

Dairy beef production systems



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Introduction

Approximately half of all beef in England is a product of the dairy herd. Surplus dairy-bred male calves can prove to be a useful option for farmers looking to source animals to rear and finish. However, producing good-quality beef from male dairy cattle needs careful management but is possible for those with the resources and skills to do so. There is a fine line between profit and loss when finishing black and white cattle.

Identifying a target market is the key to successful cattle finishing, as is building relationships with customers. Then the task is to produce cattle to meet their specific needs as cost-effectively as possible. There are other elements to get right too, such as avoiding price penalties due to poor handling or health, presenting clean animals and hitting the right specification for conformation, fat class and weight.

It is essential to source cattle that have received adequate colostrum and are healthy as they will achieve greater growth rates and require less veterinary intervention. Adequate nutrition and housing throughout all stages of life are important to produce cattle that meet market specification.

Success depends on running a system that suits the animals, the farm and the customer's requirements. As with any livestock farming enterprise, it is wise to secure a market and carry out budgets to check financial feasibility before starting, then monitoring performance as the animals grow.

The way dairy-bred beef cattle can be managed is wide and varied. This manual gives an overview of systems to consider, with their advantages and disadvantages, along with helpful hints on potential health issues and guidance on preparing and selecting animals for slaughter.



Sarah Pick
Knowledge Exchange
Programme Manager

Summary of dairy beef systems

Production systems for dairy male calves range from specialist veal and young beef systems to extensive, forage-based systems. Entire males can be finished relatively quickly and should be slaughtered before they are 16 months of age to ensure meat-eating quality. Alternatively, steers and heifers can be grown more slowly, finishing between 18 to 24 months of age.

See Table 1 for an overview of the different systems – these figures are a guide only and will vary depending on the target market. If entering into a contract, there will be a strict criteria for slaughter age and a maximum carcase weight, which may differ from the ranges in the table.

Veal

Veal is legally defined as the meat from cattle aged less than eight months old at slaughter. All RSPCA-labelled veal is rosé veal – meat from calves over the age of six months that must have had fibre included in their diet and hence the darker colour of the meat compared with calves who have only been fed on milk (white veal). White veal only makes up a small proportion of the UK market (~5%) and is more popular on the continent.

Before setting up a veal operation, it is important to secure a market outlet and to work out the likely costs of production. When the market price for beef is high, you may get a greater financial return by keeping animals longer and finishing them heavier. Try to find a market for the whole carcase, not just the premium cuts. Castration is not necessary.

Bulls or steers?

There are advantages and disadvantages of both options. Bulls tend to have superior feed conversion efficiency compared with castrated animals, due to the testosterone in their bodies. They also produce leaner carcases with a higher yield of edible meat in a shorter time than steers. However, producing bull beef is a specialist enterprise and requires higher fixed and variable inputs. Steer production can be more flexible, utilise grazing land and be easier to manage.

Given the inherent poorer conformation of this type of cattle, a finishing period with a fast rate of gain is advisable, not only to ensure the target fat classification is met but to help conformation classification as well.

Table 1. System overview

System	Rosé veal	Veal	Continental X dairy bulls	Pure dairy bulls	Holstein/native* X dairy steer/heifer semi-extensive
Growth rate (kg/d)	1.2–1.4	1.0–1.2	>1.4	>1.3	>0.8
Slaughter age (months)	6–8	10	13–14	13–14	18–24
Carcase weight (kg)	130–215	220	330–350	270–320	235–340

*For example, Hereford or Angus



Above 550 kg liveweight, daily gain of dairy bulls starts to decline, and with intake continuing to increase, the decline in efficiency is considerable.

Work in Northern Ireland has shown that Holstein steers consume 9% more feed than other beef-cross dairy breeds and have higher feed costs per kg carcase gain. However, due to their lower calf price, they can produce a similar margin over feed to beef-cross Holstein steers.

Finding an outlet

There are various ways of selling finished cattle: liveweight, deadweight, via marketing groups or through an integrated scheme on contract. You need to assess which best suits you and your system.

Key considerations before entering a contract scheme

- Find out minimum contract price and calculate the potential margin by taking into consideration likely costs during the finishing period
- Understand required specification, along with any potential bonus payments or factors which may incur deductions
- Understand if there are any specific husbandry obligations as part of the agreement

It is important that a clearly defined system is decided on before any calf is purchased and the key performance targets identified and monitored.

Do not produce a batch of finished cattle before finding a market for them. It is far better to identify a market or customer first and then produce animals to suit their specific needs.

Deciding on a system for your farm

Each system requires slightly different management, which comes with advantages and disadvantages.

13–15-month bulls (fed cereal based ration)

Advantages

- High throughput of cattle
- Easy to control and monitor
- Fast growth and early finishing reduces feed cost per kg gain

Disadvantages

- Rations may be relatively high cost per tonne
- Safety risk – adequate housing, handling and management policies must be in place for handling bulls
- Little room for slippage in growth targets due to disease challenge, variable feed quality, stress, etc.

14–16-month bulls (fed cereals and silage)

Advantages

- Potential to save feed costs by including home-grown forages
- Relatively high cattle throughput

Disadvantages

- Relies on producing high-quality forage
- Risks associated with keeping older bulls

18–19-month steers/heifers

Advantages

- Steers/heifers are easier to manage than bulls
- High degree of flexibility in terms of feeds that can be used
- Opportunity to maximise low-cost growth from pasture

Disadvantages

- Slower growth, so slower throughput than bulls
- Poorer carcase grading, due to poorer conformation than bulls

21–24-month steers/heifers

Advantages

- Good way to utilise poorer-quality land/and or home-grown forages
- Opportunity to maximise low-cost growth from pasture

Disadvantages

- Slow throughput of cattle – ties up working capital for a long time
- Two winters needed – increasing feed and production costs
- Feed cost per kg gain can be high even though daily feed costs look cheap



The type of system you choose also depends on:

1. What the customer wants and when the product is required – some customers do not buy bulls.
2. Availability and state of housing. Is it strong/secure enough for a group of bulls (maximum of 20 bulls per pen)? Bulls must be bedded up and fed from outside the pen to keep staff safe.

Any new livestock building must be designed specifically for livestock and not as a general-purpose building, as these often have an insufficient ridge opening to ensure effective ventilation.

Consider if there is enough room for groups of bulls to grow together without the need for mixing.



3. Availability and cost of straw and/or other materials for bedding.

It is important that buildings have competent drainage and ventilation for efficient straw use. Different classes and ages of stock require different amounts of straw, as shown in Table 2.

Table 2. Guidelines for bedding straw requirements

Cattle type	Amount (tonnes)*
Calf rearing to 3 months	0.2
Yearlings (300–400 kg)	0.5–0.7
Heavy store/finishing cattle (450–650 kg)	0.7–1.0

*Based on a 25-week bedding period, except where stated otherwise

When calculating straw requirements, also consider the amount needed for feed.

If you need to buy in a proportion of your straw requirements, consider how price fluctuations could affect your business. Over the last five years, straw prices have fluctuated from £30/tonne to £100/tonne.

Keep up to date with straw prices at ahdb.org.uk/dairy/hay-and-straw-prices

4. Can slurry and manure be stored/dealt with appropriately?



5. What home-grown feeds and forages are available? What quality are they?
6. Availability and cost of bought-in feeds. Compare all possibilities on a cost per unit of energy and protein in the DM basis.
Choose from a list of over 65 different feeds and enter the cost (£/tonne) of those feeds on the beef ration calculator, available at ahdb.org.uk/beef-ration-calculator
7. Do you have an appropriate handling system?

Factors to consider when improving or investing in a new handling system:

- Access needed for loading and unloading
- Types of cattle to be handled – sex, size, age, weight and temperament
- Number of cattle to be handled at any one time
- Assess the handling system from field, yard and housing
- How many people will work the system?
- Cleaning and maintenance
- Location: if inside, consider lighting and ventilation; if outside, consider the impact of prevailing winds and the position of the sun





Grazing

If you have high-quality grassland for grazing and silage production, consider an 18–24-month steer/heifer system.

Key success factors:

- Maintain high-quality swards – aim for 10–12 cm at turnout
- High-quality – modern grass varieties, along with appropriate types of clover in the sward (large leaf)
- Rotationally graze to maintain quality and utilisation
- For finishing at grass on an ad-lib ration, choose dry land to avoid poaching and to ensure there is a dry lying area
- Produce consistently high-quality silage to keep concentrate costs down – aim for 11.5 ME and 16% crude protein

For more information on rotational grazing systems for cattle, see ahdb.org.uk/knowledge-library/rotational-grazing-systems-for-cattle

Further reading

- *Better cattle housing design*
- *Better calf housing*
- *Improve cattle handling for Better Returns*
- *Making grass silage for Better Returns*
- HSE advice on handling bulls can be found at www.hse.gov.uk/agriculture/topics/livestock.htm



Preparing a budget

Margins in these systems, particularly bull beef systems, are very sensitive to changes in calf price, feed price and carcase price at sale. Producing under contract provides some security, if the customer's specifications are met.

Figure 1 shows the average deadweight cattle prices for O+ and -O grades – dairy-bred cattle typically fall into this classification.

Feed typically constitutes 75–80% of the variable costs of a beef enterprise. Before buying any animals, calculate an enterprise cost of production, including variable and overhead costs.

Consider the potential impact of rising feed prices on the bottom line. When the price of concentrates is very high, bull beef systems lose their competitive advantage over steer beef systems. For latest cereal prices, see ahdb.org.uk/cereals-market-insight

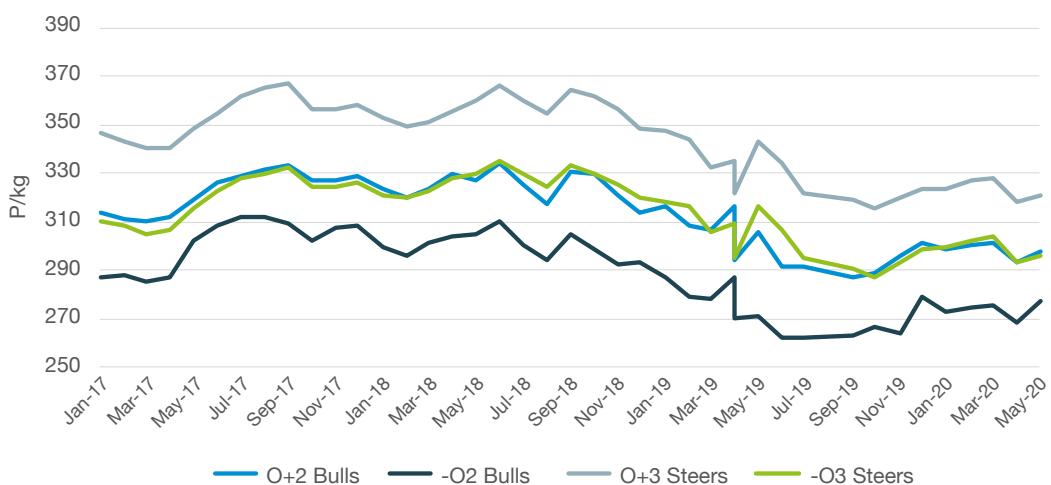


Figure 1. Average GB deadweight cattle prices

Preparing a budget and understanding its sensitivity to different market forces is important.

Apply some sensitivity analysis for key input costs and output prices to explore the effect they have on your profit and loss. These could include:

- Feed price +/- £25/t
- Interest rates +/- 2%
- Fuel +/- 10 ppl
- Grain yield +/- 2t/ha
- Calf price +/- £25/head
- Beef price +/- £0.50/kg deadweight

Calf prices can be found at ahdb.org.uk/cow-heifer-prices

A partial budget can help you to calculate the financial effect of a proposed change to one aspect of your business, for example, switching from suckled beef production to contract rearing dairy beef.

Jot down:

- Extra income of the proposed change
- Lost income
- Costs saved
- Extra trading costs

A template can be found at business-planning/changing-your-business/partial-budget

Monitoring performance

It's essential to know how your animals are performing and your costs of production. Collecting records and then analysing them is the best way to understand how your business is performing.

The following key performance indicators (KPIs) are important to monitor for beef finishing:

- Cost of production per kg of beef produced (£/kg)
- Gross margin per kg of beef produced (£/kg)
- Mortality (%)
- Daily liveweight gain (kg/day)
- Cattle hitting target specification (%)

The University of Nottingham has developed a herd health toolkit, which can be used to benchmark mortality and growth. The tool is available at herdhealth.shinyapps.io/toolkit/



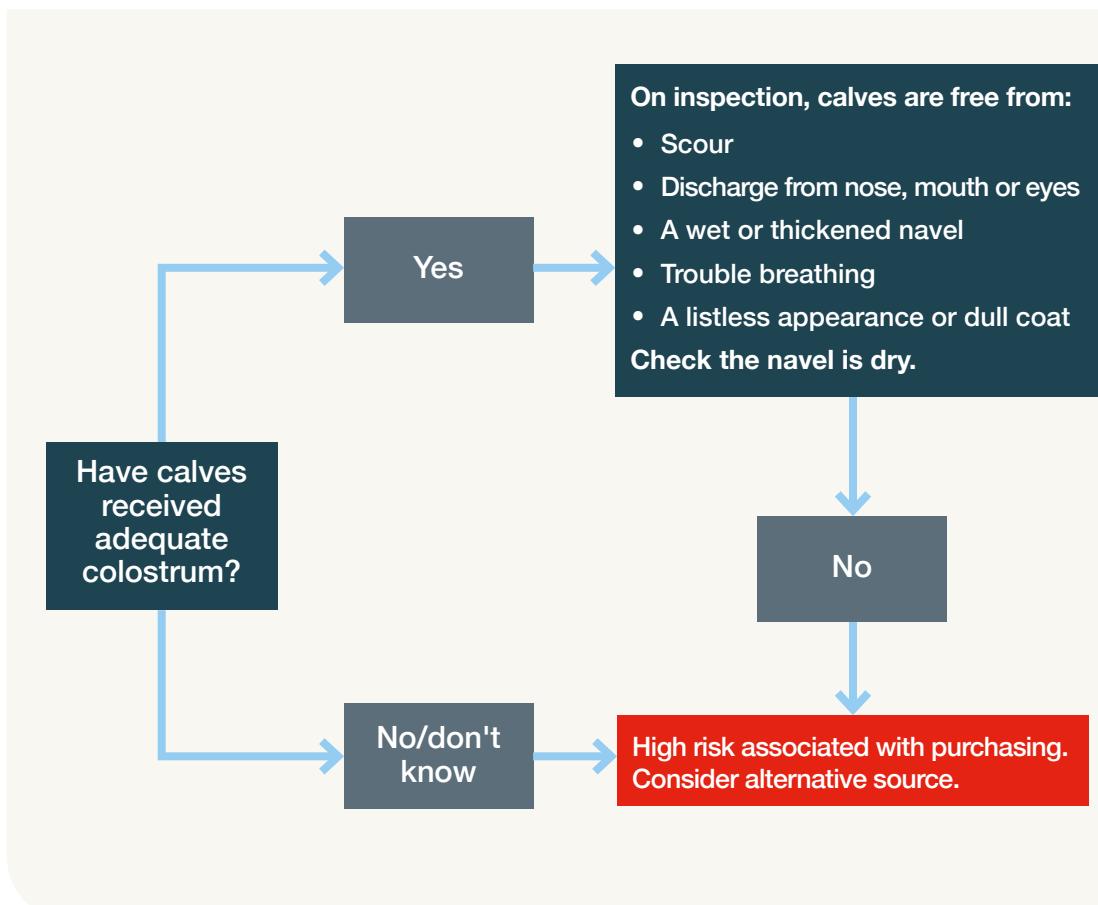
Sourcing stock

Success depends on sourcing the right type of calves for the right price. Well-grown, healthy animals have the greatest earning potential, as they are likely to respond well to feeding and grow quickly. Aim to source calves directly from a farm with a known health status.

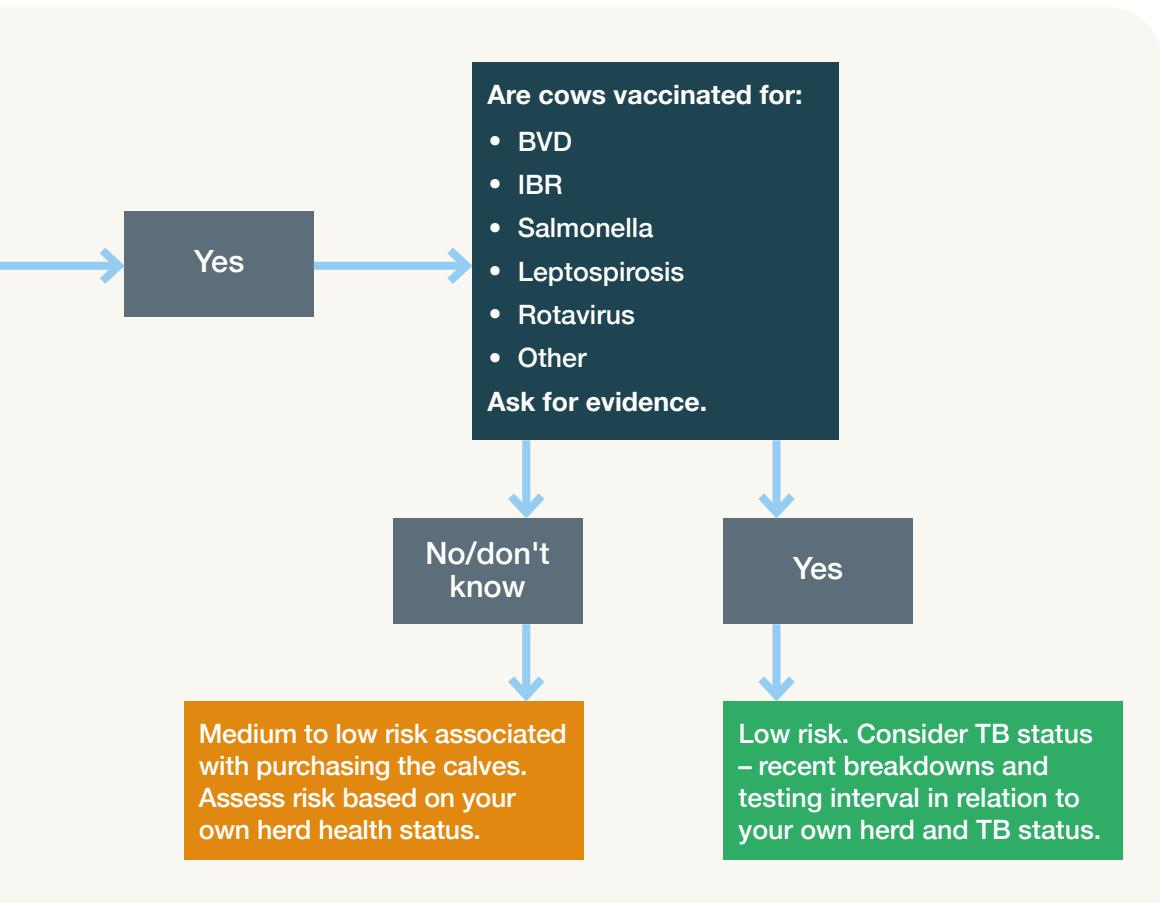
If sourcing cattle directly from farm, ask about:

- Colostrum management – is colostrum intake a priority? Buy calves which are known to have received adequate colostrum as newborns. There is a clear relationship between immune status when very young and subsequent performance
- The sires used to produce beef calves, in particular the breed and bull identification so that checks can be made on genetic merit

Assessing calf health status



- The type of dairy cows in the herd, to understand the dam's influence on frame size and conformation
- The health status of the herd, e.g. BVD, Johne's, IBR, TB, to understand the health risks associated with the calves



Physical appearance

Calves should:

- Be seven days old or more
- Well grown for their age*
- Have supple skin and a shiny coat
- Be alert and bright-eyed
- Have a dry and healed navel
- Show reasonable conformation
- Check the calves rectal temperature if unsure, a normal temperature is between 38.5–39.5°C

*Liveweight alone is not a reliable indicator of future performance, but ‘weight-for-age’ is. The heavier the calf at purchase relative to its age, the healthier it is likely to be and the better it will perform. Trials have shown that calves with poor conformation at ten days old tend to be lighter, in terms of weight-for-age, compared with better-conformed calves.

The poorer-conformed calves had higher calf mortality during the rearing phase and generally more variable performance during their life.

Sourcing cattle from an auction

If purchasing from a live auction, information on health status will be limited. If possible, ask vendors for further information on any routine vaccinations/treatments the stock may have had.

Visually assess cattle. They should:

- Be alert and bright-eyed
- Have a shiny coat
- Show reasonable conformation to enable finishing
- Be free from discharge from the nose, mouth or eyes
- No evidence of scours





Moving cattle off TB-restricted premises

When a herd is under a movement restriction due to bovine TB, cattle can only be moved under a licence issued by the Animal and Plant Health Agency (APHA). It may be possible to move cattle off the premises direct to slaughter, from one TB-restricted premises to another, to an Approved Finishing Unit (AFU), a TB isolation unit or approved dedicated markets and calf collection centres (orange markets).

AFUs provide a route for rearing and finishing cattle from TB-restricted farms and can only be approved in the High Risk

Area (HRA) and Edge Area of England, and the High TB Areas of Wales. Rearing AFUs can purchase calves from multiple TB-restricted herds, and at the appropriate stage in the production cycle, rear them and then move them to another AFU set up to receive older stock. All AFUs in England must have their own permanent County Parish Holding (CPH) number, be self-contained and isolated from other cattle with clear boundaries.

For more information, see tbhub.co.uk

To apply to become an AFU, see gov.uk/government/publications/approved-finishing-units-for-cattle-application

Managing incoming stock

Cattle may be tired after a journey, so should be penned separately from other stock in a draught-free, well-bedded pen, with plenty of space and good access to palatable forage-based feed with long fibre and clean water.

If there are other cattle on farm, quarantine new arrivals for 21 days and check for signs of disease.

After 12–18 hours' rest, check ear tags and passports and weigh each animal. Health-check and vaccinate in accordance with the farm's health plan.

Top tips for managing calves

- Offer a drink of electrolyte in 2 litres of warm water. Start offering milk the next day
- Do not disbud or castrate immediately. Allow calves time to settle

- Ideal time to disbud is three to five weeks old and before eight weeks of age
- Castration can be done using a rubber ring if less than one week of age, bloodless castration (Burdizzo) at less than two months of age – calves older than this can only be castrated using anaesthetic by a vet
- Consider dosing with multivitamins
- If BVD status is unknown, test for BVD to identify persistently infected animals

For more information, see **Calf management** guide at ahdb.org.uk

Vaccinations

Work with the vet to develop a suitable vaccination and disease-control programme, e.g. for pneumonia, clostridia, ringworm and lice.

For more information on calf health, see **Better Returns from calf rearing** at ahdb.org.uk



Housing hygiene

Suitable ventilation and drainage are key to good air quality, while effective cleansing and disinfection are essential to remove engrained biofilm on surfaces.

The risks:

- Incorrect cleaning practices can lead to the development of biofilm. This is an invisible layer of protein and fat residue which bacteria can bind to and thrive in
- Mycoplasma can survive in biofilm for up to 50–60 days
- Dusty feeds, straw and hay severely impact on air quality
- Feeders and drinkers are focal points for disease transmission

Plan to allow enough time to remove organic matter – apply chemicals for the time specified by the manufacturer, rinse and dry.

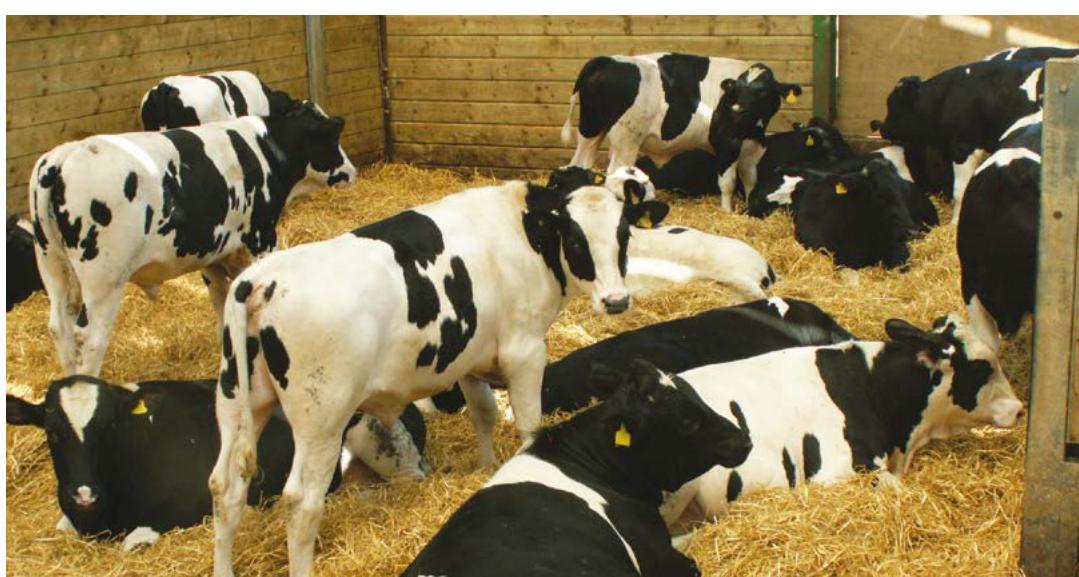
Top tips to improve hygiene in buildings

- Use renders and sealants to fix broken surfaces, which are extremely difficult to clean

- Use a steam cleaner and detergent to remove engrained biofilm on surfaces, such as FAM 30 and Virkon S (these are approved against bTB)
- Clean feeders and drinkers regularly
- Prevent manure contamination of feeders and drinkers – never step in the feed bunker
- Clean the quarantine area after each use

To minimise spreading disease on farm

- Run an ‘all-in all-out’ rearing system so that cattle of different ages are not mixed together or share the same air space
- Have dedicated sheds for calves away from other livestock
- Keep calves well bedded, with good ventilation but no draughts
- Ensure transport, handling systems and machinery used in cattle areas are regularly cleaned to avoid cross-contamination
- Clean transport after each use



Nutrition

Milk replacers

There are many different products and feeding systems, so it is important to choose a milk replacer that will deliver growth rates appropriate to the production system and then maintain consistency of product fed. Calves should grow at least 0.8 kg/day between birth and weaning and should be at least 80 kg at weaning. Milk replacer should contain 20–26% crude protein (CP) and 18–20% fat to achieve optimal growth rate in early life.

It is vitally important that calves have access to clean, fresh water all the time, even when they are drinking milk.

It is generally recognised that feeding rates for young calves have historically been too low. Current advice for most beef situations is to feed a minimum of 750 g/day, which can be achieved by feeding different concentrations as shown in Table 3.

Increasing the feeding rate increases growth rates. However, the amount of calf starter feed being eaten at the same time must also be considered.

Table 3. Daily quantity of milk replacer supplied per calf (g)

Mixing rate (g/l)	Litres fed/day				
	4	5	6	7	8
150	600	750	900	1,050	1,200
140	560	700	840	980	1,120
130	520	650	780	910	1,040
125	500	625	750	875	1,000

To work out the energy supplied by the amount of milk replacer fed to the calf, use the **Calf milk replacer energy calculator**,

available at ahdb.org.uk/calf-milk-replacer-energy-calculator

This calculator is suitable for male calves as well as heifers.



Rumen development of calves aged six weeks

Drivers of rumen development:

- Clean, fresh water supply
- Good-quality starter feed
- Clean, fresh straw

Transition management

Transition management refers to a time when the life of a beef animal changes significantly. This usually occurs when it moves between farms or when its diet changes, e.g. at weaning or going from a growing to a finishing ration.

Starter feeds

Starter feeds are designed to promote rumen development, transitioning the calf from a diet based on milk to one based solely on forages and concentrates.

Digestion of feeds rich in starch plays an important role in rumen development. Encourage intake of starter feeds as soon as possible. Figure 2 (C) shows the darker colouration and the more developed rumen papillae of calves fed a grain-based starter feed.

Fresh straw should also be supplied in racks. It is important to limit intake of good-quality hay or other forages before weaning, as this can reduce starter intake and lead to calves becoming pot-bellied.



A



B



C

Figure 2. The impact of diet on rumen development: milk only diet (A); milk and hay (B); milk and grain-based starter feed (C)

Source: Pennsylvania State University

A good calf starter feed should contain 18% CP fresh weight and a minimum of 12 MJ ME/kg DM. To achieve maximum intake, it should be fresh, free from dust and mould and offered in clean troughs.



Ensure any mouldy feed is removed daily and fresh water is available

Weaning

Good management at weaning is important for maintaining good growth rates and minimising disease.

A group of calves are ready to wean when they are routinely consuming 1.5 kg/head of high-quality starter feed a day.

Post-weaning, provide straw for the calves as the forage component in the ration. Transition slowly to silage when they are around five to six months of age.

Target growth rate: >0.8 kg/day from birth to weaning

When changing to finishing rations, which generally contain less forage and more supplementary feeds, there is likely to be increased rumen acidity and therefore potential for health problems.

Introduce the new ration gradually, with increasing amounts of the new ration supplied each day over a period of around two weeks, while the amount of original ration is reduced at the same time. The length of the changeover period depends on the extent of the difference between the rations. An example is shown in Figure 3.

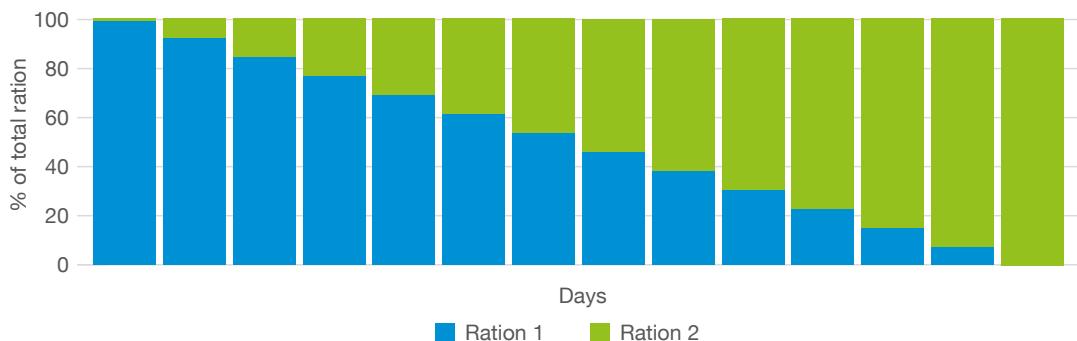


Figure 3. The gradual introduction and withdrawal of different rations

Where large amounts of concentrates are being introduced, the time period should be extended to make the change slowly. If feeding from a trough, the ration should be fed in two meals per day of no more than 2 kg per feed, then three meals per day, increasing amounts until the cattle do not clear up all the feed. Then they can be fed from ad-lib hoppers.

Fresh, clean straw should be provided in racks during the transition to ad-lib cereal feeding when other forages are reduced, to stimulate rumen function.

One of the most important ways to assess a ration is to watch the cattle eating it. Cattle which are not eating, drinking or sleeping should be ruminating. Also, look at the consistency of the dung to check it is not too runny or too dry.

As well as thinking about the transition to a different ration, it is important to minimise stress associated with transport to a new farm, mixing with new cattle and being in different housing.



Nutrition during the growing phase

The growing phase is a period of continuous growth when the aim is to grow the animals' frames. Growing animals have a large appetite compared with their body weight and thrive on high levels of good-quality forage. Rations should provide a good balance between structural and digestible fibre as found in good-quality forages and grazed pastures. They should also be high in protein, with adequate rumen degradability, and have moderate energy density, with adequate minerals and vitamins. Avoid high levels of starch as this can lead to unwanted fat deposition.

Where maximum carcase weight limits exist, reduce the growing phase to ensure cattle are not overweight at slaughter.

Table 4. Elements of a growing ration

Nutrients in total ration dry matter (DM)	
Dry matter intake (DMI) (% liveweight)	~ 2–2.5%
Metabolisable energy (MJ ME/kg DM)	10.5–11.5
Crude protein (CP) %	14–16
Neutral detergent fibre (NDF) %	>40
Starch and sugar %	<20

Grass silage is a common basal forage and its quality will have a major impact on the rate of supplementation required and cost of production (Table 5).

Analyse silage early for correct ration formulation to meet growth requirements and limit the use of bought-in concentrates.

Grazing young animals is a viable, cost-effective option to promote weight gain during the growing phase from 130 kg to 320 kg. Average weight gains of 0.9 kg/day are achievable but require good grazing and animal management. Faster weight gains generally would require supplementation with high-energy feeds. Alternatively, it is possible to feed a balanced TMR at grazing, providing adequate feeding facilities are available.



Where cattle are going out to grass the following spring, it is advisable to reduce the amount of concentrates fed for six to eight weeks before turnout, with a period of four weeks with no concentrates to pre-condition the cattle to a grazed grass diet.

Table 5. Impact of silage quality on concentrate feed levels, assuming 400 kg continental steer gaining 1 kg LW/day

Grass silage quality (MJ ME/kg DM) all 30% DM	Concentrates required to meet target performance (kg/head/day)	Cost per kg gain (£)
Poor (9.5)	5.5	1.52
Moderate (10.5)	4.2	1.36
Excellent (11.5)	1.5	1.11

Nutrition during the finishing phase

The key to profitable finishing is maximising feed conversion efficiency (FCE). This is achieved by maintaining optimum dry matter intakes and high liveweight gains. Holstein cattle tend to eat 10% more dry matter per day than traditional beef breeds, which, together with a lower potential for growth, reduces their FCE. Improving FCE reduces the amount of feed required for each unit of weight gain, so it cuts production costs.

Holsteins have a large mature size and tend to lay down lean tissue rather than a lot of fat. This means they can perform well on good-quality forages early on. However, as they grow older, they can continue to grow frame without enough fat to finish. To prevent this, the finishing ration must be high in metabolisable energy.

Finishing diets are energy-dense, usually containing feeds rich in starch, to maximise energy intake. Protein requirement of steers and heifers is relatively low, at around 12%, whereas bulls may need higher levels of protein. Finishing Holstein bulls show no growth rate response to increasing CP levels above 14% in the DM.

Grazing

Feeding rates of 0.5 kg concentrate per 100 kg liveweight are recommended for grazing animals near finishing. Therefore, a 500 kg animal would require about 2.5 kg/ head per day. However, where grass supply or quality is poor, higher feeding rates may be required to achieve finishing targets. When high levels of supplementary feeding are required, it is likely that the cattle are better suited to being housed and finished inside.

For more information, see ***Growing and finishing cattle for Better Returns.***

Table 6. Elements of a finishing ration

Nutrients in total ration DM		Notes
(% of liveweight)	1.7–2.2	Aim to maximise intake through feed access, freshness and palatability
Metabolisable energy (MJ ME/kg DM)	>12	Energy, particularly from starch, is vital to drive liveweight gain in finishing. Levels should be chosen to match cattle type and market specification
Starch and sugar (%)	>20	Feeds rich in starch and sugars are common components of finishing diets but need to be managed carefully to avoid digestive upsets. Balance with sources of digestible fibre
Crude protein (CP %)	12–14	Crude protein levels are lower in finishing rations than in growing rations
Long fibre (%)	10–12 in intensive rations	Long fibre is important in intensive rations, where cattle will eat around 12% of DMI as straw (1–1.5 kg/day). Best supplied in separate racks or mixed into the complete ration. Avoid relying on bedding to supply adequate long fibre in the diet
Oil (%)	<6	Oil can be a useful rich energy source, but excessive amounts can depress intake

Table 7. Target sward heights for growing and finishing cattle

Period	Rotational pre-grazing height (cm)	Rotational post-grazing height (cm)	Continuous (cm)
Turnout–May	10–12	5–6	5–6
June–July	10–14	6–7	6–7
Aug–Sept	10–15	7–8	7–8



Veal production



Calves may be reared on a high-energy milk replacer – up to 15 ME (MJ/kg) – throughout their life or until weaning.

Supplement milk replacer with a concentrate blend such as calf starter pellets or coarse mix with ad-lib straw. Finishing diets can vary according to availability and cost. They should be high in starch to promote muscle growth rather than frame. The diet is often a cereal-based mix. Maize silage +11 ME (MJ/kg DM) can be included, but the overall ration should be formulated to contain 16% CP in the DM. Grass-based feeds should be avoided. Offer straw throughout to provide fibre for efficient rumen function and the diet must supply all the necessary vitamins and minerals for health and growth.

Once transitioned onto concentrates or rolled cereal, intakes can be up to 2 kg/day by the time they reach six to seven months.

Table 8. Example performance targets

Target	6–8-month	10-month
Lifetime growth rate (kg/day)	1.2–1.4	1.2–1.4
Liveweight at slaughter (kg)	250–300	400–420
Carcase weight (kg)	115–150	200–215
Carcase classification	-O2	-O2
Days to slaughter	210	300

On RSPCA Assured farms, calves must have enrichment from six weeks of age, deep straw bedding and sufficient iron and fibre in the diet. The law in the UK requires all calves to be housed in groups by eight weeks of age. For more information, see page 56 of *RSPCA welfare standards for dairy cattle* at science.rspca.org.uk/sciencegroup/farmanimals/standards/dairycattle

18–19-month system

The production system for 18–19-month dairy steers/heifers differs depending on when the animals are born.

Autumn-born calves are usually reared indoors over winter to reach approximately 200–230 kg at turnout in April. They graze high-quality pasture throughout the summer, ideally on a rotational system, which maintains daily liveweight gains of 1 kg/day. They are housed in the autumn and finished on high-quality silages, along with a good energy source, such as rolled cereals and appropriate protein supplementation, with minerals if required.

Late spring-born and summer-born calves are unlikely to be old enough to make good use of grass in their first summer but may benefit from access to a paddock for loafing. The animals are usually housed over the winter, with free access to high-quality grass silage – supplemented to enable them to meet target growth rates. Depending on pasture quality and steer condition, they may be able to finish while at grass but may need supplementary feed to ensure adequate fat cover.



Table 9. Example performance targets

Performance targets (kg)	
Reared calf (3 months)	120
Liveweight at slaughter (18 months)	600–680
Carcase weight*	300–350
Carcase classification	-O/O+3

*Check minimum carcase weights for the chosen outlet

Success factors

- Maximising the use of home-grown feeds and forage – analysis is crucial
- Flexibility to take advantage of grass growth/conditions
- Regular monitoring of weight and condition, particularly in the last few weeks so they are marketed at the correct level of fatness
- A health plan should be discussed with your vet to consider vaccinations and parasite control

Finishing heifers

Heifers tend to deposit more of their liveweight gain as fat. It is important they are fed to grow sufficient frame size before they move to a finishing ration.

Research carried out by Teagasc, trialled a 19-month system, finishing dairy-beef heifers off pasture from September to November. Heifers were given 2.5 kg concentrate DM supplementation daily for 60 days pre-slaughter and target carcase weight was 235 kg. Results showed that this system was repeatable and achievable.

For more information on research carried out by Teagasc, see **Beef 2016 profitable technologies**, available at teagasc.ie

21–24-month system

Spring-born dairy steers/heifers will usually have a second grazing season before slaughter at around two years of age.

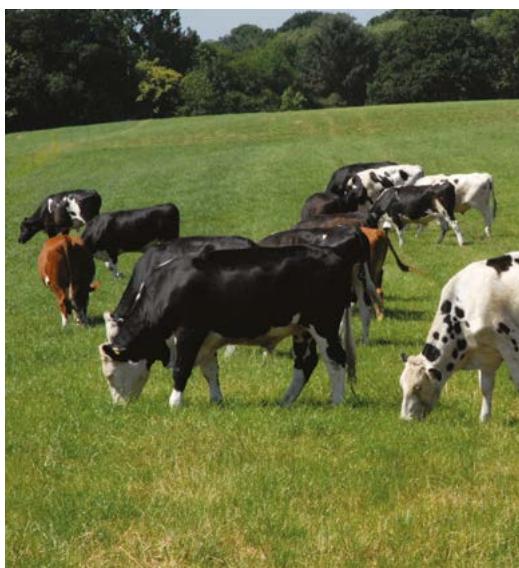
Table 10. Example performance targets

Performance targets (kg)	
Reared calf (3 months)	120
Liveweight at slaughter (18 months)	600–700
Carcase weight*	300–370
Carcase classification	–O/O+3

*Check minimum carcase weights for the chosen outlet

In their first year at grass, some supplementation is normally required. After which, housed rations are generally based around grass silage or other forages and a small amount of concentrates. During this time, the animals develop frame, with only a moderate growth rate of around 0.7 kg/day. Generally, there is no supplementation during the second summer at grass, depending on grass availability, and the cattle are finished during their second winter inside. The level of concentrate required will depend on forage quality. Seventy-five per cent of the total concentrates fed will be consumed during the finishing period. Fast growth rates during the finishing period will help optimise conformation classification. Regular monitoring of weight and condition is essential, particularly in the last few weeks so they are marketed at the correct level of fatness. Research at Teagasc found that early-maturing breed crossbred dairy heifers that were finished indoors during their second winter were overfat at slaughter. Results showed that all spring-born, early-maturing breed crossbred dairy heifers were fit to be slaughtered off pasture before their second winter.

A recent study at Harper Adams University investigated the feasibility of growing and finishing Hereford cross and Holstein-Friesian steers using predominantly grazed grass and fodder beet over the winter. The aim was to finish cattle by 22 months of age. The system had minimal reliance on cereals or other bought-in concentrates and no housed period after the initial rearing of the calf. Despite challenging weather conditions, this low-input dairy beef system is profitable.



For the system to be successful, careful considerations should be made:

- Excellent grassland management, including rotational grazing, is key
- The winter crop should be carefully set up and managed
- Careful transition between diets is essential to reduce health issues
- A health plan should be discussed with your vet to consider vaccinations and parasite control

Further information can be found at ahdb.org.uk/outdoor-dairy-beef

Dairy bulls

Health and safety when handling bulls

- Make sure your housing allows for routine tasks, such as feeding and bedding, to be done outside of the pen
- You should be able to open and close internal division gates from outside of the pen and arrange your race, crush and loading areas so that no one ever needs to be in with the animals
- Check that handling, weighing, veterinary treatment and shedding arrangements are safe and designed for the greater strength and unpredictable nature of a group of young bulls
- Put up prominent signs warning of the presence of bulls
- Never handle bulls alone

13–15-month bulls – housed and fed a cereal-based ration

Intensive beef systems for dairy-sired male calves are traditionally based on high cereal diets to promote high growth rates. However, when cereal prices are high, margins can be put under pressure and alternative high-energy feeds can be substituted for grain. Professional nutritional advice, tailored specifically to the farm and the system, is recommended.

The diet should contain protein supplementation around 16% CP in the DM (14% as fed) for bulls up to six to seven months old. After which a 14% CP in the DM (12% as fed), +12.5 ME (MJ/kg DM) cereal-based diet is generally required. All cereals must be lightly rolled. Consider including 10% beet pulp as a source of

digestible fibre, especially with high-starch rations and those containing wheat.

A source of good clean straw must always be accessible in feed racks or chopped in the ration. Average concentrate consumption with this system would be in the region of 2.4 tonnes per head.



House in well-bedded and well-ventilated yards, with at least 5.4 m² of space allowance for 600 kg bulls. Monitor feed intakes and liveweight gain. Select cattle for slaughter at fat class 3. Sell those animals that fail to thrive (poor 'doers') early.

Many processors do not take bulls under 12 months of age, so knowing your market is imperative, as well as monitoring cattle growth and finish.

Table 11. Example performance targets

Performance targets (kg)	
Lifetime growth rate	1.2–1.4
Liveweight at slaughter (13 months)	540–620
Carcase weight*	270–320
Carcase classification	-O/O+2/3

*Check minimum carcase weights for the chosen outlet

Success factors

- A lower cost ration that delivers target growth rates
- The right type of buildings/handling facilities
- Maximum ration energy density and inclusion of digestible fibre to maintain rumen stability
- Regular recording of bull weights and condition
- Strict veterinary and stockmanship regime

14–16-month – housed and fed silages and cereals/co-products

Home-grown forage can provide an efficient and cost-effective feeding system for finishing cattle, but a ration must be devised that can still deliver target growth rates. Incorporating silage into the diet will lengthen the time it takes bulls to finish to between 14 and 16 months. Grass, wholecrop, red clover, lucerne and maize silages can all be fed to finishing bulls as a simple mixed forage ration, with other feeds fed separately or as a total mixed ration (TMR).

Ongoing work at Harper Adams University suggests that 75% of ad-lib cereals could be replaced with good quality, high-energy (25+ % starch, 10.5+ ME) wholecrop with similar carcase outcomes while relying less on potentially more expensive bought-in protein.

Further information and interim results can be found at ahdb.org.uk/protein-and-mixed-forage-beef





The quality of any homegrown forage offered must be high to maintain performance. Silage must be good quality, +11 ME (MJ/kg DM) and the overall diet formulation must contain at least 15–16% CP in the DM. This can be dropped to 14% at six to seven months old. Feed 2–6 kg/head/day of concentrates to achieve a target daily liveweight gain (DLWG) based on the quality of the forage. Feed should always be available, along with straw to provide the long fibre the animals need to stimulate rumination.

Table 12. Example performance targets

Performance targets (kg)	
Lifetime growth rate (kg/day)	1.1–1.3
Liveweight at slaughter (kg)	540–620
Carcase weight (kg)	270–320
Carcase classification	–O/O+2/3

Success factors

- Best-practice silage making from crop establishment to harvest, storage and feed-out
- Rations based around silage analysis, with supplementary feed to make up shortfalls in energy and protein
- Regular recording of bull weights and condition
- Facilities robust enough for older bulls
- Selling before 16 months of age. Some abattoirs will not take or will penalise bulls older than this

Health during growing and finishing

It is recommended to have a discussion with your vet to create a written health plan to prevent disease issues developing. The plan should be discussed and agreed for all routine procedures and treatments for the herd. The health plan should be referred to and updated regularly.



Feedback from abattoirs can provide valuable information about herd health. Check for results, which can indicate signs of liver fluke infection, pneumonia or other health issues seen at slaughter. Further information is available in the ***Abattoir post-mortem conditions guide*** at ahdb.org.uk

Respiratory disease

This is the most significant disease risk in housed cattle and may also be a greater problem in herds where there are other underlying issues, such as BVD. Attention to detail in housing design and correct ventilation is essential for reducing potential problems.

- Try to allow cattle the option to run into outdoor yards – especially useful when using a straw blower
- Consider IBR vaccination if mixing and housing store cattle
- Ensure there are no draughts at animal height – stoop down to their level to assess this
- The bedding must be kept dry as pneumonia viruses live longer in warm moist air. Check that water from troughs and downpipes is not getting onto beds
- Vaccines to prevent and reduce the severity of pneumonia are available. Discuss their use with the vet
- Watch out for signs of respiratory disease – affected cattle are slow feeders, have a raised temperature and breathe quickly. They usually have discharges from their nose and eyes and may cough when moved around the pen
- Treat pneumonia cases promptly with antibiotics and anti-inflammatory drugs. Consider the other cattle in the pen. Early treatment is the most effective
- You may need to shave the backs of larger animals to reduce sweating and subsequent humidity in the shed

Acidosis

Acidosis occurs when cattle eat large amounts of carbohydrate-rich feeds, such as grains and concentrates, which they haven't been properly introduced to. This causes the rumen pH to fall below normal. The smaller the particle size, for example, following milling, the more quickly fermentation occurs and the more severe the clinical signs for a given amount ingested.

Clinical signs

- Colic
- Appear restless
- Weak and may fall and have trouble rising
- Tooth grinding
- Swollen abdomen
- No diarrhoea for the first 12 to 24 hours. Thereafter, there is runny, smelly diarrhoea
- Sweet-sour odour and may contain whole grains
- Continuous laying down and death within 24–48 hours in severe cases

Prevention

Slowly introduce cattle to new rations. Gradually increase grain/concentrate feeding over a minimum of six weeks before ad-lib feeding. Allow more than 10% good-quality roughage in the diet.

Top tips

- Do not grind cereals into fine particles – crack the grain
- Always offer a source of long fibre, e.g. straw – intake is likely to be 1–1.5 kg/day
- Never let ad-lib hoppers run out to prevent animals from gorging when they are refilled
- If not feeding cereals ad lib, feed in small meals throughout the day – avoid meal sizes greater than 2.5 kg/head/day for dry cereals
- Consider grain moisture content, as moist grains (which need to be treated with a suitable preservation method) tend to be easier to roll without shattering



Lameness

Maintaining clean housing for cattle is crucial to reduce the incidence of lameness. Some causes of lameness in beef cattle are:

- Foul of the foot
- Digital dermatitis
- Overgrowth
- Sole abscess/sole ulcers/white line disease

Examine lameness cases promptly. Seek advice if unsure of the diagnosis and treatment options.

Laminitis from ruminal acidosis in beef bulls can be avoided by making feed changes gradually, avoiding finely ground concentrates and excessive starch levels in the ration, allowing access to palatable straw and introducing rumen buffers/yeasts into the diet.

Issues seen at grass

Work out a parasite control plan with advice from the vet or animal health adviser. Grazing cattle will be exposed to gut worms, lungworm and liver fluke. Faecal samples can be used to assess the worm egg and larva burden in groups of stock. Control is aimed at limiting production loss from parasite burdens and not overusing anthelmintics. Resistance to anthelmintics can occur if products are not used correctly. So make sure cattle are not under-dosed and apply pour-on products carefully.



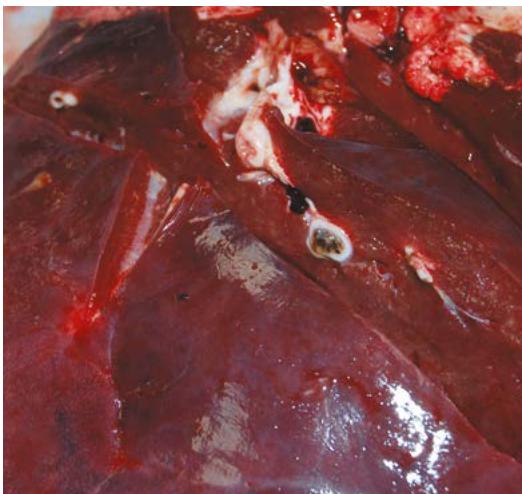
Gut worms

Warm, wet summers are ideal conditions for gut worms to survive on pasture. In such years, consider a midseason wormer dose. All stock finishing their first grazing season should be wormed at housing. By their second grazing season, most cattle will have developed a protective immunity to gut worms, so it should only be necessary to worm animals showing poor growth rates.

Liver fluke

Humid, damp summers are ideal for the snail that is the intermediate host for liver fluke. Typically, infection on pasture peaks in late autumn.

Treatment after housing can be timed to catch all ingested larva. On high-risk farms that practice early turnout, a treatment for liver fluke midseason will reduce pasture contamination.



Lungworm

Exposure to lungworm is variable. Coughing at pasture is a typical sign.

Untreated lungworm will predispose to other forms of pneumonia. In wet years, the midseason wormer can be timed to protect stock from the late-summer peak in lungworm. Consider preventative measures with the vet.

Clostridial disease

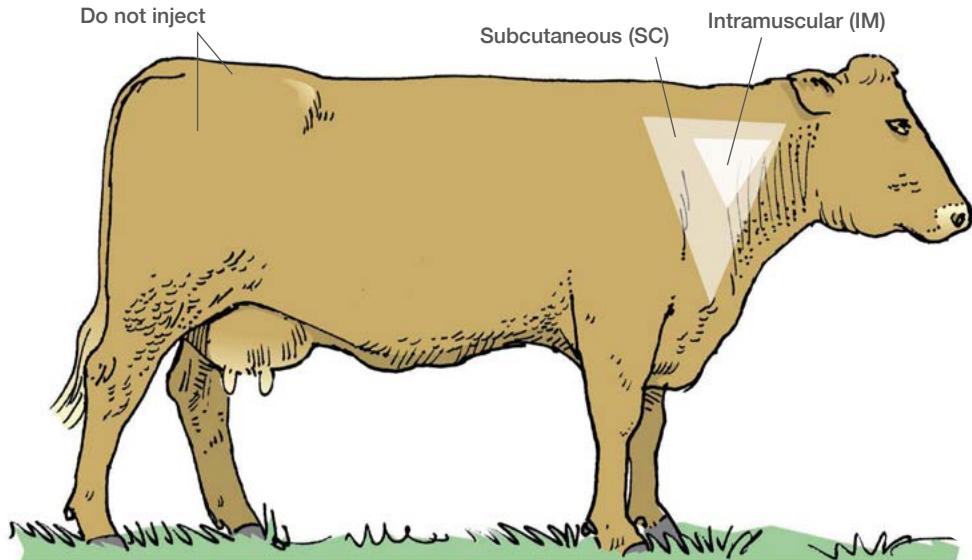
Blackleg, tetanus and other clostridial diseases are a significant cause of loss in cattle. Vaccination is effective and grazed stock are at risk. Discuss vaccination protocols with the vet.

Treatments

Always read the instructions of products before treatments. Protocols can change and some products have specific administration routes.

If you need to treat with an injectable, always inject into the neck to avoid damaging valuable meat cuts.

For more information, see the **Beef diseases directory** at ahdb.org.uk



How to inject farm animals for the best results and to minimise carcase damage

Selection for slaughter

Beef carcase classification

The current classification system for carcases in the UK and Europe uses the EUROP classification for conformation and a numeric assessment for fatness (classes 1–5). Combining scores for conformation and fat determines the market most suited for each type of carcase.

Aim for most dairy-bred cattle to fall into the O area of the grid for conformation and fat class 3, for best returns (example carcase below). Holsteins tend to have smaller muscles and deposit more marbling and less external fat than most beef breeds. They also have a lower killing-out percentage due to a lower muscle to bone ratio and higher kidney and pelvic fat content.



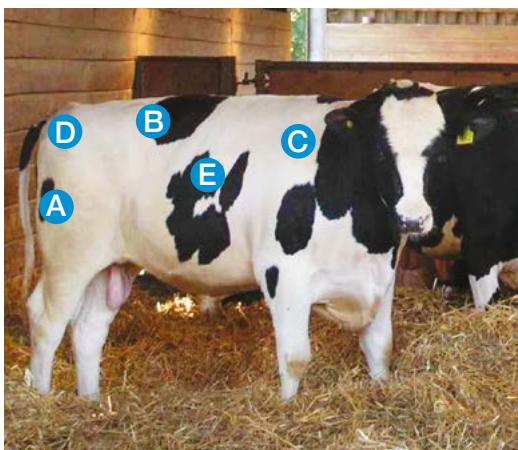
O grade carcase

Key handling points

Weight and visual appraisal are general guides to an animal's readiness for market, but to ensure accurate selection, handling the live animal is essential.

Assessing conformation

To gauge an animal's conformation, consider the depth and thickness of the round, fullness of the loin and thickness of the flesh over the shoulder.



These five key handling points give the best indication of level of finish and fat class. They combine reliability with ease of access.

To assess conformation feel the animal at:

- A The round or hindquarter
- B The loin
- C The shoulder

To assess fat level feel the animal at:

- D The pin bones and either side of the tailhead
- B The loin (transverse processes)
- E The ribs

Assessing fatness

Handle animals over the loin on the left side as seen from behind. Large amounts of kidney fat on the right-hand side can be misleading in assessing fat cover. Use just the tips of fingers to feel fat depth over the underlying muscle and bone at each of the handling points. As animals get fatter, the ends of the transverse processes (bones) over the loin and pin bones, as well as the shoulder blade ridge, become more rounded. The hollows between the ribs and shoulders fill up completely at the highest fat levels.

Hide thickness varies with breed. Consider this when assessing fatness, particularly over the tailhead, loin and ribs.

Handle with care

Sensitive handling is vital for animal welfare and avoids damage that shows up after slaughter. Bruising and abscesses lead to wasteful trimming and even partial condemnation of the carcase, which in turn reduces carcase saleability and returns.

Avoid potential losses by

- Handling cattle in races with smooth walls, non-slip floors and gradual ramps
- Not using sticks or goads
- Not overcrowding animals in vehicles and by using internal partitions to restrict movement while travelling
- Using clean injection needles to avoid infection
- Choosing injection site with care
- Separating horned and non-horned cattle

Dark cutting meat

Dark cutting beef – where the meat looks an unattractive deep red colour – can occur in all types of cattle, with the incidence highest in young bulls. Shelf life is also reduced and the carcase devalued.

This is usually caused by stress in the 24–48 hours before slaughter.

To avoid stress pre-slaughter:

- Always handle animals quietly
- Avoid mixing cattle from different groups
- Provide clean, dry bedding and plentiful water in any holding pens or lairage

For more information, see **Marketing prime beef for Better Returns**, available at ahdb.org.uk



Comparison of non-DFD (dark, firm and dry) and DFD Sirloin Steak

Produced for you by:

AHDB

Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

T 024 7669 2051

E comms@ahdb.org.uk

W ahdb.org.uk

 **@TheAHDB**

If you no longer wish to receive this information, please email us on comms@ahdb.org.uk

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