounts of fresh feed on a daily basis. Once they have been consuming starter for around 3-4 weeks, there will be enough microbes in the rumen to ferment solid feed to provide the calf with energy. There are different types of calf starter available, but in the first weeks of life, coarse (containing ingredients of similar size and palatability to avoid sorting) or pelleted (usually 3mm-5mm) are preferred. However some fine rations are becoming available, which are specially designed to avoid respiratory and digestive illnesses and offer high levels of gut protection. Intake of starter can be very variable so recording amounts that individual calves are eating is very important. Starter intake can be increased up to the point of weaning through the use of a gradual weaning strategy and calves should be consuming around 1 kg/day for at least 3 days before they are fully weaned. Monitoring growth, concentrate intake and general body condition will help you to assess calf readiness for weaning.

Water

Water is an often neglected element of calf rearing systems, as it is often assumed that calves get any water they need from the milk feed. However this is certainly not the case as it bypasses the rumen and goes straight to the abomasum. Providing calves with free access to fresh drinking water from birth is not only a legal requirement from birth, but along with concentrate intake is essential for development of the rumen. This is because drinking water goes straight to the rumen and creates the perfect environment for fermentation of concentrate feed by rumen bacteria. Water intake also drives concentrate intake, this contributing to greater growth rates in the pre-wean period. As a general rule of thumb, calves need 5 litres of water for each 1 kg of dry feed consumed, in addition to the milk feed. If calves are housed individually or in pairs, water should be provided in buckets outside the front of the pen to minimise potential contamination with faeces, bedding or feed and replenished on a daily basis. Buckets should be cleaned regularly to limit bacterial contamination. If calves are in group pens with a common drinker, the drinker should be easily accessible for daily cleaning and there should be an adequate number of drinkers available depending on stocking rate.

Forage

Providing calves with a fiber source at an early age is a good means of supporting growth and development of the muscular layer of the rumen and helps keep the rumen lining healthy as it prevents the papillae from clumping. It also encourages mastication which promotes salivary production. Improving rumen pH has a protective effect against bloat. However, not all fibre sources are equal and providing low quality, long-stemmed, indigestible forage can create a gut fill effect that will suppress concentrate intake and impair growth. Straw bedding should not be considered as an appropriate forage source due to bacterial contamination. It is recommended that calves are provided with small amounts of good quality chopped forage (e.g. straw with a 3-4 cm chop length) on a daily basis to ensure freshness as this will encourage intake. This should be offered from birth using a feed rack or clean bucket, which is at the right height for calves to minimise the likelihood of contamination with faeces or urine.

Top tips for rumen development in the pre-wean period

- Provide calves with small amounts of fresh starter concentrate from birth - monitor in-takes.
- Feed a coarse or pelleted concentrate feed with no less than 12 MJ/kg on a dry matter basis and a crude protein content of 16-18%.
- Fresh drinking water is not optional it is a necessity - make sure calves have a source of fresh clean water and check water buckets and drinkers daily.
- Straw bedding is not an appropriate forage source - provide small amounts of high quality chopped straw in separate feed buckets or racks to avoid contamination.
- Monitor concentrate intake alongside animal growth and condition to assess readiness for weaning - calves should be consuming ~1kg concentrate /day.
- Aim to double birth weight between birth and weaning and grow between 0.6-0.8 wkg/day.

Housing and hygiene

The principle requirements for calf housing are to provide a clean, warm, dry and well ventilated environment with a complete absence of draughts. Calves at this age should also be housed in a separate airspace from older animals to minimise disease transmission. Overall housing and pen set up should be designed to allow ease of cleaning and management.

For a complete overview of calf housing guidelines for new builds and modifications to existing buildings, see the Optihouse housing design booklets.

Ventilation

The aim of ventilation is to provide fresh air delivery to all parts of the calf house and to remove stale air. Ventilation is also essential to aid in removal of moisture from the calf house. The majority of calf housing relies on natural ventilation, which is driven by the wind and relies on sufficient air inlets and outlets. There will be a prevailing wind direction, however, at some point the wind will come from all directions. Therefore, to ensure effective natural ventilation, there should be porous cladding in all walls above calf height. The total minimum inlet in each side wall (above calf height) is 0.04 per calf. Large air inlets are only a problem if the incoming airspeed is not controlled, as this can cause draughts (airspeeds over 0.3m/s). Target airspeed within animal housing is 0.15-0.3 m/s, housing with airspeeds less than 0.1m/s are considered "airless".

Ventilation outlets are required in the roof above eaves height to remove warm, stale air to exit the building. The outlet area at ridge height should be approximately 0.04 m² per calf. Optimum outlet design should include upstands to protect the opening in the ridge whilst providing a negative pressure at the ridge all the time the wind is blowing. Upstand height above ridge height is 75% of the designed width of the ridge outlet. Roof pitch should be a minimum of 15°.

The basic minimum ventilation requirement is four air changes per hour. Where sidewalls do not provide sufficient air inlet, and to ensure delivery of fresh air, another option is positive pressure tube ventilation (PPTV). PPTV air intake should be from outside, if on an exposed site, preference is to locate the fan on the gable end of the building towards the prevailing wind. The fan air intake should be protected by an external cowl to maintain efficiency and fitted with a mesh screen that should be routinely cleaned.

When considering fitting a PPTV system, the below should be taken into consideration to ensure delivery of fresh air without draughts:

- Length and width of building.
- Eaves and ridge height (needed to calculate building volume).
- Number of calves.
- Location of calf pens.
- Height of bottom of tube level above the ground.
- Probable location of fan across width of building.
- Remember to monitor tube condition - clean regularly and replace when needed.

Flooring and drainage

Floors should provide a non-slip surface and be age and size specific of calves. Calves under 4 weeks of age shouldn't be housed on totally slatted floors and calves up to 200 kg should be provided with a non-slatted lying area. Good practice is to check guidelines in quality assurance schemes to ensure compliance. A calf house produces a lot of moisture, failure to ensure effective drainage can increase bacterial load and result in cold wet bedding which impacts on calf health and performance. Bedding can look dry, but it may actually be very damp underneath the top layer, carrying out a simple kneel test to check. The floor should slope from the back of the pen to the front of the pen towards channel drains - a pen floor should have a minimum slope of 1 in 60 to permit effective drainage after cleaning and an optimum 1 in 20 slope for drainage under straw bedding. Channel drains should be 75-100mm wide.

Pens

- Calves can be kept in individual pens up to 8 weeks of age but must be housed in groups of 2 or more after this.
- Individual pens for calves up to 60kg (~4 weeks of age) should provide a minimum internal space allowance of a minimum of 1.5m² (1m x 1.5m) with a requirement 1.8m² (1m x 1.8m) for calves up to 80kg.
- Group pens should have solid floors and have a minimum space allowance of 1.5m² for calves under 85kg, 1.8 m² for calves between 85-140kg and 2.4 m² for calves between 140-200kg.
- Providing sufficient space allowance is important for calves to express normal behaviour and to help keep bedding dry and clean.
- Pens for young animals often have solid sides as a means of reducing disease transmission and reducing draughts at calf height, but it's important to ensure that air circulation isn't impeded, and pens must allow at least visual contact between calves.
- Pens should be made of materials that are easy to clean to limit bacterial load. Pens should always be thoroughly cleaned and disinfected between calves.
- Feed and water troughs should be at an appropriate height for calves and should be located at the front of the pen to allow ease of checking and cleaning.



Remember: Calves can spend 80% of the day lying down, so providing them with a warm, dry, clean environment is essential to promote health and growth. Straw bedding should be provided and should be deep enough that calves can nest without their legs being visible. In cold temperatures, calf jackets or heat lamps can be beneficial for calves under 4 weeks of age as they cannot maintain their own body temperature without using energy. If using calf jackets, the calf should be completely dry before it is fitted and should be cleaned between each use by washing at 60°C and fully dried before the next use.

Hygiene

Young calves are very susceptible to disease, and this can have a profound impact on growth in early life. Working from youngest to oldest calves can help limit disease transfer to the most susceptible calves and ensuring clothing is clean and boots and disinfected before entering calf housing is good management. Setting up some standard cleaning procedures can help to make this process easier and quicker.

Cleaning calf pens

Cleaning and disinfection of calf housing should take place at the beginning and end of each calving season and in periods of disease outbreak. Individual pens should be cleaned between each new calf, and group pens as soon as all calves are weaned and removed from the pens. Cleaning out of bedding build-up and faeces should be carried out every 3-4 weeks to limit exposure to disease and poor hygiene. Allow for more capacity than calves at any one time - this gives sufficient clean and rest timeframes.



Cleaning feed equipment

Regular cleaning of feeding equipment prevents calves from picking up infections, and good hygiene prevents transfer of disease between individual animals and animal groups. Equipment such as stomach feeding tubes, colostrum dump buckets, milk bottles, teated buckets and feed buckets should be cleaned on a daily basis or between each use with hot water and disinfectant using the process below.



Calf health

Ill health in early life can reduce heifer survival and economic return on the dairy farm through direct losses due to calf morbidity and mortality, as well as indirect effects of increased feeding costs and reduction in lifetime yields. Ensuring high standards of hygiene, alongside sufficient ventilation, can help to reduce bacterial load within calf housing, thus having a positive impact on calf health. Two of the most prominent diseases in young calves are scour and pneumonia.

Scour

Scour can have a nutritional or infectious cause. Nutritional scours are usually from changes in feeding or management, but they can predispose calves to infectious scour and will increase pathogen load and moisture in the bedding. Infectious scours are caused by viruses (rotavirus and coronavirus), parasite (cryptosporidia and coccidia) and bacteria (E.Coli and Salmonella).

Symptoms of scour include:

- Increase in frequency of defecation and quantity of faeces produced.
- Faeces appear loose due to the increased water content.
- Change in faecal colour or appearance.
- Blood in faeces.
- Calves can appear depressed/weak and are reluctant to feed.
- Weight loss or reduction in daily live weight gain.
- Dehydration can result in skin tenting, sunken eyes and pale, sticky oral mucous membranes.
- Infectious scour can increase core body temperature outside of the normal range (over 39.5°C).

In order to limit the exposure to other calves, it is essential to isolate scouring calves. It is very important to take care to avoid the spread of infection on footwear. Calves should be placed in a clean, dry pen and bedding should be refreshed regularly. Keeping the calves warm by providing sufficient bedding for nesting or through the use of a heat lamp or calf jacket is advised. As scour can result in dehydration due to the increased water content of the faeces, it is vital to ensure that calves receive sufficient fluid. Providing calves with a constant supply of fresh, clean water and administering electrolytes between milk feeds will

help to replace any lost fluids. It is essential to continue to offer milk or milk replacer as this will provide the calf with energy required to fight the infection and can also help to heal the intestine. However, it is important that milk/milk replacer is not stomach tubed.

Non-nutritional scour is most commonly caused by viruses or parasites, which cannot be treated with antibiotics, however some therapeutic options for Cryptosporidia are available. Antibiotics should only be administered if the calf has a temperature outside of the normal range (38.5-39.5°C), the calf looks very sick or on the advice of your veterinary surgeon. If a group of calves are showing signs of scour, work with your vet to take a sample prior to any treatment can help to determine the cause. If bacterial, your vet will indicate which antibiotic will provide the most effective treatment. Hygiene practice in and around pens is paramount and ensure correct use of disinfectants.

Pneumonia

Respiratory infections and pneumonia can be caused by bacteria, viruses and parasites. Its onset can also be triggered by environmental and management conditions such as poor hygiene, insufficient colostrum, poor ventilation and stress, so it is often referred to as a multifactorial disease. The bacterial causes of pneumonia are often carried by healthy calves with disease precipitated by other factors such as the environment. Pneumonia not only results in higher husbandry and veterinary costs but also impacts on first lactation production performance. High risk periods of respiratory distress are notable during mixing of calves into group, after weaning and changeable weather conditions/fluctuations in ambient temperature. It is therefore advisable to avoid management practices that cause increased stress e.g. regroup calves 1-2 weeks after weaning rather than at weaning.

Symptoms

If treatment of pneumonia is to be successful, early diagnosis is essential. Initial signs and symptoms of pneumonia can include:

- Dullness or generally being off form.
- Reduction in feed intake.
- Breaks in milk feeding and a reduction in drinking speed.
- Fever (core temperature > 39.5 °C).
- Increased respiratory rate or 'blowing'.
- Discharge from eyes and nose.
- Tilted or dropped ear position.
- Repeated coughing.

Treatment

Veterinary advice should be sought as early as possible when treating pneumonia. The appropriate treatment will be dependent on a range of factors including causes, the clinical state, and the history of infection in both the animal and the herd. The decision on whether an antibiotic treatment is needed, and if so, what antibiotic is likely to be the most appropriate, should always be taken in conjunction with your veterinary surgeon. When an antibiotic is indicated, it should be used at the recommended dose rate and the full course given. It should be noted that there are no antibiotics available that are effective against any of the viral causes of pneumonia. However, antibiotics may still be indicated in such cases to prevent secondary bacterial infection. Close monitoring of calves on a regular basis is needed, particularly outside feeding times when calves are resting, to detect any changes in behaviour. It is always better to try and prevent pneumonia rather than treat outbreaks. It is advisable to have a health and vaccination programme in conjunction with your vet addressing immunity issues and what to do with those animals that are most susceptible to pneumonia ahead of when they are mostly likely to develop it. Vaccine programmes must be carried out in line with manufacturers guidelines.

Top tips for prevention of disease

- Discuss the implementation of a health and vaccination programme for dams and youngstock with your veterinary surgeon.
- Disinfect the calf's navel as soon as possible after birth - preferably within a few minutes.
- Provide 10% of birth weight of good quality colostrum within the first 6 hours after birth - colostrum from vaccinated dams can help to prevent viral causes of scour.
- Maintain high levels of hygiene within the calving pen and calf rearing accommodation to limit the spread of infection - clean bedding, feeding buckets/ equipment and water drinkers are vital.
- Isolate calves as soon they are observed showing signs of ill-health.
- Monitor the environmental conditions within the rearing accommodation to ensure that there is sufficient ventilation to provide clean, fresh air whilst avoiding extreme temperature fluctuations and drafts at animal level.
- Provide clean, easily accessible drinking water.
- Feed adequate amounts of high quality calf milk replacer and concentrates - monitor feed intake to identify any animals that may have a depressed appetite.
- Record incidences of ill health and treatments provided to identify patterns within individual or groups of calves.

Antibiotic usage

Reducing the use of unnecessary antibiotic administration is of key importance within replacement dairy heifer systems to help prevent the development of antimicrobial resistance (AMR). Antibiotics can be very effective for certain types of ill-health and should be used when required, but their application needs to be targeted, and they shouldn't be used to compensate for poor management practices. Minimising disease on your farm will help reduce reliance on antibiotics and will also improve overall animal productivity. Improving farm husbandry practices can help to improve overall animal health and this can be done by:

- Ensuring adequate immunity by feeding an adequate amount of good quality colostrum (Brix score >22%) within 2 hours of birth.
- Ensuring appropriate nutrition for the life stage and environment of the animal.
- Minimise animal stress - don't introduce numerous stressors at once.
- Minimise potential exposure to pathogens by developing specific management and hygiene protocols.
- Provide good housing that will ensure adequate ventilation without draughts at calf height - this will also help to remove moisture from the house which will reduce the impact of cold weather.
- Develop a health and vaccination plan with your vet to ensure that animals are protected before the greatest period of risk or challenge.
- And remember - only use antibiotics when necessary.

Routine management procedures

A number of routine management procedures are carried out during the first 3 months of life. It is important to consider when these are carried out as they can cause stress and pain which can impact on calf health, growth and well-being. Following guidelines from quality assurance schemes as well as discussing routine procedures with your vet can help to ensure that they are carried out properly with minimum impact to the calf. Below are the guidelines from the Red Tractor Standards for Dairy Cattle 2021.

PROCEDURE/METHOD			CONDITIONS OF USE		
		Animal Age	Operator	Anaesthetic	Analgesic
Castration	Elastration/Rubber Ring	1st week of life only	Competent stock person		
	Clamp/Bloodless	Up to 2 months	Competent stock person		With
	Other Method	Up to 2 months	Competent stock person	With	With
	When animal is over 2 months of age	Over 2 months	Vet only	With	With
Disbudding	Chemical Cauterisation	1st week of life only	Competent stock person		With
	Other method than above e.g. hot iron	Up to 2 months	Competent stock person	With	With
Dehorning	Cutting/sawing horn (must not be used routinely)	Up to 5 months	Competent stock person	With	With
Removal of Supermumerary Teats	Using clean, sharp scissors	Over 5 months	Vet only		
		Up to 3 months	Competent stock person	With	With
		Over 3 months	Vet only		

Routine tail docking of cattle is not permitted

Key messages (0-3 months)

- Provide calves with 3-4L good quality colostrum (Brix score >22%) within 2 hours of birth - make sure feeding equipment is clean as any bacteria will go straight to the gut.
- Feed calves at least 15% body weight milk or milk replacer to provide enough energy for maintenance and growth - use a gradual weaning plan over 10-14 days to encourage consumption of solid feed and reduce likelihood of post wean weight loss.
- Starter feed, forage source and clean drinking water need to be provided from birth to facilitate rumen development - make sure these are fresh on a daily basis.
- Monitor growth at regular intervals to keep on target.



- Assess your calf housing - calves should be housed in a clean, warm, dry and well-ventilated environment to improve feed utilisation and health.
- Set up protocols for hygiene management to ensure regular cleaning, disinfecting and drying of feeding equipment and calf housing - this will reduce bacterial load in the environment and help limit the spread of disease.
- Work with your vet to develop herd health and vaccination plans so that animals are protected before key risk periods and to limit unnecessary antibiotic usage.

Managing the post-wean heifer (4-12 months)

Life stage	Focus areas	Growth target	Target % mature weight by end of life stage
0-3 months	Colostrum, milk feeding, rumen development, weaning	0.7-0.8 kg/day	17% mature weight
4-12 months	Growth targets, grazing	0.7-0.8 kg/day	50% mature weight
13-15 months	Heat checks and mating	0.7-0.8 kg/day	55% mature body weight
16-24 months	Monitor growth and BCS, mixing heifers into milking herd, pre-calving minerals	0.7-0.8 kg/day	90% mature body weight

Target body weight for each life stage (based on mature weight of 650kg). In addition to weighing calves at birth you should measure as regularly as possible at:

- Weaning.
- One-two weeks post weaning.
- 6 months of age.
- 12 months of age.
- At breeding.

Weighing at 6 and 12 months gives time you time to make sure any corrective actions can be taken prior to breeding.



Age (Months)	Stage	Body weight %	Mature weight %
0	Birth	40	6
1		52	8
2	Weaning	75	12
3	Post-weaning	110	17
6		175	27
9	Puberty	260	40
12		325	50
14	Pre-breeding	358	55
24	Pre-calving	585	90
MW	Adulthood	650	100

Post-wean nutrition and growth

In the period immediately following weaning, calves should remain on their starter ration until they reach approximately 10-14 weeks of age before transitioning to a grower ration (16% CP on a dry matter basis at a rate of ~1.5-2kg/head/day). At this point they should be consuming 2.5-5kg of feed per day. Appropriate post-weaning nutrition relies on supplying sufficient metabolisable protein to facilitate muscle weight gain whilst avoiding excessive energy to ensure that heifers do not become overfat as this can affect fertility. If the aim is for heifers to calve at 24 months of age, then heifers need to reach a target weight (55-60% of mature body weight) to start breeding at 13-15 months of age. If the weaning weight, breeding weight and a goal age for breeding are known then an appropriate growth rate and corresponding dietary requirements can be calculated. For example, if a heifer has a mature bodyweight of 600 kg and is weaned at 80 kg at 2 months of age, to reach 55-60% of mature bodyweight at breeding (330-360 kg at 13 months) she needs to gain between 0.75-0.84 kg/day. Regularly monitoring heifer live weight between 4-12 months of age will mean heifers behind target can be identified and provided with the appropriate diet containing sufficient nutrient quantities to meet maintenance energy and protein requirements in addition to supporting the correct ADG required to achieve live weight at first service. Feeding heifers to attain a live-weight gain of 0.8 kg/day is recommended.

Grazing the young heifer

Calves are selective grazers meaning that maintaining a high quality sward is vital to maximise performance. Grass quality should be monitored throughout the season and should ideally not fall below 10.5MJ/kg if growth targets are to be met. There are several grazing options but monitoring grass growth and utilisation is key to system costs and efficiency throughout heifer rearing process.

Set stocking provides calves with unrestricted access to a large area of grass throughout the season. This is a low maintenance system with low input costs and can work if sward height is managed. Rotational grazing requires closer monitoring of forage supply and investment in fencing but can result in higher productivity as animals are moved around a number of small paddocks based on sward height and cover. In a rotational system, paddocks have time to rest and recover and a more consistent sward height can be maintained which can extend the grazing season period. Where older heifers are grazing the same area, a leader-follower system should be implemented to allow younger animals into a paddock or strip before the older heifers. This system allows younger animals to access the best quality sward and helps them to avoid picking up intestinal parasites whilst ensuring paddocks are grazed out.

Spring born calves shouldn't be put out to grass until they are strong enough and the weather is milder and more settled - calves should usually be around 12 weeks of age before being put out to grass. Young calves should be regularly monitored for signs of ill-thrift and ill-health and should be provided with concentrates for at least one month after turn out. The amount of concentrates fed will depend on the size and age of the calves alongside the quality and availability of grass but allocating about 1 kg/head/day is sufficient. Aside from the first week or so after spring turnout, autumn born calves generally do not require any concentrates, however providing extra concentrate feed can be useful to maintain calf growth rates during periods of bad weather or restricted grass growth. Generally, pasture allowances of 2.4% of bodyweight offer the optimal balance between grass utilisation and animal performance. Pre- and post-grazing heights of 2500 and 1500 kg DM/ha, respectively, should be targeted.



Top tips for grazing

- Grass quality should not be below 10.5MJ/kg if growth targets are to be met.
- Spring born calves should be of sufficient age and size before turnout and will need concentrates for at least 1 month after turnout.
- Rotational grazing systems offer a good balance between grass utilisation and animal growth - measure your grass and allocate ~2.4% body weight.
- Graze swards at the 3-leaf stage which is equivalent to a pre-grazing sward height of 2500 kg DM/ha.
- Target post grazing height should be 1500-1700 kgDM/ha, depending on ground conditions kg DM/ha or 4cm.
- Older heifers can be used to ensure post grazing targets are met without damaging re-growth.
- Move heifers ~ every 3 days to prevent back grazing of new swards.
- Fresh water is essential - make sure it is available at all times in every paddock.
- Concentrate feeding may be required in periods of bad weather, restricted grass growth or poor quality sward.
- Shelter may be required for young calves in poor weather.
- Regular weighing and monitoring of animal health is essential - having a mobile weigh scale for outfarms or routinely weighing at worming or dosing is the only way to access growth performance.

Worm control

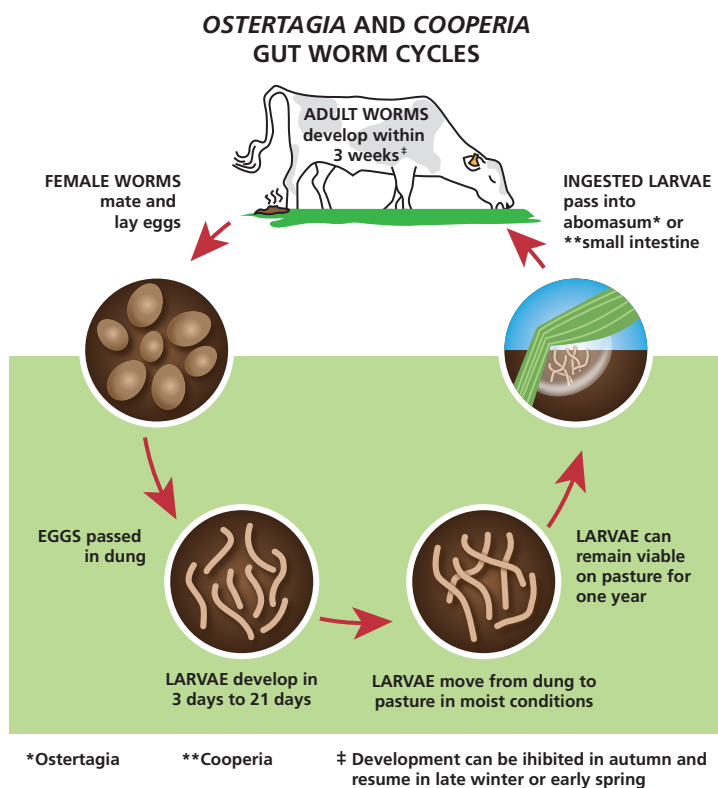
Gastrointestinal (GI) roundworm and fluke infections can have a considerable economic impact, as well as implications for the growth, productivity and welfare of cattle. Resistance to all classes of broad-spectrum anti-nematode anthelmintics and some flukicides are common. This places increased importance on implementing a control programme which uses diagnostics to inform treatment decisions, and management practices to lower contamination of the environment.

Infection with gutworms such as *Ostertagia ostertagi* and *Cooperia oncophora* (types of roundworm) causes Parasitic Gastroenteritis (PGE). This disease is most commonly found in first season grazing calves as they have not yet developed immunity and have the potential to ingest large numbers of overwintered larvae when introduced to pasture. Even when worm challenge is low, PGE can reduce growth rate in youngstock by around 30%, making it difficult to achieve target growth rates. Other signs of *Ostertagia ostertagi* infection can be loss of appetite, loss of body condition and scour.

Cattle do acquire immunity when exposed to roundworms, however, this can take a considerable length of time, particularly for *Ostertagia ostertagi* which can take up to two grazing seasons. Immunity can only develop when cattle graze pasture, however, it must be remembered that immunity is never complete and cattle of all ages can still have worms.

If young calves are never exposed to pasture, they will be parasite-naïve when they are grazed the following spring.

In order to make the most effective use of cattle wormers, it's important to work alongside your vet to develop a herd health plan for your farm. Remember the importance of treating the **RIGHT ANIMAL**, using the **RIGHT PRODUCT**, at the **RIGHT TIME**, with the **RIGHT DOSE RATE** in the **RIGHT WAY**. Additionally, using diagnostic tests such as faecal egg counts can help to provide useful information on infection burden throughout the grazing season.



Key messages (4-12 months)

- Calves should remain on their starter ration until they reach approximately 10-14 weeks of age before transitioning to a grower ration (16% CP on a dry matter basis at a rate of ~1.5-2kg/head/day).
- Good quality forage should be provided - monitoring forage quality is helpful to ensure calves are being provided with sufficient energy for growth.
- To calve at 24 months of age heifers need to reach a target weight (55-60% of mature body weight) to start breeding between 13-15 months of age.
- Weigh your heifers at 6 and 12 months to ensure they are on target for breeding - this will give time for corrective actions.
- Operating a rotational grazing platform helps to ensure that calves get the highest quality grass available - pasture allowances of 2.4% of bodyweight offer the optimal balance between grass utilisation and animal performance.
- Target pre- and post-grazing sward heights of 2500 kg DM/ha and 1500 kg DM/ha.
- Spring born calves should be at least 12 weeks of age before turnout and should receive ~1 kg/hd concentrate for at least the first month after turnout.
- Discuss worm control with your vet to ensure the right animals are dosed at the right time with the right product.

Managing the breeding heifer (13-15 months)

Life stage	Focus areas	Growth target	Target weight by end of life stage
0-3 months	Colostrum, milk feeding, rumen development, weaning	0.7-0.8 kg/day	>100 Kg
4-12 months	Growth targets, grazing	0.7-0.8 kg/day	>250 kg
13-15 months	Heat checks and mating	0.7-0.8 kg/day	350 kg (55% mature body weight)
16-24 months	Monitor growth and BCS, mixing heifers into milking herd, pre-calving minerals	0.7-0.8 kg/day	570 kg (90% mature body weight)

Importance of being at target growth and body condition score

Often in a farm business once heifers are weaned they can be unintentionally forgotten about when put out to grass or moved away from the main farm. However a structured protocol for monitoring weight gain and body condition score in heifers is vital on the run up to bulling so they can be served at the ideal time.

To achieve target calving at 22-24 months heifers need to be served between 13-15 months of age when they are 55-60% of their mature body weight. For this to happen nutritional requirements must be sufficient to ensure a growth rate of 0.8kg daily liveweight gain and a body condition score (BCS) of 2.5/3.0. Serving heifers which are too low in liveweight or BCS has shown to reduce fertility percentage and promote increased calving difficulties. On the other hand, serving heifers which are carrying more body condition has an increased risk of dystocia (a harder calving). This is usually seen when 'catch up' feeding is introduced to increase heifer size once served or just before serving. These over conditioned heifers do not meet target growth and consequently show little improvement in milk yield when calved. In targeting weights there are a few different methods that can be used. The most accurate method would be to take weight recordings and the second is to use a heifer weighband. The weighband is calibrated to assess the liveweight of replacement Holstein bred heifer through measuring the girth diameter. In April 2013 a survey of farmer attitudes determined the weighband viability - see table below.

Parameter			
Ease of weighband	77% easy and quick	23% not easy or quick	
Accuracy of weight	27% expected	55% heavier than expected	18% lighter than expected
Alter timing of serving on farm	67% changed		

On units where it is not possible to weigh heifers the most practical 'eye balling' management technique is to use wither height with a 'mark on the wall' approach. Although this is not the best measure of weight it has a place in accessing continuity of heifer condition. Attention to detail is the key in targeting heifer growth and weight at service. It does not matter which method is chosen to measure as long as it is done at regular intervals and the same method is used on each occasion. The table below shows the percentage of mature weight to target at different stages, using an average mature body weight of 650 kg.

Age	Stage	Consuming (kgDM grass)	Bodyweight (kg)	Wither height (cm)	Mature weight %
13-15 months	Breeding	8	390	115-125	55-60
24 months	calving	11	585	125-135	90

Summary targeting growth rates and BCS

- Serve on average between 13-15 months (55-60% of cows mature weight) to calve at between 22-24 months.
- Weigh to monitor growth and assess management practices.
- Prevention to minimise underperforming or sick animals as well.
- Maximising litres in later lactation.
- Lowering replacement rates consequently maximising return on your investment.

Intakes and nutrition

Poor nutrition and intakes reflect on heifers not reaching puberty in time to breed. However, if puberty is reached following a lower plane of nutrition and heifers are bred then the potential for a lower conception and higher pregnancy loss is increased. To reach 55-60% mature BW at 15 months nutrition must be on target between 4-12 months. Between 4 and 15 months of age heifers must be on a settled diet prior to service with good quality silage and between 1-2kg of grower concentrate to achieve a steady growth rate of 0.7kg/day. Feed space and stocking density greatly influence growth target achievements.

At grass

Issues to consider whilst grazing include how to monitor animal performance and setting up grazing systems to cope with difficult grazing conditions.

- Pre graze cover 3,000 kg DM/ha.
- Aim for Intakes of 2.5 % of body weight in dry matter (8.75 kg DM/head/day for 350 kg heifers will give 0.75kg/day live weight gain). 3% of the liveweight will give 0.82kg/d liveweight gain for post weaned heifers.

- Make time to weigh heifers at 13months then again at 15month - supplementary feeding may be needed to ensure the required weight for age targets are met.
- Turn out yearlings and older animals before younger calves.
- Animals not achieving target live weights should continue to be kept indoors for at least the early part of the grazing season.

Sire selection and replacements

Developing your herds potential starts with sire selection. The ability to use Artificial Insemination is the number one way for increasing genetic improvement in your herd. This will not only lower the risk associated with keeping a bull on farm, but increasing the ability in selecting superior sires within or across a breed. Knowing how many replacements you need is a key management factor. A successful replacement strategy requires preparation of selection criteria/indices to pick sires which will improve the productivity and profitability by estimating the genetic merit of both production and non production traits with corresponding economic values. With the use of genotyping the ability to generate quick genetic evaluations is accelerated. Indexes only offer different options for herd breeding goals but also impact how management can affect genetic expression of traits. Just because you breed for the low SCC does not mean your management practice lends itself to promote this trait. In theory a herd of 100 cows requires the rearing of 20 to 30 heifer replacements each year to have an average of 25% replacement rate. Being able to choose specific traits that fit the herds specific management alongside overarching farm aims is the first step. Fertility, longevity and health status are three of the most desired traits in most dairy herds. When selecting on fertility index it is worth remembering that for every 1 point increase you are decreasing calving interval by half a day and non return rates by 0.5%. Milk composition is becoming one of the more popular traits as farmers are seeing economic benefits of selecting of bulls with higher milk solids. Milk composition varies between breed with milk protein % and milk fat % notability different between breed; heritability of milk fat can range from 0.51-0.54%. Economic value of traits has historically been the driver for genetic selection with Profitable lifetime index (PLI) still the go to index if you want an all round summary of good production and health (Expressed on a lifetime basis and indicates extra margin an animal is expected to pass onto its progeny in its lifetime). In all systems sires must be selected on 'ease of calving' to reduce potential calving difficulties and minimise risks to cows. In theory selecting a sire is all about balance - a cow lives as long as needed whilst being healthy and a reduced risk of disease susceptibility whilst producing efficiently for as long as she is profitable.

Simple steps when selecting sires for your system

- Select bulls with a higher £PLI value than your best cow.
- Select fitness traits to maintain your strengths and address herd weaknesses (Fertility, Lifespan, etc.).
- Selected calving ease especially for maiden heifers.
- Selects for reduced maintenance cost.
- Match type to suit your herd.
- Use Sexed semen on heifers - speeds up genetic progress and cuts down on calving issues.
- Promote milk quality rather than volume.
- Improves udder and leg health.
- Places strong emphasis on fertility.
- Places strong emphasis on longevity.

Heat detection and accurate heat recording

As previously stated, AI will provide greater scope for selection and genetic improvement in the dairy herd, but it requires a higher level of skill in heat detection. The ability to have automated heat detection aids gives a higher management control of your herd and so allowing more efficient and effective decisions to be made. Other than automated heat detection by tags or collars, visual heat detection is another option but requires more time to walk heifers. Detection aids such as tail paint and patches that are based on mounting behaviour are used most commonly used for this. For aids applied to the tail to be most effective, it is essential that they are checked and maintained daily to reduce the number of false-positive and false-negative heats. Costly mistakes commonly made on farm without heat detection aids are missed heats and miswritten dates and cow numbers. The best heat detection programmes start with careful planning, good observation and stockmanship alongside, the effective use of detection aids.

Things to remember when selecting heat detection aids

1. Select a method of heat detection which suits your heifer management on farm.
2. Inadequate heat detection affects profitability - £2.47/head/day for every day over 24 months not calved down.
3. Undetected heats result in older heifers to calve down - number of non milking heifers on the farm increases.
4. Missed heats and low conception rates may lead to higher culling for fertility.
5. A clear understanding of heat detection systems ensures the highest accuracy in heat detection programmes. Heat detection targets of heifers eligible for insemination, should be at least 75%+ detected and submitted for insemination.

AI programmes and sexed semen

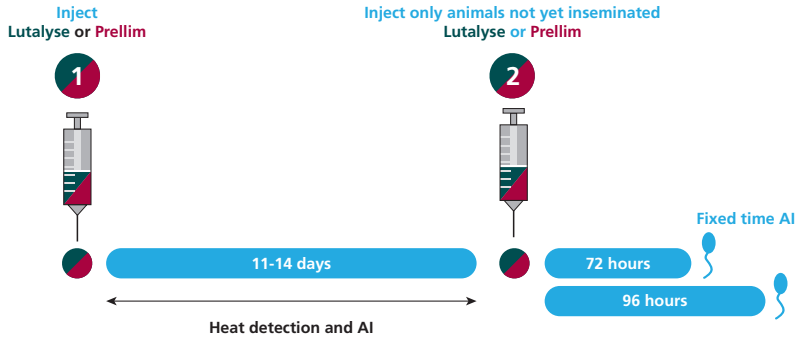
Traditionally cows and heifers are inseminated 12 hours after they first show signs of heat - those seen on heat at night are usually bred first thing in the morning whilst those seen in the morning are bred that evening. However there are now management techniques adopted between optimal timing with sexed and conventional semen which add to their success. Due to the sorting process for sexed semen the overall viability is shortened. What this means is where conventional semen has the ability to get the animal pregnant in a time frame usually greater than 24 hours, sexed semen has the ability to do this in only a 12 hour window. Therefore, the timing of serving using sexed semen is more important than if using conventional semen straws.

AI protocols

There are various AI protocols available but the most common is to use injections of prostaglandin and then serve based on heats shown for the next 14 days (typically heats shown 2-5 days). If no heats are shown, then a second injection is given 10 days after the first injection and the heifer served when heats are expressed. If heifers are not cycling, then a progesterone releasing device programme would be best. Providing heifer is mature enough to programme, this allows you to synchronise the heifer to a controlled breeding cycle as noted below:

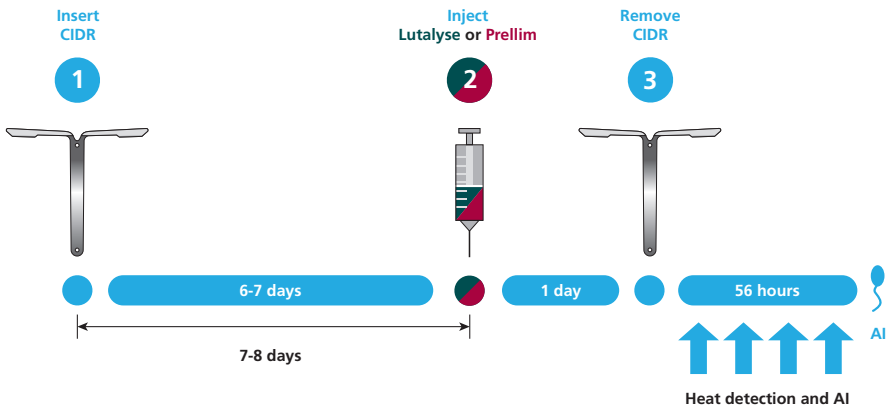
Prostaglandin programme for cycling animals

This straightforward protocol with heat detection and follow up AI for cycling heifers reduces animal handlings and improves the number of heifers served in a given time period.



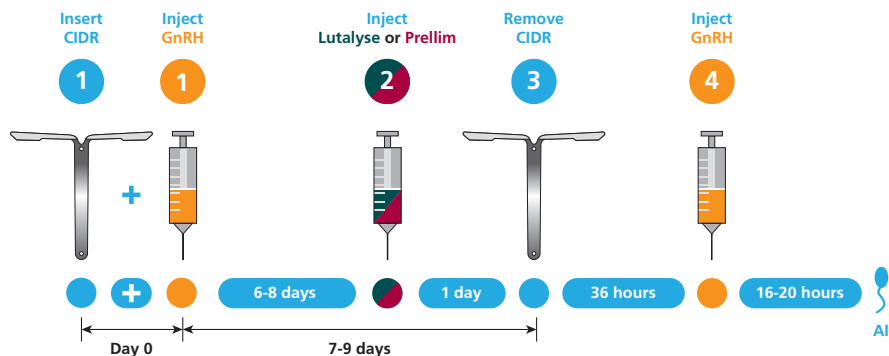
CIDR Programme for cycling animals

The combination of heat detection after CIDR removal with a 'finishing' FTAI at 56 hours optimises the use of resources and maximises submission rates.



CIDR Sync for cycling and non cycling animals

This programme provides highly precise synchronisation of ovulation, especially useful in embryo transfer programmes or when performing insemination with sexed semen. Non-cycling animals are likely to have their natural cyclicity corrected to enable successful breeding at this service or in subsequent cycles.



The best indicator of fertility performance in a herd is the pregnancy rate. Pregnancy rate is calculated as the percentage of eligible cows that become pregnant in a 21-day period. A cow doesn't become eligible for breeding until the voluntary waiting period (VWP) has finished.

Take home messages for AI programmes and serving

- Plan ahead, identifying replacement heifers early so that they can reach their target service weight.
- Discuss with your vet the most suitable synchronisation protocol and if using AI, also discuss with your AI technician.
- Programming heifers will ultimately tighten the calving pattern which in turn can minimise stress when introducing heifer groups into the milking herd.
- Conception rate general rule of thumb is 70% if conventional semen is used and 60% for sexed (when using a heat detection aid).
- Synchronising heifers has the added advantage in giving the precise ability to serve a group of heifers at one time and have a uniform group.
- If synchronising have good handling facilities and set up adequate calving pens for larger numbers.

Genomics

Genomic testing replacement heifers gives the ability to build up a reference for your herd. This data generated is the DNA information of sires with a high reliability daughter-based proof from which you will breed from. Being able to identify the heifers with the best genetics is costly but invaluable as it helps accelerate the genetic potential of your herd. If breeding top heifers to best bulls then accuracy rates of 70% will pay off.

Housing and good animal handling

As with dairy cows, if heifers are to be in cubicles there should always be at least 5% more cubicles than animals. Overcrowding leads to more bullying with the increased potential for injuries and also reduced lying times and increased lameness, which then becomes problematic in adult life. Although feeding maybe be ad lib there must be sufficient space allowance to permit adequate feeding behaviour, growth rate potential and lessen the risk of silent heats. Heifers accessing the feed barrier must have at a least 2m pass width behind them.

Weight of animal (kg)	Width of feed space (m)
<100	0.30
100-199	0.35
200-299	0.40
300	0.50

Adequate Water availability should allow 10% of the group to drink at any one time.

Cubicle size and dimensions

Recommendation taken from Red Tractor Minimum Requirements. Cubicles are determined by animal size and can range between breeds.

Liveweight (kg)	Dimensions (m)	
	Length	Width
200	145	0.7
300	170	0.85
350	205	1.05
>350	210	1.10

Group housing can be seen as an effective cost reducing measure to house heifers.

In this environment heifers must have the ability to lie down simultaneously, rise, turn around and stretch without difficulty. Recommended space allowances are outlined below.

	Space allowance (m2/head)		
	Solid floors		Fully slatted
Liveweight (kg)	Bedded	Including bedded, feeding & loafing area	
200-299	2.0	3.0	1.1
300-399	2.75	3.95	1.5
400-499	3.50	4.90	1.8
500-599	4.25	5.85	2.1
600-699	5.0	6.80	2.3

Managing the in-calf heifer (16-24 months)

Life stage	Focus areas	Growth target	Target weight by end of life stage
0-3 months	Colostrum, milk feeding, rumen development, weaning	0.7-0.8 kg/day	>100 Kg
4-12 months	Growth targets, grazing	0.7-0.8 kg/day	>250 kg
13-15 months	Heat checks and mating	0.7-0.8 kg/day	350 kg (55% mature body weight)
16-24 months	Monitor growth and BCS, mixing heifers into milking herd, pre-calving minerals	0.7-0.8 kg/day	570 kg (90% mature body weight)

Diet for appropriate growth and BCS

As heifers approach calving at 24 months, they should be 90% of their mature cow weight.

The optimal body condition score (BCS) at the point of calving is 2.75-3.00.

Animals should be fed accordingly, so they are fit, but not fat at calving. Typical diets for heifers 16-20 months will contain grass silage (28-32kg fresh), energy MJ (92-104MJ) and protein 11-13%.

Depending on breed and mature cow weight, the target daily live weight gain for heifers is 0.75-0.80 kg per day. If the heifer has exceeded her target weight at breeding, her required DLWG may reduce between breeding and calving.

Insufficient maternal nutrition has been shown to impact calf development, producing calves with lower birth weights and with a greater chance of mortality.

To prevent early embryo loss, it is recommended that the management of heifers and their nutrition remains constant for at least six weeks after the breeding season ends.

Heifers calving with low BCS have been shown to be more likely to have difficulties calving, have an increased post-partum interval, reduced rebreeding success and poorer colostrum quantity and quality.

The BovIS Growth rate calculator

Implementing calving at between 22-24 months on your farm means your heifers must meet certain growth milestones to be ready for breeding at 13-15 months, and you must provide sufficient nutrition to support the growth of both the heifer and her unborn calf. To help you to achieve this, the Agri food and Biosciences Institute with support from DAERA and CAFRE have developed a free online Growth Rate Calculator. The tool generates a list of breeding heifers on your farm and allows you to compare their growth to expected targets.

Simply enter the animals weight and the date the animal was weighed. The tool will then give you the heifers target weight, tell you whether she was on target, and provide a target weight for three months' time. Of course, knowing what the target is and hitting the target are two different things. That is why the tool allows you to provide the quality of the silage you are feeding and calculates the intake required at both a group and individual level. The tool will also indicate whether your silage quality is sufficient for the heifers to hit their targets. The tool stores each weight recorded for each heifer; this means you can track her performance throughout her life. The Growth Rate Calculator is available for free through your government gateway account, by clicking "BovIS" then "Bovine Growth Rate Calculator". For more information on the Growth Monitoring Tool, you can ask your CAFRE advisor or email the BovIS team at bovis.administrator@afbini.gov.uk

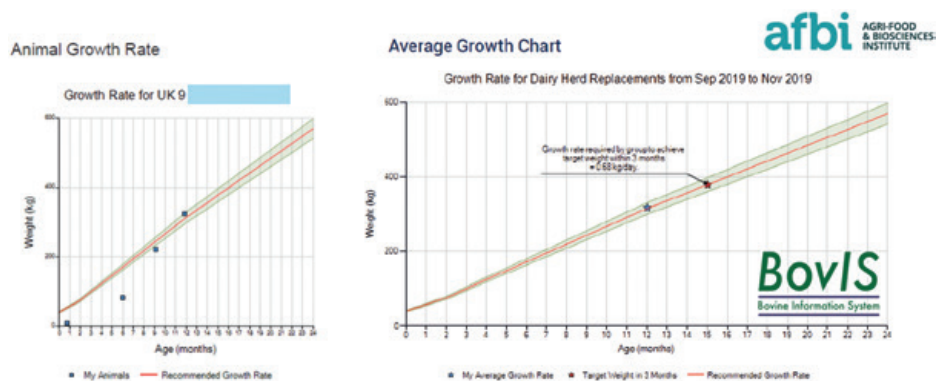


Figure 1: The growth rates of animals is shown at both an individual level (left) and a group level (right), allowing you to tailor management at either group or individual level

Second grazing season

In-calf heifers grazed in a well-managed, rotational grazing system have been shown to be able to achieve target daily liveweight gain (DLWG), without the requirement of concentrates.

Over feeding in-calf heifers will increase BCS and increase the risk of problems at calving. However feeding supplementary concentrate strategically will help when weather conditions are less favourable.

Best practice grazing targets apply, with target pre grazing covers of 3,000 kg DM/ha and residuals of between 1500-1700 kg DM/ha where conditions allow, in a 21 day rotation in mid-season.

Weigh and body condition score BCS heifers regularly to ensure they are on target.

Fly control is important to monitor, to avoid issues of summer mastitis.

Pre-calving minerals

The diet of the heifer in the run up to calving is key to helping to reduce ill-health at the start of her first lactation, including subclinical milk fever and retained cleansings.

Heifers should be supplemented with minerals between 6-8 weeks pre-calving, to ensure a good reserve of minerals are built up before calving.

The mineral status of forages can significantly vary year on year. Test the forage in animals' diet to determine its mineral status and balance the mineral supplement accordingly.

Housing

Feed space

- Sufficient feed space is important to allow all animals to feed simultaneously. Even though feed may be available for the majority of the time, peak periods for feeding such as when feed is just put down, will cause subordinate heifers to give way to more dominant heifers. Reducing potential DMI as it changed feeding behaviour and can alter BCS and growth rates.
- Water trough space should be provided for at least 10% of the group to drink at any one time.
- Loafing areas are areas separate from lying, passageway and feeding areas that allow animals freedom to express normal behaviours, including grooming and heat expression. Incorporation of loafing areas for in-calf heifers can reduce bullying and stress within the group.



Weight of animal (kg)	Width of feed space (m)
< 100	0.3
100-199	0.35
200-299	0.40
300	0.50

Ventilation

- A continual supply of fresh air is essential in preventing diseases, especially respiratory diseases, and improving production.
- Good ventilation removes stale, damp air which helps ensure that viruses and bacteria cannot survive for long outside the animal.
- Natural ventilation is the most efficient and least expensive system for providing an optimum environment within a building.

Cubicles

- Cubicle size should be designed for the size of the animal at the end of the housing period.

- Cubicle length is dependent on the size of the animal. Dimensions for a 500kg should be approximately 1.10m wide, 2.4m long (against a wall) and 2.25m long (head to head).

Weight (kg)	300	400	500
Width (m)	0.85	0.95	1.10
Length - against wall (m)	1.95	2.15	2.4
Length - head to head (m)	1.8	2.0	2.25

There should be 5% more cubicles than animals to increase lying times and reduce bullying and associated injuries.

Key points to maintain a clean environment are:

- regularly clean out and disinfect calving pens between calving's.
- have enough calving pens based on the calving profile to clean and rest pens.
- have a hot water source close by for the quick and easy washing of calving, milking and feeding equipment.
- provide good access to a clean water supply for the fresh calved animal.
- ensure sufficient clean straw is provided if using a bare concrete floor.

Integration of heifers into milking herd

Joining the milking herd can be a very stressful experience for a heifer, as they establish their place in the social hierarchy of the herd. Putting heifers through the parlour pre-calving and getting them used to the sights, sounds and meal feeding is good practice. Heifers should be introduced into the milking herd after evening milking if possible. Research shows they are more likely to lie down, compared to after morning milking. Some may only lie for 2-3 hours/day at this stage if put in with a large group of cows.

The advice on when to mix heifers and cows is not conclusive, (probably depends on whether they will be mixed after calving or not). If kept separate after calving, then best to keep them separate before calving and vice versa.

It is important to monitor somatic cell counts of heifers post calving. If 10% or more are calving in with somatic cell counts over 200, the pre-calving management needs to be re-assessed. (Heifers somatic cell counts should generally be less than 100 post calving).

Remember, heifers post calving are still growing and need to be fed accordingly. At Greenmount, once a calved heifer enters the milk herd, the maintenance+ figure for heifers is usually kept 2-3 litres lower than cows to allow for continued growth.

Vaccination

As these in-calf animals are soon to join the milking herd it is important that all vaccinations are up to date. At Greenmount Campus, in-calf heifers get booster vaccines at the same time as the main milking herd: leptospirosis - April, BVD - October, IBR - September and March, Salmonella - January/February. In-calf heifer also get rotavac approximately 2 months pre-calving as a defence against calf scour.

Footbathing

Heifers can be carriers of digital dermatitis so should have regular footbathing pre calving. At CAFRE a footbath at the crossovers between the feed passage and cubicles in the dry cow shed is a handy way to accomplish this.

The average age at which Digital Dermatitis (DD) is seen in youngstock is 12 months. As this is an average figure, some animals become infected at a very young age. Heifers are particularly sensitive to DD. To date, no immunity to it has been shown and unless infectious lameness is controlled in dairy heifers, they will act as a source of infection when they enter the main herd. Foot bathing heifers may seem an extra chore when time and resources are short, but it is important to keep DD levels under control. As a rough guide, if more than 10% of heifers are affected with DD, then foot bathing should be done at least 2 or 3 times a week. With 1 heifer pass equating to 1 litre volume in the footbath (200 litre footbath ~ 200 passes).

Preparation before calving

Calving is another key time to try and reduce stress on the heifer.

Having the correct facilities in place will help to reduce the time required to complete the task, improve the safety of the task and minimise the stress on the animal and the stockperson. Good facilities should allow the stock person to:

- Separate the animal and move her to the calving area unassisted.
- Appropriately and safely restrain the animal to be examined.
- Harvest colostrum and feed the new born calf safely.

Calving is a time when both the heifer and the new born calf are especially susceptible to disease due to lowered immunity. Cleanliness is key to minimise disease build up and transmission.

Summary

	0-3 months	4-12 months	13-15 months	16-24 months																															
Housing	Calves need to be in deep, dry straw bedding.	Good ventilation is key - especially if housing contains animals of different age range.	In cubicles there should always be at least 5% more cubicles than animals.	Good ventilation removes stale, damp air which helps ensure that viruses and bacteria cannot survive.																															
	Needs to be inlet of fresh air and outlet to remove stale air without draughts.	Allow sufficient airspace for circulation of air - do not overstock houses.	Although feeding maybe be ad lib there must be sufficient space allowance.	Cubical dimensions for a 500kg in calf heifer should be approximately 1.10m wide, 2.4m long (against a wall) and 2.25m long (head to head).																															
	Avoid shared airspace with older animals.	Ensure floor area is well drained and kept clean.	Weight of animal (kg) Width of feed face (m):																																
	Good drainage is essential - aim is for floors to be dry.	Make sure feed and water troughs are positioned for ease of cleaning and to avoid contamination -ensure sufficient drinking and eating space.	<table><tr><th>kg</th><th>m</th></tr><tr><td><100</td><td>0.30</td></tr><tr><td>100-199</td><td>0.35</td></tr><tr><td>200-299</td><td>0.40</td></tr><tr><td>300</td><td>0.5</td></tr></table>	kg	m	<100	0.30	100-199	0.35	200-299	0.40	300	0.5																						
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Make a routine plan for cleaning housing, pens and equipment - hygiene is essential to minimise disease.	Check your cubicle size.	Cubicles are determined by animal size:																																	
	Incidence of respiratory disease linked to ventilation and air circulation in housed cattle.	<table><tr><th colspan="4">Weight (kg)</th></tr><tr><td>100</td><td>150</td><td>200</td><td>300</td></tr><tr><th colspan="4">Width (m)</th></tr><tr><td>0.55</td><td>0.6</td><td>0.7</td><td>1.10</td></tr><tr><th colspan="4">Length (m) (against wall)</th></tr><tr><td>1.5</td><td>1.6</td><td>1.7</td><td>1.95</td></tr><tr><th colspan="4">Length (m) (head to head)</th></tr><tr><td>1.4</td><td>1.5</td><td>1.6</td><td>1.8</td></tr></table>	Weight (kg)				100	150	200	300	Width (m)				0.55	0.6	0.7	1.10	Length (m) (against wall)				1.5	1.6	1.7	1.95	Length (m) (head to head)				1.4	1.5	1.6	1.8	
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		Design your calf house to allow easy management practices.																																	

	0-3 months	4-12 months	13-15 months	16-24 months
Feeding	<p>Target minimum of 15% bodyweight in whole milk or CMR e.g. 750-900g CMR or 6L whole milk.</p> <p>Provide small amounts of concentrate and chopped straw on a daily basis from birth.</p> <p>Provide fresh drinking water on a daily basis from birth.</p> <p>Clean feeding equipment on a daily basis.</p>	<p>Move to a 16% protein concentrate ration.</p> <p>If housed, feed high quality forage (e.g. 11 ME/12 CP grass silage).</p> <p>Make a grazing plan. Measure your grass and budget accordingly. Monitor growth to ensure energy demands are being met.</p>	<p>Poor nutrition and intakes reflect on heifers not reaching puberty in time to breed and/or a lower conception and higher pregnancy loss is increased.</p> <p>To calve down at 24 months your heifers must be served when they are 55-60% (650kg Mature BW).</p> <p>Settled diet prior to service - good quality silage and between 1-2kg of grower concentrate to achieve a steady growth rate of 0.7kg/day.</p> <p>At grass - intakes of DMI 2% of liveweight will give 0.75kg/day live weight gain. 3% of the liveweight will give 0.82kg/d liveweight gain for post weaned heifers.</p>	<p>As heifers approach calving at 24 months, they should be 90% of their mature cow weight.</p> <p>Target daily live weight gain for heifers is 0.75 – 0.80 kg per day.</p> <p>Insufficient maternal nutrition impacts calf development.</p> <p>To prevent early embryo loss-nutrition remains constant for at least six weeks after breeding.</p> <p>Heifers should be supplemented with minerals between 6-8 weeks pre-calving.</p> <p>Test the forage in animals' diet to determine its mineral status.</p>

	0-3 months	4-12 months	13-15 months	16-24 months
Health	<p>Targets are:</p> <p><15% pneumonia (best units <5%)</p> <p><10% scour</p> <p><2% mortality</p> <p>Discuss vaccination programmes with your vet.</p>	<p>Time to discuss worm control with your vet - especially important in grazing animals.</p> <p>Monitor gut fill and signs of ill-thrift.</p>	<p>Monitor BCS and growth - prevention to minimise underperforming or sick animals.</p> <p>Pre breeding checks vital - detecting dirty and non cycling heifers.</p> <p>Minimise stress when grouping and breeding.</p>	<p>Over feeding in-calf heifers will increase BCS and increase the risk of problems at calving.</p> <p>The diet of the heifer in the run up to calving is key to helping to reduce ill-health at the start of her first lactation, including subclinical milk fever and retained cleansings.</p>
Key Targets	<p>Weight gain 0.6-0.8 kg/day in pre-wean period and >0.8 kg/day in post wean period.</p> <p>Calves should be consuming ~1kg/day of concentrate for several days prior to weaning.</p>	<p>Weigh your heifers at least monthly to make sure you'll meet target breeding weight.</p> <p>Need to grow at ~0.8kg/day.</p> <p>Calves should be 27% of mature bodyweight at 6 months and 55% at 14 months.</p> <p>Grazing - Quality a must.</p>	<p>Make time to weigh heifers at 13months then again at 15month -supplementary feeding may be needed to ensure the required weight for age targets are met.</p> <p>Turn out yearlings and older animals before younger calves.</p> <p>Animals not achieving target live weights should continue to be kept indoors for at least the early part of the grazing season.</p> <p>Heat detection aids-vital - missed heats and low conception rates lead to high culling and infertility.</p>	<p>Joining the milking herd can be a very stressful experience for a heifer- Putting heifers through the parlour pre-calving and getting them used to the sights, sounds and meal feeding is good practice.</p> <p>Heifers should be introduced into the milking herd after evening milking if possible.</p>

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