Bovine Medicine
Diseases and Husbandry of Cattle

Second edition

Edited by

A.H. Andrews

with

R.W. Blowey

H. Boyd

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Preface

It is now about ten years since the first edition of *Bovine Medicine* was published. While it was originally anticipated that it would be used mainly in Britain and Europe, it is pleasing to note that a good proportion of the sales have been in other parts of the world. In recognition of this, more emphasis has been placed on conditions and their treatment in areas other than temperate regions. Additionally, a new section gives an insight to the differences in bovine medicine as practised in various parts of the world.

Almost all parts of the book have been updated or completely rewritten. There are some new chapters, including one which integrates the various problems which occur in cattle, another on basic surgical techniques and others on artificial insemination and embryo transfer. An effort has been made to encompass all the main subjects which occur in the husbandry and diseases of cattle.

I wish to thank all the authors and co-editors for their hard work. Roger Blowey, Hugh Boyd and Roger Eddy have provided advice and assistance despite their many commitments. I would also like to thank John Sproat for supplying the photographs of cattle used on the end papers.

I hope that everyone reading the new edition will find it to be an interesting source of information.

Readers' note

Inevitably, when it comes to therapies, medicines and vaccines, each country has different needs and requirements. The laws concerning the use of particular therapeutic and preventative agents may vary and the reader is reminded that it is his or her duty to ensure that any preparation prescribed conforms with all relevant national legislation where the preparation is to be used. It is also essential to ensure that dosages and routes of administration are determined according to any national or local directions and other product information which has been provided with the medicine. While every effort has been made to ensure that the uses suggested and doses recommended are correct they should always be checked with currently available information. It must also be remembered that any meat withdrawal time or milk witholding time for drugs should follow the guidelines of the country in which a drug is used.

A.H. Andrews

Preface to the First Edition

Bovine Medicine aims to provide, within the covers of one book, much of the practical information available on cattle disease and production. Such an objective is admirable in sentiment but very difficult to achieve in practice. It involves the concentration of effort by a large number of different, and often very busy, experts into one volume. For the present part it is hoped that what we have produced will not only be a source of information but, in many areas, it will be an enjoyable, educational read. It is hoped that it will be used as a working guide rather than a reference book and that it will be of particular help to those at the 'sharp end' of the veterinary profession, i.e. in practice. Bearing this in mind, this work does not contain every detail concerning each disease, organism or clinical entity.

Inevitably there are some areas of subject overlap as might be expected with skin conditions and ectoparasites and 'downer cow', etc. Where possible each author has provided his or her own perspective on the subject.

In addition, references have been kept to a minimum to ensure a less disjointed read. In consequence, we would be pleased to receive comments from readers on any deficiencies or difficulties encountered in presentation or content.

It has taken approximately 2 years to complete a work of this magnitude. The continual expansion in veterinary knowledge and expertise may well mean that in certain areas some recent developments have been omitted. Again, we would be pleased for any such deficiencies to be pointed out to us.

There has been considerable recent interest in alternative medicine for animals. Mindful of this, a section is included on the subject to help readers make up their own minds on its relevance to cattle therapy.

I must thank Blackwell Science, and particularly Peter Saugman for his patience during the production of this book. Much work has also fallen on my coeditors Hugh Boyd, Roger Blowey and Roger Eddy. However, the book would not have been completed but for the dedicated secretarial and managerial help of Mrs Rosemary Forster.

A.H. Andrews

Part 1
MANAGEMENT

Chapter 1

Calf Rearing

D.M. Allen

Introduction

Whether calves from the dairy herd are being reared as dairy herd replacements or for beef production, a good start in life is essential. Calves of subnormal weight at three months of age tend to lag behind throughout the growing period.

The starting point for good calf rearing is the consumption of at least 2 litres of colostrum by suckling or bucket feeding within the first six hours of life and a further 2 litres within 12 hours. The passive immunity conferred on the calves by the immune lactoglobulin in colostrum is vital to disease resistance, especially if calves are transferred to another farm for rearing, probably via a collection centre or auction. Mortality among calves deprived of colostrum is high. Therefore, it is advisable to keep some colostrum in a freezer in case of emergencies.

Colostrum is a rich feed and a good source of the fat soluble vitamins A, D and E. Therefore it is sensible to feed all available colostrum even to calves that are beyond the stage when they can gain passive immunity.

Calf reception

Dairy-bred calves for beef rearing are usually purchased at about two weeks of age, often from a calf group or dealer. When they arrive at the farm, calves should be inspected individually and any showing signs of ill health returned to the supplier or isolated. Navels should be dipped in a concentrated iodine or phenol solution to guard against navel ill and joint ill. Any calves with signs of lice should be treated with an approved ectoparasite product. A multivitamin injection containing vitamins A, D and E is good value for money.

The calves should be housed in pens bedded liberally with dry straw and clean, fresh water should be made available. Milk is best withheld for a few hours after arrival but any calves that appear stressed may be given a warm drink of 1 litre of a proprietary electrolyte solution.

If calves are housed individually, which is permissible up to eight weeks of age, pens should be at least 1.8×1.0 metres and should permit visual and physical contact with at least one other calf. Group-housed calves up to 150 kg liveweight need a minimum space allowance of 1.5 m^2, rising to 2.0 m^2 at 150–200 kg. Pen floors should have a slope from back to front of at least 1 in 20 to permit good drainage.

Calves do not mind cold weather but need good ventilation without drafts. The modern trend in temperate climates is to erect simple monopitch buildings in which calves can be housed until they are 12 weeks or older. In the coldest weather straw bales or wooden sheets can be placed above the rear half of pens to provide more insulation. Where calves are single-penned, the pens are dismantled at weaning and the calves left where they are as a rearing group. If buildings and pens are used continuously for calf rearing, after each batch they should be power washed or steam cleaned, disinfected and left empty for at least two weeks before restocking.

Rearing systems

In high yielding dairy herds, calves are weaned off their dams as soon as possible after they have received colostrum and are reared by the early weaning system pioneered in the UK but also applicable worldwide. Calves can be weaned off milk replacer after five to seven weeks, which makes the system convenient and saves money compared to weaning at an older age. The secret of success is to ensure that individual calves are eating at least 1 kg per day of a palatable early weaning concentrate before they are weaned.

The commonest rearing system is a twice daily bucket feed of milk replacer, but some rearers use computer-controlled machines that mix milk replacer and provide it to the calves via teats from which they suckle.

In the EU, where milk production is subject to milk quotas, milk produced over the quota has no market value so it is sensible to feed it to calves rather than purchase a milk replacer. However, if milk production is at or under quota, a milk replacer should be used. Feeding whole milk needs just the same attention to temperature and feeding level as milk replacer.

The high cost of dried skimmed milk on which milk replacers used to be based has led to the development of so-called 'zero' milk replacers. These are based on dried whey supplemented with fats and lactose to equate as closely as possible to cow's milk. Whey-based replacers are up to 25 per cent cheaper than skimmed milk products but can give equally good results.

For bucket feeding, replacers are mixed at 125–150 g/l, according to the manufacturer's recommendation. The mix is made up with water at 45–50°C so that the temperature at feeding is 42°C. Automatic feeding machines mix replacer at 100–125 g/l but can be set to vary reconstitution rates according to the stage of rearing. It is essential to keep all feeding equipment scrupulously clean.

Scouring and pneumonia are the twin scourges of calf rearing. Typically, calf mortality is 5 per cent, mainly due to these two causes, but it can rise to 10 per cent. The target in a well-managed calf rearing unit should be to keep mortality below 3 per cent.

Scouring is most likely in the first two weeks following removal from the dam and may be simply because the calf has been overfed or the milk replacer is at the wrong temperature. However, it may also be caused by pathogenic organisms. *E. coli* is the classic cause but a survey of calf units by practising veterinarians identified a number of other pathogens responsible for scouring. The immediate reaction to scouring is to take the calf off milk and feed a warm electrolyte solution. If the scouring does not start to clear up within 24 hours veterinary advice should be sought. Antibiotics should only be used on veterinary prescription.

If salmonella infection is suspected, veterinary advice should be sought straight away and rectal swabs taken for laboratory analysis so that the appropriate antibiotic can be prescribed. Infected calves should be isolated. Many *Salmonella* species are transmissible to humans so during an outbreak special attention needs to be paid to personal hygiene. Salmonellosis usually occurs in the first two or three weeks of life but can occur later, even beyond the milk feeding period (Chapter 15).

Pneumonia can occur at any time but is most prevalent in still, damp winter weather and is exacerbated if calves are moved at this time. Frequent observation is needed to identify the early symptoms of pneumonia – listlessness, holding back at feeding time, a runny nose, rapid breathing or coughing. Veterinary advice should be sought straight away. Not only is pneumonia a major cause of calf mortality but also infected calves that recover often fail to thrive due to lung damage.

Dehorning and castration are stressful and so should not be done together, nor should they coincide with the stress of weaning. Healthy calves can be dehorned three weeks into the rearing period using a hot air or hot iron disbudder, with castration at four weeks.

Early weaning: bucket feeding

The commonest early weaning rearing method is twice daily bucket feeding with weaning at five to seven weeks. With milk replacer mixed at 125 g/l, the first full feed for a purchased calf is 1 litre. Home-bred calves are fed this level twice daily until they are about five days old, then the feeding level per feed is increased by 0.25 litres every other day up to a maximum of 2 litres per feed, that is 4 litres per day.

Some expert calf rearers have found a useful saving in labour, without detriment to calf performance, by feeding the calves milk replacer once daily after the first seven to ten days. In this case the feeding level is built up gradually to 3 litres per day. However, the saving in labour should not compromise calf inspection, which should continue frequently to detect health problems.

From the start calves are fed an early weaning concentrate containing 18 per cent crude protein and with a good amino acid profile, since the calf needs some of its protein intake to escape fermentation and degradation in the forestomachs. The energy value should be at least 12.5 MJ ME/kg DM.

Even the youngest calves crave some roughage in their diet and, rather than letting them pick up straw from the bedding, it is better to feed hay or straw from a rack. Hay is rarely of good enough quality for calves and, even if it is, they eat too much of it at the expense of concentrates and become pot-bellied. Instead, feed bright, dry barley or oat straw.

As previously mentioned, calves must be eating at least 1 kg concentrate per day before they can be weaned. Weaning may be abrupt after about 35 days, or a gradual weaning procedure may be used in which the level of milk replacer is reduced gradually over an additional 5–10 days to encourage concentrate consumption. Gradual weaning avoids the check to growth that accompanies abrupt weaning.

The early weaning concentrate should be fed *ad libitum* until it is replaced by a cheaper follow-on concentrate, or until it is rationed as forage feeds are introduced (p. 5).

The consumption of milk powder is 15–20 kg and the target daily gain to weaning is 0.5–0.6 kg/day, depending on breed type and sex.

Early weaning: machine feeding

Feeding milk *ad libitum* to group-housed calves can be the preferred choice where the buildings used for calf rearing do not lend themselves to the erection of individual pens or, as in dairy herds, where calves are born over a long period.

The saving in labour is not as great as might be supposed because, although mixing is automatic and cleaning is quicker, handling the calves is more time consuming, especially teaching them to suckle.

The most sophisticated machines are computer controlled and recognize individual calves fitted with an electronic tag. So mixing rates and feeding levels can be varied from calf to calf, including a gradual weaning procedure. Some machines can feed whole milk as well as milk replacer and even dispense a small quantity of concentrates to encourage calves to eat dry feed immediately after suckling. Of course these machines are expensive but the cost is spread over up to 80 calves that can be reared at a time, so the annual depreciation per calf may be reasonable.

A cheaper approach to *ad libitum* feeding held sway for a time but is little used now. This was to feed cold acidified milk which stays fresh for two to three days stored in a simple plastic bin and is led to a teat through a tube fitted with a non-return valve. The equipment is cheap but lacks the sophisticated control of individual calves achieved by computer-controlled feeders.

Calves are trained to suckle about 1 litre of milk replacer and then the milk supply is removed until the next feed. The procedure is repeated twice in the next 24 hours and then calves are allowed to suckle *ad libitum*, with not more than six calves per teat. Intake may be depressed in the coldest winter weather and then it is advisable to use an immersion heater to take the chill off the milk replacer. The feeding equipment should be cleaned thoroughly between mixes.

A trough containing early weaning concentrates should be placed near the teats, but far enough away to avoid spoilage by saliva or spilt milk.

Calves fed *ad libitum* consume more milk replacer than restricted bucket-fed calves. This manifests itself as rather loose faeces that must be differentiated from scouring. The high replacer intake inhibits early concentrate consumption and may delay weaning. Therefore, it is important to employ a gradual weaning programme to allow weaning at five to seven weeks. Even at these high intakes of milk replacer, it is essential that fresh water should always be available.

Consumption of milk replacer powder is 25–30 kg and the target daily gain to weaning is 0.6–0.7 kg/day, depending on breed type and sex.

Follow-on rearing

When calves are weaned at five to seven weeks the early weaning concentrate must continue to be fed *ad libitum.* In the case of calves going into intensive beef systems, concentrate feeding continues to appetite through to 12 weeks, although the finishing diet is introduced gradually from eight to ten weeks.

Where calves are designated for forage-based beef systems, forage is introduced by the tenth week and the early weaning concentrate is replaced by a cheaper mix. When calves reared through the winter are to be grazed in the next summer, it is important to hold gains at 0.6–0.8 kg/day until turnout in the spring or the ability of the calves to exhibit extra rapid compensatory growth on high quality grazed grass will be inhibited. To achieve this the follow-on concentrate needs to be rationed at about $2^1/_2$ kg/day with forage fed to appetite.

Performance targets

Performance targets for early weaned bull calves fed concentrates *ad libitum* to three months are shown in Table 1.1.

Veal production

Veal production is a specialized system of calf rearing designed to produce a white meat that is especially popular in Italy and Germany. Traditionally, calves were housed in narrow crates and fed milk only until slaughter at 14–16 weeks, producing a carcass of 100–110 kg. Subsequently the feeding period was extended to 22 weeks or more to produce a carcass of 160+ kg.

Consumer revulsion at the unnatural production method has brought about considerable changes in the way veal is produced, sanctioned by EU and national legislation. For example, veal crates have been banned in Britain since 1990, although EU legislation does not ban existing crated housing in continental Europe until 2006. Similarly, legislation stipulates a minimum iron content for calf milks and insists that calves over two weeks of age have access to digestible solid food. The effect has been to promote the production of veal that is pink in colour rather than white.

A welfare-friendly veal production system has been demonstrated experimentally in Britain with group-housed calves fed milk replacer from a machine and

Table 1.1 Calf rearing targets to three months of age for bull calves fed concentrates *ad libitum.* Source: Meat and Livestock Commission (MLC).

	Bucket feeding		Machine feeding	
	Holstein–Friesian Hereford × F	**Charolais × F Simmental × F**	**Holstein–Friesian Hereford × F**	**Charolais × F Simmental × F**
Feeds (kg)				
Milk powder	15–20	15–20	25–30	25–30
Concentrates	170	185	160	180
Liveweight (kg)				
Purchase	50	55	50	55
Weaning	68	76	71	80
3 months	110	120	115	130
Daily gain (kg)				
Preweaning	0.5	0.6	0.6	0.7
Post weaning	0.9	1.0	0.9	1.0

F = Holstein–Friesian.

supplemented with barley straw as a source of roughage. Carcasses were acceptable to the veal trade but variability of performance was an unsolved problem.

In the Netherlands, the main EU veal producer, there are now two approaches to veal production. First there is a white veal system in which group-housed calves are fed largely on milk replacer but with limited access to maize silage (which does not affect meat colour). The calves are slaughtered at about six months of age at around 285 kg liveweight. A pink veal system is also employed by some producers in which calves are fed about 40 kg milk replacer powder plus 500 kg concentrates and 500 kg maize silage. The calves are slaughtered at about 32 weeks at a weight of around 320 kg.

Calf identification

A beneficial consequence of the BSE crisis and subsequent foot-and-mouth disease epidemic is a realization that being able to trace the whereabouts of cattle throughout their lives is an essential requirement of food safety for people and disease control in cattle.

Traceability is subject to EU legislation. The British Cattle Tracing System (CTS) is administered by the British Cattle Movement Service (BCMS) that commenced operations in September 1998. This fully computerized system was preceded by a paper passport system that started in July 1996. A one-off survey was undertaken of all cattle in 2000, including older cows and bulls which did not have passports, so that all cattle could be included in the BCMS database.

Calves must be double tagged within 36 hours of birth unless they are being sent for immediate slaughter. An application for a passport must normally be made within seven days of tagging but calves can be moved twice during the first 28 days of life, using the reverse of the cattle passport application form as a temporary passport. An all-numeric numbering system has replaced the former alpha numeric identity.

Chapter 2

Suckler Herds

D.M. Allen

Introduction

The key indicator of profitability and technical efficiency in suckler herds is the calf output produced annually from each cow that is bulled. The most profitable herds owe their success to producing a large number of live calves per 100 cows bulled, with low calf mortality, rapid growth to weaning and a high sale value per kg for well-reared calves. This is as true under dry range conditions as it is on productive temperate grassland.

Suckler herd management is not the simple matter it may seem at first sight, with a cow suckling a single calf. The linked components are reproductive efficiency, milk production and growth. However, in practice the body condition of cows is a simple and sensitive barometer of their nutritional status and potential performance. Controlling body condition through the year is the key to high herd output at low cost.

Most beef suckler cows are kept on marginal land in upland or range areas where winter (or dry season) feeds are scarce. So it is common for calves to be sold at weaning, or after a period of further feeding, to finishers on better land. However, increasingly in UK upland herds where suitable buildings are available, male calves are finished as bull beef on purchased concentrates.

Planning the suckler herd

Fitting a suckler enterprise into farm resources is as important to profitable production as herd management. Can the herd be integrated with a sheep flock? Are there arable crop residues that can be used to cheapen cow feeding? Are buildings and feeds available to add value to calves by feeding them beyond weaning? The answers to these and other relevant questions provide the framework on which a profitable enterprise can be built.

Particularly important is the choice of season of calving. Most herds calve in the spring or at the start of the rainy season because this minimizes cow feeding costs. The cow is working hardest suckling her calf on low cost, high quality grazed forage. On productive grassland autumn calving is an option, the extra cost of winter feeding cows suckling calves being offset by greater calf weaning weight. Autumn calving usually achieves the highest financial gross margin per cow, but spring calving rivals its gross margin per hectare. The need to reduce production costs has forced many former autumn-calving herds to change to spring calving.

The decision on calving season may be forced by the availability of housing and labour, regardless of feed availability. Housing allows a choice of calving season and avoids poaching of land by outwintered stock. However, the provision of housing increases fixed costs on the farm.

Choice of bull

The bull contributes half the genes of all the calves sired by him and so choice of breed and individual bull are both critical to herd performance. Even at weaning, when maternal effects are expressed at their maximum, sire breed has a greater effect on weaning weight than dam type.

Heavy breeds such as Charolais and Simmental are generally used as terminal sires, that is to produce the slaughter generation. They sire calves with the highest weaning weights (Table 2.1) and the rapid gains are carried through into the post-weaning period. However, the cost of this extra growth performance is a higher proportion of assisted calvings and greater neonatal calf mortality (Table 2.2). Overall, nevertheless, calves sired

by heavier breeds produce the greatest annual output of weaning weight per cow.

It is several years since these survey data were collected and there may have been subsequent changes in the relative performance of breeds. Also, breeds such as the double-muscled Belgian Blue are now available to commercial producers in the UK. This breed is just below the Charolais in growth performance but has greater dystokia. Belgian Blue crosses have exceptional carcass characteristics with high killing out and meat yield percentages. Limousin crosses are also outstanding for these characteristics.

Most commercial suckler herds in Britain have opted for continental terminal sire breeds, especially Charolais, Limousin and Simmental. However, some producers prefer local breeds or use Angus bulls to gain quality premiums that offset poorer growth performance. Easy care Angus and Herefords are often selected in pastoral and range countries where large numbers of cattle are managed by a single stockworker. Breed choice would also be affected if herd replacements are home bred. Then easy calving breeds with good maternal abilities would be preferred (see p. 9).

The selection of an individual bull within a breed is just as important as breed choice. In recent years bull selection has been transformed by the development of a sophisticated statistical method of analysing breeding records from pedigree herds, known by its acronym BLUP (best linear unbiased predictor). The analysis of records from all related cattle, whatever herd they are in, effectively disentangles management and genetic effects on performance to calculate estimated breeding values (EBVs) that can be used with confidence to select bulls of above average genetic merit.

In Britain the recording agency Signet combines EBVs for selected performance characters into selection indices of overall genetic merit. There are two such indices. The calving value is used where ease of calving is paramount, for example for heifer matings and in the selection of bulls to breed female replacements. The beef index is used for bull selection when growth rate and carcass quality are the objectives, for example for terminal sires in suckler herds. Signet publishes EBVs and selection indices for participating breeds. A maternal index is under development.

Table 2.1 Effects of sire breed on calf 200-day weights. Source: Meat and Livestock Commission (MLC).

Sire breed	Type of farm		
	Lowland	Upland	Hill
Hereford 200-day weight (kg)	208	194	184
Difference from Hereford (+/– kg)			
Charolais	+32	+33	+21
Simmental	+24	+28	+14
South Devon	+23	+27	+16
(North) Devon	+17	+21	+7
Lincoln Red	+14	+20	+5
Sussex	+7	+13	+2
Limousin	+7	+10	+2
Aberdeen Angus	–14	–12	–8

Choice of cow breed type

In range countries the tradition was to keep purebred herds of Angus, Hereford, Shorthorn or local breed cattle. To some extent that tradition still exists. For example, French suckler cows are still largely purebred. However, crossbred cows have a considerable advantage over purebreds due to hybrid vigour (or heterosis), which is most pronounced for improved reproductive efficiency. The outcome is that the weaning weight of calves from crossbred cows is 15–25 per cent above the average of the parent breeds. Add to this an

Table 2.2 Effects of sire breed on calving ease and annual productivity. Source: Meat and Livestock Commission (MLC).

Sire breed	Assisted calvings (%)	Calf mortality (%)	Calving interval (days)	Calf weaning weight per cow per year (kg)
Charolais	9.0	4.8	374	208
Simmental	8.9	4.2	374	203
South Devon	8.7	4.0	375	203
(North) Devon	6.4	2.6	373	200
Limousin	7.4	3.8	375	199
Lincoln Red	6.7	2.0	373	198
Sussex	4.5	1.5	372	196
Hereford	4.0	1.6	372	189
Aberdeen Angus	2.4	1.3	370	179

improvement in longevity and the lifetime advantage to crossbreds is considerable.

Recognition of the benefits of crossbreeding in Britain is as old as the development of breeds themselves. Traditional crossbreds include the celebrated Blue Grey (White Shorthorn bull × Galloway cow), Shorthorn × Highland and Irish-bred Blue Grey (Angus × Dairy Shorthorn). As supplies of these traditional crosses started to become scarce some 30 years ago, beef breed × dairy cows started to be used as suckler cows, notably Hereford × Friesian and Angus × Friesian. It was later still that US ranchers discovered the heterosis advantage of Hereford × Angus and the reciprocal cross over either of the pure breeds.

The Hereford × Friesian was, and still is, widely used as a suckler cow. It produces more milk than the Blue Grey and weans a heavier calf; however, the Blue Grey has better reproductive efficiency and, overall, performance of the two crosses is similar. Both crosses share the advantage of medium body size. Heavy cows such as Charolais × Friesian need more feed but are unable to translate enough of their greater weight into heavier calf weaning weight to rival the efficiency of a lighter breed type. Nonetheless, many British suckled calf producers use these heavier cows and are prepared to trade a theoretical reduction in efficiency (that may not be apparent at farm level) for the improved conformation of calves which commands a premium at the calf sales and later in carcass value.

The penetration of the Friesian breed by extreme dairy Holstein genes from North America has caused such a deterioration in beef breed × Friesian cow conformation that it shows through in the calf. This has sparked off a search for alternative suckler herd replacements that are crossbred with good maternal qualities and have acceptable conformation. Moreover, in the wake of the BSE crisis many herd owners wish to breed their own replacements so that they can maintain a closed cow herd.

Merely saving heifer calves from terminal sire breeds such as Charolais increases cow size progressively and reduces maternal performance – the worst of all worlds. The simplest planned approach to breeding replacements is to breed about half the herd to a sire breed of medium size with good maternal qualities, for example Angus or Salers. In smaller herds this is best done by artificial insemination (AI). In the next generation, Angus cross females, for example, might be mated to Salers whose female progeny are in turn mated back to Angus. This two-breed rotation is known as criss-crossing. The other half of the herd would usually be mated to terminal sire breeds.

Bulls for breeding herd replacements should be selected to have a good calving value index (which incorporates EBVs for calf birth weight, ease of calving score and gestation length) and a high EBV for 200-day milk (an estimate of the genetic merit for milk production that the sire passes to his female offspring).

In some parts of the world, notably the US, sophisticated breeding programmes have been used to create composite breeds combining the best features of three or four foundation breeds. A composite may be bred to feature maternal qualities, terminal sire qualities, heat tolerance and so on. A four-breed composite is effectively a purpose-bred pure breeding population that retains up to 75 per cent of the hybrid vigour of the initial first (F1) crosses between the original four breeds.

The creation of composite breeds needs very large numbers of cattle. However, commercial suckled calf producers with relatively small herds will have access to composites from international genetics companies with large-scale breeding operations involving thousands of cattle. The main demand will be for purpose-bred suckler herd replacements of good maternal ability.

Rearing replacement heifers

The replacement policy in a suckler herd should involve culling cows that are persistently barren, calve unacceptably late or are on the verge of the emaciation commonly associated with old age. A typical replacement rate is 16 per cent which indicates an average herd life of seven years.

In the UK, culling policies have been disrupted in the wake of the BSE crisis by the Over Thirty Month Scheme (OTMS) in which the carcasses of cattle over 30 months old are removed from human consumption. Compensation payments for culls are much lower than cull cow values before the BSE crisis and this will continue to inhibit planned culling until the scheme is eventually wound down.

Replacements may be purchased as calves from dairy herds, as bulling heifers or, less frequently nowadays, as heifers on the point of calving. With calves and bulling heifers it is prudent to purchase a surplus of 15–20 per cent to allow selection. Heifers that prove unsuitable as replacements are slaughtered for beef.

In most situations heifers should be calved for the first time at two years of age to optimise lifetime performance. However, autumn-born calves from the dairy herd would usually be calved at $2^1/_2$ years in a spring-calving suckler herd. In either case, good management is necessary to achieve target mating and post calving weights (Table 2.3).

Heifers are best calved at the start of the herd calving period to allow for an almost inevitable slippage in time to the second calving. Also, since dystokia is worst in

Table 2.3 Rearing targets for replacement heifers.

	Mating weight (kg)	Post calving weight (kg)
Two-year calving		
British breed crosses	325	510
Continental breed crosses	350	550
Calving at 2½ years		
British breed crosses	400	540
Continental breed crosses	435	575

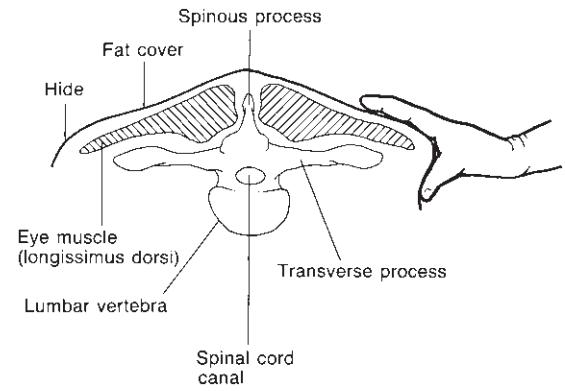

Fig. 2.1 Technique for condition scoring.

heifers, it is desirable to mate them to an easy calving breed such as Angus or Hereford. Difficult calving is a cause of delayed rebreeding.

Suckler herd management

Suckler herd management aims for a high proportion of cows producing live calves in a calving period of 12 weeks or less. The advantages of a compact calving period are, firstly, that herd rationing matches closely the nutritional needs of individual cows, saving feed costs. Secondly, calvings can be supervised closely to provide assistance when needed, reducing calf mortality. Finally, calf performance is uniform with few of the late-born calves that are so difficult to utilize profitably.

Generally, a long drawn out calving period is a sure sign of low herd conception rate. Late calvers have too little time to rebreed by the end of the mating season and get later and later, eventually failing to get in calf altogether. The only solutions to an over-long calving period are to cull late calvers or switch them between spring- and autumn-calving herds so that they calve on time. The danger of the latter strategy is that cows shuttle from one herd to the other without the underlying causes of low conception rate being tackled.

The main reason why cows fail to conceive is that they are too thin. Under UK conditions, body condition at mating, scored on a scale from 0 (emaciated) to 5 (grossly overfat), needs to be 2½ in winter but can be as low as 2 if cows are grazing high quality forage and current nutrient intake is high. The key targets that achieve the necessary body condition at mating are a score of 3 in the autumn and 2 at turnout to grazing in the spring. The time to carry out condition scoring is in mid pregnancy, while there is still time to adjust feeding management before calving.

The method of condition scoring (Fig. 2.1) is to grip the loin between the thumb and forefinger mid-way between the hip (hook) bone and the last rib on the left side of the cow. The thumb curls over the ledge formed by the transverse processes of the spine to feel the overlying fat cover. It is best to handle cows until experience of the technique has been gained but, thereafter, a skilled stockworker can use close visual inspection to obtain a working guide to condition.

Descriptions of condition score classes are presented in Table 2.4. One possible confusion is with continental crosses of good conformation. Their thick muscling may overhang the transverse processes of the spine and confuse handling or visual assessments. If this is the case, condition should also be assessed by handling the ribs with the flat of the hand. If the score is above 3 in the autumn, autumn-calving cows are put at the risk of a difficult calving. If spring calvers score less than 3 in the autumn, the permissible winter weight loss is reduced and feed costs increase.

Feeding spring-calving cows through the winter that are at target condition score 3 in the autumn allows the loss of one unit of condition score, which equates to about 100 kg liveweight or 0.5 kg daily. Autumn calvers, on the other hand, must be fed through the winter for the additional strain of lactation and must be at condition score 2½ when mated in mid-winter. Therefore, in cows at condition score 3 in the autumn a weight loss of only 0.25 kg/day is permissible until they are safely in calf. If there is a time to feed suckler cows generously, this is it. Thereafter, the rate of weight loss can increase to 0.5 kg/day. Autumn-calved heifers are still growing as well as milking and should not be allowed to lose weight through the winter.

These guidelines are translated into daily metabolizable energy (ME) allowances expressed as megajoules (MJ) for cows fed a typical moderate quality ration in Table 2.5.

It is all too easy during the grazing season to concentrate on calf performance and forget that cows at target condition score 2 in the spring need to gain

Table 2.4 Condition scoring of suckler cows.

Condition score	Description
0	Spine very prominent with no detectable fat cover over the sharp transverse processes of the spine
1	Spine still prominent but transverse processes no longer sharp
2	Transverse processes can still be felt, but now rounded with a thin covering of fat
3	Individual transverse processes can now only be felt with firm pressure by the thumb
4	Transverse processes can hardly be felt, even with firm pressure
5	Transverse processes completely obscured with a thick layer of soft fat and puffy fat deposits around the tail head

Table 2.5 Metabolizable energy (ME) allowances for winter feeding suckler cows. Reproduced from Allen (2001) with permission of Chalcombe Publications.

Liveweight (kg)	Daily weight loss (kg)	Milk yield (kg)	ME (MJ/day)
Spring calver			
(a) Precalving[a]			
500	–0.5	0	55
600			62
700			69
(b) Post calving[a]			
500	–0.5	10	89
600			97
700			105
Autumn calver			
(a) Premating[b]			
500	–0.25	10	99
600			107
700			115
(b) Post mating[b]			
500	–0.5	7	74
600			81
700			88

[a] If no weight loss is permissible add 20 MJ ME per day.
[b] If no weight loss is permissible add 10 MJ ME per day.

100 kg liveweight by the autumn. If by mid-season there is any doubt that the whole herd or individual cows may not attain the required total gain, action must be taken to rectify the situation. The provision of more selective grazing of fresh pasture may suffice. Alternatively, it may be necessary to take more drastic action with autumn calvers and wean calves early to remove the strain of lactation.

Suckled calf management

If cow performance is good, calf performance is usually also good. This is not to say that calf performance looks after itself. Nevertheless, a compact calving means fewer of the late-born calves have subnormal weaning weights. In addition, achieving target body condition scores in cows is conducive to high milk yield.

In most situations the cow is capable of producing as much milk as the calf can suckle. This can lead to problems early in the suckling period, especially with spring-calving beef × dairy cows of high milk potential, when calves consume too much milk and scour. If the cause of scouring is viral or bacterial it is worth considering an appropriate scour vaccine.

Milk consumption increases quickly during the first month of suckling and, although calves pick at solid food early in life, milk intake dominates calf performance in the first three months. With a cow type of moderate yield potential, milk still accounts for half the calf gain in the third month and in higher yielding beef breed × Friesians this balance is not reached until the fourth month. Nevertheless, by this time the intake of solid food by the calf is increasing rapidly.

Milk intake is especially important to the spring-born calf that has a relatively short suckling period of six to seven months. The nutritional requirements of the calf and seasonal grass growth are well matched, although supplementary feeding helps to sustain daily gain from late summer onwards as grass growth and quality decline.

Management of the autumn-born calf is more complicated because the suckling period is longer and peak milk yield must be supported on winter rations. The most cost-effective approach over the winter is to feed the cow well in the early months until she is safely in calf and then to rely increasingly on creep feeding calves concentrates and the highest quality conserved forage available. It is energetically much more efficient to feed the calf directly than to increase cow feeding to stimulate milk yield.

When autumn-calved cows are turned out to grass in the spring there is a boost to milk yield, but by late summer calves require creep feeding to sustain daily gains. It is wise to wean the calves sooner rather than

Table 2.6 Performance targets for lowland and upland suckler herds.

	Continental breed sire[a]			British breed sire[a]		
	Autumn	**Spring (silage)**	**Spring (straw)**	**Autumn**	**Spring (silage)**	**Spring (straw)**
Calves reared/cow	0.92	0.92	0.92	0.95	0.95	0.95
Calf gain (kg/day)	1.0	1.1	1.1	0.9	1.0	1.0
Weaning (months)	10	7	7	10	7	7
Calf autumn weight (kg)	350	280	280	320	260	260
Cow concentrate (tonnes)	0.25	0.12	0.3	0.25	0.12	0.3
Calf concentrate (tonnes)	0.25	0.08	0.08	0.1	0.05	0.05
Silage (tonnes @ 22% DM)	6.5	5.0	—	6.5	5.0	—
Feeding straw (tonnes)	0.5	1.0	2.5	0.5	1.0	2.5

[a] Mated to suckler cows of average weight 550–600 kg.

later so that they can be managed separately and the cows left to gain condition before housing. The least stressful way of breaking the bond between calf and dam at weaning is to house the calves. An alternative approach is to put the cows and calves in well-fenced adjacent fields within sight and sound of each other.

In most ranching and pastoral countries bull calves are castrated for the convenience of herd management and a preference for steer beef over bull beef. However, in France, Italy and Spain it has become the custom to rear male calves entire because they grow faster and leaner than steers and are more profitable. In the UK, suckler bull beef is increasing and finds a ready market. The most common approach is to wean spring-born bulls in late summer and transfer them gradually over a period of about three weeks to an all-concentrate diet (Chapter 3).

For the system to be successful it is a considerable advantage to have a compact calving period so that older bull calves do not pester late-calving cows when they are in oestrus. In any case, cows with bull calves need to be separated from those with heifers by six months of age or there is a risk of premature pregnancy in the heifer calves. For this reason the system works best in spring-calving herds because there is no need to split the herd.

Grassland management

Grazed grass is the cheapest and one of the most nutritious feeds available on the farm. With financial margins under pressure, the key to profitable production is to utilize grazing to the full. This involves good grazing management and extending the grazing season where practicable.

Grassland management for suckler herds does not necessarily mean using the levels of nitrogen fertilizer employed by dairy farmers, although this may be the right policy on some productive lowland farms. In practice, especially on the upland farms where most suckler cows are kept in the UK, farmers use only moderate levels of nitrogen fertilizer and rely more on clover to increase sward productivity. Moreover, extensive grassland management is encouraged in the EU by the payment of extensification premiums for stocking lightly.

Whatever the type of sward, grazing management should aim to control the average sward height of grazed and ungrazed areas. Cows gain most weight early in the grazing season when average sward height is maintained at 8–10 cm. However, they graze selectively leaving patches that go to seed and are of poor nutritional quality when they have to be grazed later on. So until mid season it is necessary to graze swards more tightly at an average sward height of 6–8 cm to inhibit seed heading. Thereafter, when the risk of seed heading is less and there is an inevitable build-up of dead herbage in the base of the sward, average sward height can be relaxed to 8–10 cm to allow selective grazing.

In the period of peak grass growth in early summer, high stocking rates of three autumn calving cows per hectare or four spring calvers are needed to exert the necessary control of sward height. At these relatively high stocking rates it is important to have a reserve grazing buffer in case of reduced grass growth in dry weather. This can be achieved by setting aside an additional 25 per cent of grassland that is conserved as silage if possible, but grazed if necessary.

As the season progresses beyond mid season the grazing area needs to increase and this is achieved by grazing aftermaths on fields cut previously for silage or hay.

Parasitic worms causing gastroenteritis and bronchitis are less of a problem in suckled calves than in young dairy-bred calves in their first grazing season. Nevertheless, it is advisable to treat autumn-born calves at weaning. In any case, both autumn- and spring-born calves should be treated at yarding to guard against winter scour (Chapter 19).

With silage making the priority is a feed with high intake characteristics rather than the highest possible ME per kg dry matter (DM). Cutting can be delayed for a week or so to await dry sunny weather that allows an effective 24-hour wilt for clamp silage, longer for big bales, and produces silage with the best fermentation quality.

Targets of performance

The objectives of suckler herd management outlined in this chapter have been compiled into suckler herd targets appropriate to lowland and upland herds in the UK and other European countries with similar climatic conditions (Table 2.6). For the predominant spring-calving herds targets are shown for herds both on grass farms, where silage is the basic winter feed, and on arable farms, where winter diets are based on straw and concentrates. Achieving the physical targets is a prerequisite of profitable production.

Reference

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Chapter 3

Beef Finishing Systems

D.M. Allen

Introduction

A whole range of overlapping beef finishing systems is applicable to cattle bred in suckler and dairy herds. The higher the lifetime daily gain of the beef system, the younger is the slaughter age and the lighter the slaughter weight at a stated carcass fat cover. Also, within a given beef system, bulls grow faster and are leaner than steers which, in turn, grow faster and are leaner than heifers.

These characteristics of beef systems make it possible to chart average relationships between slaughter age and slaughter weight, illustrated in Fig. 3.1 for Charolais crosses. It is possible to construct similar graphs for other breed types and to predict the likely slaughter weight of cattle slaughtered at a particular age and vice versa. Note that as long as the Over Thirty Month Scheme (OTMS) is in place as a BSE control measure in the UK, beef from cattle over 30 months old at slaughter is destroyed, although this will change from 2004 onwards.

Cattle remain in an EU fat class for several weeks. The main EU fat class for bull carcasses is 3 on a five-point scale from 1 (ultra lean) to 5 (grossly overfat) and 4L for steers and heifers, which is the average fat class for all carcasses in Britain.

Calves from beef suckler herds on marginal land usually have to be sold in the autumn for finishing on farms with more productive land. However, spring-born calves may be overwintered for sale in spring, if buildings and feed are available, and bull calves may be finished on purchased concentrates as suckler bull beef.

The heaviest yearling steer calves purchased by finishers in the autumn may be finished through the ensuing winter for sale at 16–18 months old. Heifers and lighter steer calves are fed a store ration over the winter in preparation for grazing the following summer. Any that fail to finish off grass are yarded for a further winter finishing period.

Still, all too many cattle are managed aimlessly with no particular finishing system in mind and are sold finished or in store condition when prices seem favourable. This approach leads to a good deal of trading in suckled calves and stores, some of which may change ownership three or four times in their lifetime. Farm assurance schemes now limit the number of times an animal can be traded within the scheme.

Under range conditions in the USA, the growth rate of suckled calves is poorer than on European grass farms. However, feed grains are cheap and a special approach to finishing has been adopted in beef feed lots. Weaned calves from range herds are sold to 'back grounding' farms where they are grown on forage at moderate store rates of gain as feeder cattle. They then enter feed lots at 12–18 months of age for rapid finishing over a five-month period on a 'hot' high-grain ration.

In the case of dairy-bred calves, several distinctive beef systems have been developed. At one extreme is cereal (barley) beef in which bulls fed an all-concentrate diet grow rapidly to slaughter at 11–13 months of age. At the other extreme are forage-based systems in which steers and heifers are either winter finished off silage supplemented with concentrates for slaughter at 16–20 months of age or grass finished in summer at 20–24 months old.

In reality, cattle passport statistics indicate that more than a third of steers do not follow any of the production systems described here and are slaughtered at 24–30 months of age. The reason is thought to be that farmers delay slaughter until after they have obtained the second beef subsidy (p. 15), paid from 22 months of age. It demonstrates how subsidy rules manipulate production and marketing decisions.

Planning and budgeting

The fall in market prices for beef cattle in the aftermath of the BSE crisis has focused attention on beef system

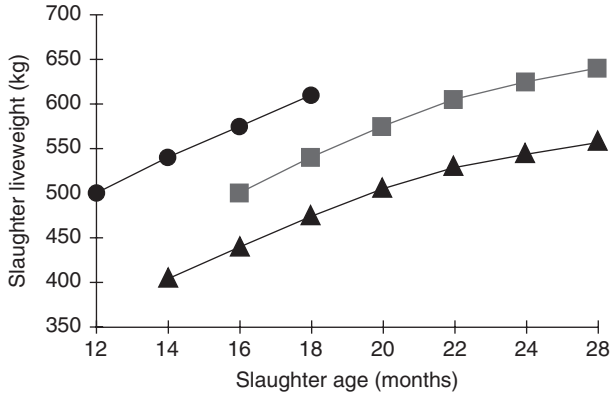

Fig. 3.1 Average relationships between slaughter age and slaughter weight for Charolais cross cattle. (Bulls were slaughtered at EU fat class 3, steers and heifers at EU fat class 4L.) ● = Bulls; ■ = steers; ▲ = heifers.

plans and budgets. Formerly, too many beef farmers were preoccupied by the margin between buying and selling prices, or even just the sale price achieved regardless of cost. Now controlling costs, whilst achieving performance targets, is very important. Also essential is maximizing eligibility for EU subsidies, without which profitable production is difficult.

The EU beef regime that came into effect in January 2000 is more complex than previous schemes. As before, bulls may qualify for a single Bull Premium and steers for one or both Beef Special Premiums (BSP), the first of which is paid at 9–20 months of age and the second at over 22 months. There is no upper limit on the number of claims provided the stocking rate does not exceed 1.8 Livestock Units (LU) per forage hectare, otherwise claims are scaled back. If a national ceiling of claims is exceeded, payments are also scaled back. Cattle must be retained for at least 2 months after the claim is made. All slaughter cattle, including cull cows, qualify for a slaughter premium provided they have been on the farm for at least two months. Suckler Cow Premiums are paid up to a farm quota and a minimum of 5 per cent and maximum of 40 per cent of claims can be made on heifers over 8 months of age. Complex rules apply to Extensification Premiums paid on farms practising extensive production methods. Detailed rules and rates of payment can be found in official publications. In 2003 discussions were in progress to alter fundamentally the basis of subsidy payments with headage subsidies replaced by area payments.

The starting point for planning is a decision on which beef system fits farm resources best, setting performance targets and drawing up a budget to evaluate margin potential. Figure 3.2 presents a budget format that can be used to evaluate finishing systems and shows as an example cereal bull beef from purebred Holstein–Friesian bulls.

If production is based on borrowed capital, it is important to calculate the interest on working capital that must be paid. The conventional method of calculation is the cost of the calf or store plus half the variable costs multiplied by the monthly bank interest rate for the number of months cattle are fed.

Sale returns are highly dependent on the quality of cattle produced, especially their conformation. Figure 3.3 illustrates differentials for steer carcasses classified by the EU method, in a conformation range from E (excellent), U+, –U, R (average), O+, –O and P (very poor). Note the severe discount for poor –O conformation, especially for carcasses that stray into what is regarded by most buyers as overfat class 4H. Holstein–Friesian carcasses fall into the poorest conformation classes –O and P and a high proportion of the beef is used for manufacturing. Good conformation classes –U and better contain mainly continental breed crosses.

Generally, young bulls sell for the same price per kg carcass or slightly less than steers in deadweight sales, but command a premium at selected live auction markets. Heifers usually sell at a small discount. There is a steady move towards deadweight selling under pressure from supermarket buying specifications.

Finishing suckled calves and stores

At the start of a winter feeding period there are two options for steers and heifers. Either the cattle are fed to gain at least 0.9 kg/day, often higher, for finishing that winter. Or they are fed a store ration to gain 0.6–0.8 kg/day in preparation for grazing the following summer.

It is generally held that the profitability of finishing depends mainly on buying and selling skills. It is perfectly true that the feeder's margin – the difference between the purchase and sale price – determines the average gross margin. However, finishers with the best margins owe much of their success to achieving high standards of cattle performance.

Winter finishing

Winter finishing has a feeding period of four to eight months, depending on breed, sex category and individual performance. At the start of the winter the cattle may be yearling suckled calves or older store cattle. Commonly, they are fed rationed concentrates with silage to appetite, but on arable farms arable byproducts may partly or wholly replace grass silage.

Steers of all breed types are well suited to winter finishing. Early maturing heifers are less suitable because they finish too quickly at light weights. Nevertheless, continental cross heifers can be winter finished at around 0.9 kg/day on a high forage diet.

	Budget (£/head)	Example: cereal beef[a] (£/head @ 2003 prices)
A Calf or store cost		40
B Calf rearing to 3 months: dairy-bred calf		58
C Forage costs . . . cattle/ha @ . . . £/ha[b]		0
D Concentrate costs *1.9* tonnes @ £*100*/t		190
E Other feeds: straw *0.3* tonnes @ £*30*/t		9
straights . . . tonnes @ . . . /t		
by-products . . . tonnes @ . . . /t		
F Other variable costs: veterinary		10
bedding		20
marketing		8
Miscellaneous		10
Total		**48**
G Total calf + variable costs (**A + B + C + D + E + F**)		**345**
H Sale weight (kg liveweight or carcass)		475 kg
I Forecast sale price (£/kg)		0.8 £/kg
J Returns: weight **H** × sale price **I**		**380**
K Gross margin (excluding premiums)		35
L Premiums: 1st beef special premium		0
2nd beef special premium		0
bull premium		130
slaughter premium		50
extensification premium		0
Total		**180**
Overall gross margin (including premiums) **K + L**		**215**

[a] Holstein–Friesian bull beef.

[b] Guidelines on forage costs at 2003 prices:
intensive (350 kg N fertilizer/ha) £210/ha
semi-intensive (250 kg N/ha) £150/ha
extensive (75 kg N or less/ha) £70/ha.

Fig. 3.2 Budget format for beef finishing systems.

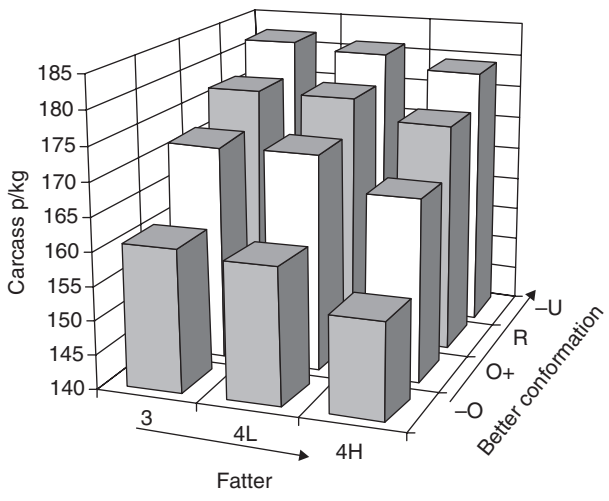

Fig. 3.3 Price differentials for steer carcasses of different EU conformation and fat classes. Source: Meat and Livestock Commission price report 1999.

Standards for winter finishing suckled calves and stores are shown in Table 3.1. Continental cross steers slaughtered at two years old or more may be too heavy for some buyers.

Suckler bull beef is still relatively new to the UK, but has been commonplace in France for many years. Production is expanding in the UK but demand is limited and it is important to secure a market before commencing production. The system is simplest for spring-born calves which are weaned in the autumn and transferred gradually over about three weeks to an all-concentrate diet containing 16 per cent crude protein. However, autumn-born calves weaned in the spring can also be used. The British safety code for bull beef production recommends no more than 20 bulls to a pen but much larger groups are housed in continental Europe.

Maize silage is short of protein but has good feed intake characteristics and is an excellent source of energy. In continental Europe maize silage is widely