Finishing dairy-origin beef Blueprint

Main Authors
Dr Norman Weatherup (CAFRE Greenmount)
Dr Lynne Dawson (AFBI Hillsborough)
Paul McHenry (CAFRE Greenmount)

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afbi Agri-Food and Biosciences Institute

cafre College of Agriculture, Food & Rural Enterprise

Introduction

A modelling study conducted by the Northern Ireland Red Meat Industry Task Force (report first published October 2007) identified that 'there may be viable models of production using dairy-origin beef that break even on a full economic profitability basis in Northern Ireland assuming aggressive cost efficiencies and farm-gate prices closer to those seen in GB'.

The Northern Ireland Red Meat Industry Task Force Strategy Review provided data on two alternative finishing models – one for dairy/beef crosses, and one for full-bred dairy animals, and indicated that they would break even on a full economic profitability basis assuming the following criteria were applied:

(1) Efficient grassland management to enable grass-fed animals to be finished at 18 months of age or less;
(2) Correct breed and gender choice to enable this to happen, such as dairy/Aberdeen Angus and Hereford crossbred steers and heifers, dairy/Continental crossbred heifers or dairy steers for grass-based systems;
(3) Holstein or dairy/Continental cross bulls are finished intensively on a cereal-beef system;
(4) Labour efficiency is increased to 400 animals per man at any one point in time.

Efficiency improvements are not only likely to lead to profitability, but will also reduce the carbon footprint of beef production, a matter which has come to the fore since the original Task Force Report.

The objective of this booklet is to describe the optimum finishing systems for dairy origin animals from purchase as weaned calves through to slaughter. Much of the information has been derived from research work conducted at AFBI Hillsborough, which came to a conclusion after the Task Force Report was published. The first step of production – the calf rearing phase – was covered in the "Dairy Calf Rearing Protocol" which has already been published by the Task Force.

Section 1: Objectives, Targets, Alternative Systems and Markets

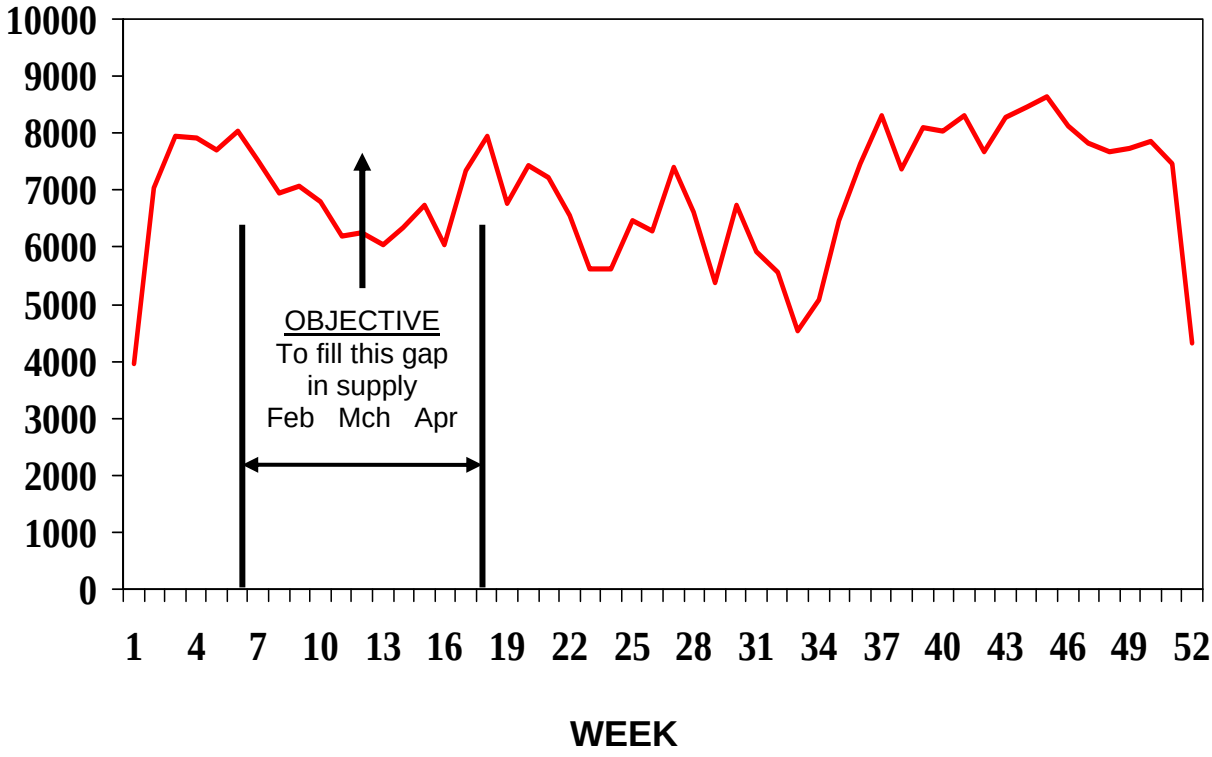
- **To finish on a grass-based system autumn-born dairy calves from 15 weeks of age for slaughter in the spring at 18 months of age.**
- **To finish bull calves on a cereal based system at 12 months of age or on a grass silage/cereal system at 14 to 16 months of age.**
- **To purchase calves at 15 weeks of age from professional calf rearers.**
- **To finish at weights specified by processors.**
- **If a breed specific market outlet is intended, check requirements promptly with processor as scheme requirements may vary.**

➢ Objectives and Targets

Reason:

There is a gap in supply to the market in spring as shown in Figure 1.

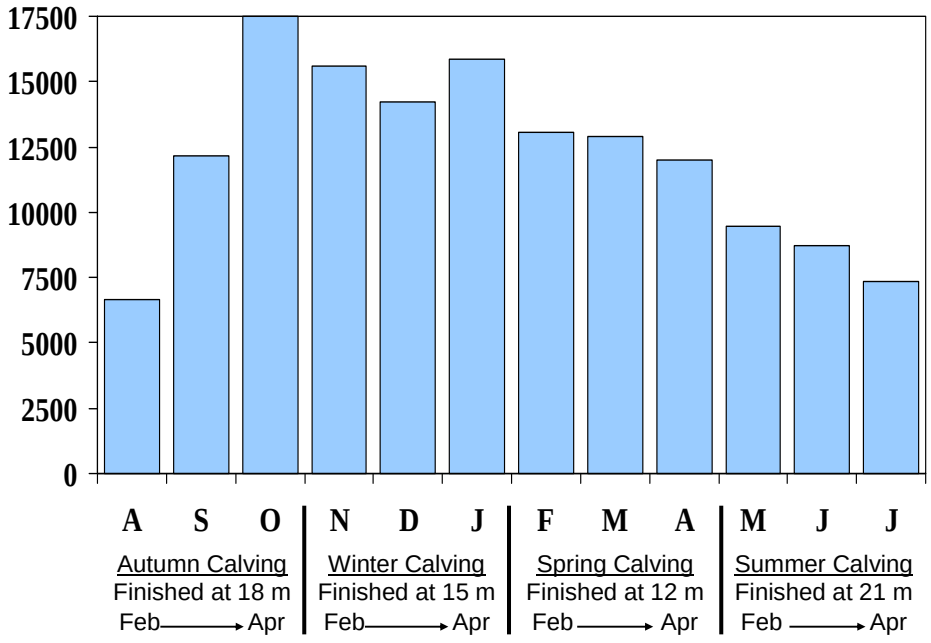
Figure 1: Weekly clean cattle kill numbers, 2009



Practice:

There is a peak of calving in dairy herds in the autumn. Most dairy calves born in the autumn will be full-bred dairy breeds as dairy farmers breed pure in order to get their heifer replacements from their earliest calving cows. As the season progresses the number of dairy-sired calves reduces and is replaced by beef sired calves. Calves should be finished on different systems according to their breed and gender – for example male dairy breed calves intended for a grass based system should be castrated and reared as steers to 18 months of age, whereas if a cereal system is intended they should be left entire and reared as bulls to 12 months of age, thus filling in a late summer gap in the market as shown in the graph above. Beef breeds and crosses should be adapted to finish at a range of ages as shown in Figure 2.

Figure 2: Calf birth registrations by month, 2008



- **Market requirements**

Reason:

Processors have specific requirements for carcase weight, conformation and fatness as shown in Table 1.

Table 1: NI processors' specification for prime beef carcases

	Steers & Heifers	Young Bulls
Weight (kg)	280 - 380	280 - 380
Age	Less than 30 months	Less than 16 months
Grades	E3 E4L U3 U4L R3 R4L O+3	E3 E4L U3 U4L R3 R4L O+3
Farm Quality Assured	Yes	Yes
Max number of resident farms	4	4
Days on last farm	90	90
Days on last farm for 1 customer	21	21

Practice:

Carcase weight required: 280 – 380 kg.

Young bulls to be less than 16 months of age.

Pure dairy bulls will have inferior conformation and terms should be negotiated for these.

Section 2: Weanling procurement

- **Only healthy weaned calves should be sourced directly from farms of known health status (preferred sources are professional calf rearers with calves in age batches).**
- **Identify potential sources of weanlings to be supplied during the summer months.**
- **At purchase calves must be approximately 15 weeks of age and consuming at least 1 kg of concentrates per day and long forage (e.g. hay) (Precautions similar to those detailed in the "Calf Rearing Protocol" should be taken).**

➢ **Only healthy weanlings should be sourced directly from farms of known health status.**

Reason:

Healthy calves have the greatest potential for profitable growth performance, low veterinary costs and low mortality.

Practice:

Purchase weanlings from farms which have a known health status. This will reduce the possibility of buying in multiple diseases. Further details are discussed in the health section. Source farms which are free from or have control programmes in place against economically important diseases. Herds which are members of the AFBI Cattle Health Scheme or any other health schemes (especially for BVD and IBR) should be considered.

Only healthy weanlings that have a shining coat, bright eyes and a clean moist nose should be purchased. Calves should be rejected if they are dull and listless, show signs of diarrhoea, are breathing heavily or if they have discharges from the eyes, nose or mouth.

- **Identify potential sources of weanlings to be supplied during the summer months.**

Reason:
It is essential that sufficient weanlings are available to establish the scale of finishing unit required, with all animals at approximately the same age, which will make management easier.

Practice:
Full-bred dairy weanlings (Holstein heifers and bulls) are in greatest supply from October to January with limited availability during the summer months. Beef cross calves are in greatest supply in April, May and June.

- **At purchase weanlings must be approximately 12 weeks of age and consuming at least 1 kg of concentrates per day and long forage (e.g. hay).**

Reason:
Weaned calves that are consuming forage with some concentrates will be easy to adapt to either grass-based or cereal finishing systems.

Practice:
After a settling in period of a few days, change diets gradually over a two-week period.

Section 3: Systems suitable for young bulls

3.1 Spring-born, intensive Holstein bull beef system

3.1.1 Description of system

Objective:

Purchase spring-born Holstein bull calves born February to April, feed concentrates *ad libitum* and slaughter at 13 months of age

Reason: Eliminate forage requirement, achieve high live weight gains and provide animals for slaughter during the spring period.

Practice: A summary of this system is provided in the Table below.

Table 1: Description of the spring-born, intensive Holstein bull beef system

Parameter	**Details**
Date of birth	Spring - February/March/April
Age at purchase	15 weeks
Accommodation	Housed from purchase to slaughter
Diet	Concentrates *ad libitum* (plus forage to maintain rumen function)
Age at slaughter	13 months
Live weight at slaughter	500 kg
Date of slaughter	Spring – February/March/April

3.1.2 Target performance

Objective

Target growth rate of 1.3 kg/day from purchase (15 weeks of age) to slaughter at 13 months (500 kg live weight; 265 kg carcase weight) with a concentrate input of 2.2 tonnes/head

Reason: High growth rates must be maintained throughout the growing and finishing period to meet the target slaughter age of 13 months.

Practice: Table 2 details target live weights for Holstein bulls at specific periods through the finishing period. Target growth rate throughout the period is 1.3 kg live weight/day. February/March/April born bulls will be slaughtered in February/March/April of the following year.

Table 2: Target live weights for spring-born Holstein bulls finished on a high concentrate input system

	Target live weight (kg)	Live weight gain (kg/day)
	Holstein	
15 weeks (purchase)	120	
6 months	221	1.3
9 months	340	1.3
13 months (slaughter)	500	1.3

Carcase weight 260 kg, Killing out % = 52%, Grades = 40% O3, 60% P3

3.2 Spring born, grass, grass silage/concentrate-based Holstein and continental cross Holstein bull beef system

3.2.1 Description of system

Objective: Purchase spring-born Holstein and continental cross Holstein bull calves born February to April, feed grazed grass, grass silage plus concentrates and slaughter at 16 months of age

Reason: Potential to reduce feed costs through a reduction in concentrate inputs and utilisation of grazed grass during the first summer and grass silage during the finishing period. Ability to maintain relatively high live weight gains and provide animals for slaughter during the summer period.

Practice: A summary of this system is provided in Table 3.

Table 3: ***Description of the spring-born, grass/grass silage/concentrate Holstein and continental cross Holstein bull beef system***

Parameter	**Details**
Date of birth	Spring - February/March/April
Age at purchase	15 weeks
Accommodation	Turned out to grass from purchase to September/October, housed from October until slaughter
Diet	Grazed grass plus concentrates, grass silage: concentrates (50:50 on a DM basis).
Age at slaughter	16 months
Live weight at slaughter	550 kg
Date of slaughter	Summer – June/July/August

Target performance

Objective: Target growth rate of 1.0 to 1.2 kg/day from purchase (15 weeks of age) to slaughter at 16 months (550 kg live weight; 290 kg carcase weight) with a silage input of 0.9 tonnes dry matter (DM)/head (4 tonnes fresh/head (22% DM)), concentrate input of 1.6 tonnes fresh/head and a stocking rate of 15 animals/ha.

Reason: Depending on grassland management, spring-born Holstein and continental cross Holstein bulls turned out to grass in their first summer may have lower live weight gains compared with autumn born bulls fed a grass silage/concentrate-based diet.

Practice: Calves are turned out to grass in their first summer and offered at least 2 kg concentrates per head per day. Sward quality must be maintained by close attention to management and grass heights should be maintained at 8 to 9 cm (2600-2850 kg DM/ha grass cover depending on season). High quality grass silage must be offered during the winter feeding period (D-value $\geq$ 68) and concentrates must contribute at least 50% of the diet on a dry matter basis increasing to 70% of the diet one month prior to slaughter. Target live

weights throughout the finishing period are presented in the Table below. February/March/April Holstein and Continental x Holstein bulls will be slaughtered in June/July/August of the following year.

Table 4: Target live weights for spring-born Holstein and continental cross Holstein bulls finished on a grass/grass-silage/concentrate-based diet

Age (weeks)	Target live weight (kg)		Live weight gain (kg/day)
	Holstein	Continental x Holstein	
15 weeks (purchase)	120	122	
6 months	198	200	1.0
9 months	290	292	1.0
12 months	400	401	1.2
16 months (slaughter)	550	550	1.2

Holstein bulls – Carcase weight 290 kg, Killing out % = 53%, Grade = 60% O3, 40% P3
Continental cross Holstein bulls – carcase weight 295 kg, Killing out % = 54 %, Grades 50% O+3, 50 % R3

3.3 Autumn born, grass silage/concentrate-based Holstein bull beef system

3.3.1 Description of system

Objective: Purchase autumn-born Holstein bull calves born September to October, feed grass silage plus concentrates and slaughter at 16 months of age

Reason: Potential to reduce feed costs through a reduction in concentrate inputs, while still maintaining high live weight gains and provide animals for slaughter during the early spring period.

Practice: A summary of this system is provided in Table 5.

Table 5: Description of the autumn-born grass silage/concentrate-based Holstein bull beef system

Parameter	**Details**
Date of birth	Autumn - September/October
Age at purchase	15 weeks
Accommodation	Housed from purchase to slaughter
Diet	Grass silage plus concentrates (50:50 ratio on a DM basis)
Age at slaughter	16 months
Live weight at slaughter	550 kg
Date of slaughter	Spring – January/February

3.3.2 Target performance

Objective Target growth rate of 1.1 to 1.2 kg/day from purchase (15 weeks of age) to slaughter at 16 months (550 kg live weight; 295 kg carcase weight) with a silage input of 1.1 to 1.2 tonnes dry matter (DM)/head (5 to 5.5 tonnes fresh/head (22% DM)) and concentrate input of 1.6 tonnes fresh/head

Reason: Marginally lower live weight gains will be sustained on a grass-silage/concentrate based system relative to an intensive concentrate-based system.

Practice: High quality grass silage must be offered (D-value $\geq$ 68) and concentrates must contribute at least 50% of the diet on a dry matter basis increasing to up to 70% of the diet one month prior to slaughter. Target live weights throughout the finishing period are presented in the Table below and are marginally lower than those obtained on a high concentrate-based bull system due to the greater contribution from forage. September/October born Holstein bulls will be slaughtered in January/February of the following year.

Table 6: ***Target live weights for autumn-born Holstein bulls finished on a grass-silage/concentrate-based diet***

Age (weeks)	Target live weight (kg)	Live weight gain (kg/day)
	Holstein	
15 weeks (purchase)	120	
6 months	206	1.1
9 months	306	1.1
12 months	407	1.1
16 months (slaughter)	554	1.2

Holstein bulls - Carcase weight 290 kg, Killing out % = 53%, Grade = 60% O3, 40% P3

3.3 Management of bulls

3.4.1 Management on-farm

Objective: Avoid injury to personnel and other livestock and avoid bulls straying into neighbouring fields.

Reason: Bulls are aggressive and, if grazed in fields adjacent to breeding cows/heifers, will be unsettled and prone to poach and gain access.

Practice: Ensure that grazing bulls are securely enclosed by stock-proof fencing and that gates are securely fastened. Erecting an electric fence 0.5 m inside the external perimeter hedge or fence will provide more security.

3.4.2 Management prior to slaughter

Objective: Minimise stress of bulls during handling and transportation to factory and slaughter as soon as possible after arrival at abattoir.

Reason: Bulls are more excitable and more aggressive towards each other than steers. When moved from their normal accommodation to unfamiliar surroundings such as the lairage in an abattoir there is a risk that they will fight. If this persists for several hours it results in dark cutting beef being produced by a proportion of the animals.

Practice: Where possible, do not mix different groups of bulls prior to loading on to the lorry or on the lorry. Load and transport with minimum of disturbance and transport to the abattoir as quickly as possible. Make adequate arrangements with meat plant to ensure that the animals are slaughtered as soon as possible after leaving the farm and ideally slaughter within two hours of leaving their normal accommodation.

Section 4: Systems for steers and heifers – 18 month beef

4.1 Autumn born steer calves (Holsteins)

4.1.1 Objective (1):

To achieve target growth rates of 0.9 kg/day during the first winter, 1.0 kg/day during the summer grazing season and 1.0 kg/day from housing to slaughter at 550 kg at 18-20 months of age.

Reason:

To maximise performance from grazed grass (the cheapest feed available) and to reach market specification weight by 18-20 months of age.

Practice:

Modest rates of gain during the first 6 to 7 months of age in an autumn-born calf allows the animal to express compensatory growth during the grazing season. Produce high quality silage to minimise concentrate requirement.

4.1.2 Objective (2):

To have finished beef animals at the end of their second housed period or before 24 months of age at the end of their second grazing season.

Reason:

Younger animals are more efficient and number of housing periods is minimised.

Practice:

A summary of the system is shown in Table 7.

Table 7: ***Target live weights for autumn-born Holstein steers finished at 20 months.***

Event/Age	Month	Weight (kg)	Liveweight gain (kg/day)
Purchase (15 weeks)	January	120	
			0.9
Turnout (7 months)	April	200	
			1.0
Housing (14 months)	November	410	
			1.0
Finish (20 months)	May	580 (273-290kg cold weight)	

Holstein steers – Carcase weight 290 kg, Killing out % = 47-50%, Grade = O-3

4.1.3 Objective (3):

To achieve a daily gain of 0.9kg/d from 15 weeks to 7 months of age.

Reason

Modest rates of gain during the first 6/7 months of age in an autumn born calf allows the animal to express compensatory growth during the grazing season.

Practice

Feeding regime to gain 0.9kg/d will require 3.5kg/day of an 18% CP concentrate ration with the silage quality required described in Table 8.

4.1.4 Objective (4):

Produce high quality silage.

Reason:

To minimise concentrate requirement at store and finishing stages.

Practice:

Perennial ryegrass cut in May at leafy stage with a 6-7 week regrowth to meet quality parameters below (refer to section 6 for further details). At current concentrate prices (£180/t) cutting later decreases silage quality and profit.

Table 8: Silage quality parameters.

Parameter Units	**Range**
Dry matter (g/kg)	250-300
ME (MJ/kg ME)	11+
CP (g/kg)	120+
Intake potential	100
Ammonia (g/kg total N)	Max 70

4.1.5 Objective (5):

To maximise performance of cattle at grass.

Reason:

Grazed grass is the cheapest feed available in Northern Ireland. Grazed grass is normally consumed *in situ* and animals spread their own slurry at the same time. However, peak grass growth occurs in May/June and grass does not grow at all for several months of the year in winter. Housing, conserved fodder, feeding arrangements, labour requirements and slurry disposal make winter the most expensive period in the animals' lifetime. A young finishing age is therefore critical in determining profitability as this maximises the proportion of the animals life spent at grass and minimises the proportion housed. Autumn born calves could be finished from 18-24 months. Calves finished at 18 months will have two housed periods and only one grazing season while those finished at 24 months will have two winters and two grazing seasons.

Practice:

A rotational grazing system can be used to match grass growth and animal demand. Greater control is achieved when there are greater numbers of paddocks and animals spend a shorter time in each paddock. A minimum of 6 paddocks is recommended with each grazing cycle lasting 24 days in spring and 30 days in autumn. Thus each paddock is grazed in 4-5 days and has 20-25 days "rest" between grazings. Grass cover should be 3000kg DM/ha (10cm) when animals enter and 1600 kg DM/ha at exit (in spring/summer) or 1800 kg DM/ha (4-5cm) in autumn.

Swards must be well grazed during the early grazing season, as under-grazing will result in a build up of stemmy, low digestibility grass which reduces performance later in the season. A stocking rate of 15 animals per hectare from turnout until early June is recommended for young swards with 100 kg N/ha applied per year. Stocking rate can then be reduced to approximately 10 animals per hectare by bringing in an area of silage aftermath. The area which has been grazed from turnout should be topped to ensure that the quality of grazing available for the remainder of the season is as high as possible. Stocking rate is further reduced as the season progresses by bringing in aftermath grazing after the second silage cut.

4.1.6 Objective (6):

To obtain market specification carcases at the end of the finishing winter.

Reason

Carcases within specification are more valuable to the producer and to the meat industry.

Practice

Steers should be managed in to gain 1.0kg in their finishing winter. With silage quality previously described, a concentrate feeding level of 2.5-3.5kg/d will be required. Rolled barley with a suitable mineral/vitamin mix containing additional Vitamin E will be adequate as research has shown that higher CP levels do not improve growth performance but significantly increase carcase fatness. Holstein steers should be marketed at fat class 3/4L.

If cattle have not reached 410 kg by 1st January, they will not reach minimum slaughter weight by May. These cattle should be placed on a store regime (no concentrates until turnout). With excellent quality silage weight gains of a further 90kg should be achieved. Animals should be turned out to high quality spring grass, managed using the rotational grazing system previously described and marketed at fat class 3/4L at a carcase weight of 290kg.

4.2 Programme for spring born steer/heifer beef (AA, Hereford X)

4.2.1 Objective (1)

To finish cattle at the end of their second grazing season with a carcase weight of 290kg.

Reason:

To maximise performance from grazed grass (the cheapest feed available) and to reach market specification weight by 18-20 months of age. Animals spend two thirds of their lifetime at grass in this system and the proportion of time spent in the house is minimised.

Practice

A summary of the system is shown in Table 9.

Table 9: **:** ***Target live weights for spring-born Angus and Hereford X steers and heifers finished at 20 months.***

Event (age)	Date	Weight	Liveweight gain (kg/d)
Purchase (4 months)	July	120	
			1.0
Housing (7 months)	October	210	
			0.7
Turnout (13 months)	April	335	
			1.0
Finish (20 months)	November	550 (290kg cold weight)	

Expected carcase grades : Killing out % = 50%, Grade = 50% O, 50% O+, 50% fat class 3, 50% fat class 4L.

4.2.2 Objective (2):

Maximise use of grazed grass.

Reason:

Grazed grass is the cheapest feed in NI and its efficient use will ensure cattle reach target carcase weight at slaughter.

Practice:

Research evidence has demonstrated that young calves in their first grazing season are very sensitive to sward quality. However, well managed swards can sustain liveweight gains of over 1kg/d. A sward height of 9cm (2850 kg DM/ha grass cover) is optimum but requires a high stocking rate in the early part of the season (16 calves/ha, eventually decreasing to 4 calves/ha in September). A rotational grazing system should be implemented as described above.

4.2.3 Objective (3):

Store cattle to gain 0.7kg/d during the first store winter.

Reason:

This is the optimum growth rate taking compensatory gain and lifetime performance into account.

Practice:

Cattle that are to be "stored" over the winter and offered silage quality previously described will require 1.5-2.0kg/d of concentrates to sustain a liveweight gain of 0.7kg/d. Concentrate CP level should be 18%, e.g., maize gluten feed. Concentrate feeding should be eliminated 6 weeks before turnout.

4.2.4 Objective (4):

To maximise performance from grazed grass and produce a carcase within specification.

Reason:

Carcases within specification are more valuable to the producer and to the meat industry.

Practice:

Cattle should be managed to gain 1.0kg/d using a rotational system as described above. Concentrates (rolled barley) should be fed at a rate of 0.5kg/100kg liveweight for the last 6 weeks pre-slaughter to maintain growth performance, to help ensure cattle reach fat class 3/4L at slaughter and to minimise the risk of dark cutting beef.

Section 5: Nutritional regimes

Concentrate supplementation

Concentrate feeding

5.1 Grass silage

Objective: To produce high quality grass silage – D-value > 68%, ME concentration = 11.0 to 11.2 MJ/kg DM, ammonia < 70 g/kg total nitrogen

Reason: Digestibility is the most important factor affecting the feeding value of grass silage. High digestibility silage is required to achieve high target growth rates of 1 to 1.2 kg/day in bulls, 1.0kg/day for steers and 0.9-1.0kg/day for heifers.

Practice: Grass silage should be cut in mid to late May to achieve D-value of at least 68%. As fermentation quality can affect digestibility, good management practice should be adopted during harvesting and ensiling – allow 1 day/2kg of Nitrogen applied before cutting, minimise soil/slurry contamination, short wilt of 12-24 hours, fill silo in 1-2 days, precision chop to 1-3 cm, spread evenly, roll and seal well

At present concentrate prices of £180/t this beef finishing system would be less profitable if lower quality silage was fed. The quantity of 68D silage and concentrate required per animal for this system is 0.9t (DM) and 1.7t (fresh) respectively.

5.2.1 Level

Objectives:

Bull systems:

1 ***Ad libitum* concentrate** (spring-born, intensive Holstein bull beef) - gradually increase concentrate supplementation to *ad libitum* by feeding at least 3 times/day initially.

2 **50:50 grass silage:concentrate on a DM basis** (spring-born, grass, grass silage/concentrate-based Holstein and continental cross Holstein bull beef and autumn-born, grass silage/concentrate-based Holstein bull beef) – gradually increase concentrate supplementation to 50% of the total diet on a DM basis.

3 **Grazed grass plus concentrates** (spring-born, grass, grass silage/concentrate-based Holstein and continental cross Holstein bull beef) - offer 2 kg concentrates per head per day to spring-born calves turned out to grass in their first summer.

Reason: To minimise incidence of digestive upset, concentrate supplementation should be increased gradually as indicated in Tables below. Concentrate supplementation is required at grass to achieve target growth rates.

Practice:

Bull systems

1 ***Ad libitum* concentrate feeding (spring-born intensive Holstein bull beef)** - on arrival at 15 weeks of age, offer 2 kg fresh concentrates plus *ad libitum* access to grass silage. Over a period of 5 weeks increase concentrate supplementation level by 1 kg per week to *ad libitum.* Approximate concentrates intakes are shown in Table below. Five kg fresh grass silage or 1 kg fresh straw per head should be offered to maintain rumen function.

Table 10: Concentrate feeding levels for ad libitum *concentrate-based bull systems*

Spring born intensive Holstein bull system	**Feeding level (approx)**
15 weeks (purchase) to 20 weeks	2 to 6 kg/day (increase by 1 kg per week)
21 weeks to 9 months	6.0 kg/day to 7.5 kg/day
9 months to 13 months (slaughter)	7.5 kg/day to 10.0 kg/day

2 **50:50 grass silage:concentrate on a DM basis** - for autumn-born Holstein bull calves, on arrival at 15 weeks of age or spring-born bull calves at housing at 7 months, offer 2 kg fresh concentrate plus *ad libitum* access to high quality grass silage. Increase to 3 kg fresh concentrate per head per day after one week. One month prior to slaughter increase concentrate supplementation to 70% of the diet on a DM basis. Concentrate intakes throughout the lifecycle are shown in Table 11.

Table 11: Concentrate feeding levels for 50:50 grass silage/concentrate-based bull systems.

Autumn born Holstein bull system	**Spring-born Holstein and continental cross Holstein bull system**	**Concentrate feeding level**
15 weeks (purchase)	Housing (7 months)	2 kg/day increasing to 3 kg/day after one week
16 weeks to 9 months	7 months to 9 months	3.0 kg/day to 4.0 kg/day
9 months to 15 months (slaughter)	9 months to 15 months (slaughter)	4.0 kg/day to 5.0 kg/day
15 months to 16 months (slaughter)	15 months to 16 months (slaughter)	5.0 kg/day to 8.0 kg/day

These values depend on silage DM concentration and are based on a concentration of 22%

4 **Grazed grass –** for spring-born Holstein and continental cross Holstein bulls calves, turn out to grass at purchase and initially offer 2 kg fresh concentrates per head per day. If grass heights are maintained at 8 to 9 cm (grass cover 2600 to 2850 kg DM/ha) throughout the season target growth rates concentrate supplementation can be reduced to zero. However, if grass supply is 6 to 8 cm (grass cover 2100 to 2600 kg DM/ha) offer at least 2 kg concentrates per head per day.

5.2.2 Concentrate ingredient composition

Objective: To produce a balanced concentrate feed which meets the energy, protein and mineral/vitamins requirements of growing and finishing bulls, steers and heifers and represents good value for money.

Reason: Due to the wide range of ingredients available which vary in their cost and protein and energy concentration which affects their ability to sustain high target growth rates required for bull beef systems, a number of options exist for producing a ration for growing and finishing bulls.

Practice: Concentrates can be divided into a number of categorises as follows – energy sources with relatively low protein content, cereal by-products, other by-

products and high protein oilseed meals. The main feedstuffs within each of these categories are outlined below.

(1) Energy sources with relatively low protein content

Wheat and barley have a high content of rapidly digested starch so there is a greater risk of digestive upsets when feeding these cereals, more so with wheat than barley. Therefore they should be introduced into the diet gradually. Maize meal is an excellent feed for finishing cattle especially those of high growth potential and when included as a component of high concentrate diets has a feeding value 15 to 25% above that of barley.

(2) Cereal by-products

Maize distillers' has a high energy and protein content, but they also have a high oil content which can affect rumen function and reduce silage intakes. Maize gluten has a high protein content but is an acidic feed and there have been concerns about feeding maize gluten with very acidic silage.

(3) Other by-products

Sugarbeet pulp and citrus pulp are very palatable and are useful sources of energy in rations for calves, store and finishing cattle receiving moderate inputs of concentrates. However, when cattle of high growth potential are receiving large quantities of concentrates, with the aim of achieving high liveweight gains, the inclusion of a large proportion of citrus or beet pulp in the ration may limit performance due to their lower energy content.

(4) High protein oilseedmeals

Rapeseed meal is a good source of protein but due the high oil content, care needs to be taken when including in the diet. At high levels of inclusion rumen function may be affected. Cottonseed cake and sunflower meal also have high protein contents and can be useful sources of protein for young growing cattle or lactating suckler cows. However, the energy content can vary considerably between batches.

It is important to note that when evaluating by-product feeds, consideration needs to be given to the fact that composition can be variable and physical characteristics can vary between batches which can affect intake.

When offered to cattle as supplements to silage, individual feedstuffs have different effects on the digestion of silage in the diet. Consequently, individual feedstuffs may have either lower or higher feeding values as supplements to grass silage than their chemical analysis would suggest. A programme found on the DARD RuralNI website (http://www.ruralni.gov.uk/index/livestock/livestock_dairy /protein_herd/relative_feed_values.htm and click on 'Relative feed value programme') evaluates the ability of feedstuffs to sustain animal performance relative to barley and soyabean meal. If the current cost of barley and soyabean meal are inputted into this programme, the relative value of feedstuffs can be determined.

Table 12: Chemical composition of main feedstuffs

Feedstuff	Protein content (% fresh)	ME (MJ/kg fresh)
(1) Energy sources with relatively low protein contents		
Barley (14% MC)	9.5	11.4
Wheat (14% MC)	11	11.2
Maize meal	8	13.2
(2) Cereal by-products		
Maize gluten	18	10.9
Maize distillers' dark grains	26	11.6
(3) Other by-products		
Sugarbeet pulp	9	10.6
Citrus pulp	6	10.6
(4) High protein oilseed meals		
Rapeseed meal	36	10.8
Cottonseed cake	30	10.1
Sunflower meal	27	8.7
Soyabean meal	46	11.6

Refer to http://www.ruralni.gov.uk/index/livestock/livestock_dairy/protein_herd/relative_feed_values.htm for further details

5.2.3 Concentrate nutrient composition

Objective:

Bulls

For bulls up to 340 kg live weight (growing phase) offer concentrates containing 16% crude protein (fresh), decreasing to 13% (fresh) above 340 kg live weight (finishing phase). During growing and finishing phase concentrates should contain at least 11.2 MJ ME/kg fresh.

Reason: Young bulls have a high potential for growth and need high protein and energy intakes to promote muscle growth. However this response decreases as the animal matures and protein intakes should be decreased from 16% to 13% from 340 kg liveweight to slaughter to prevent the carcases becoming over fat, although energy density of the ration should be maintained at 11.2 MJ ME/kg fresh.

Practice: Offer concentrates containing 16% crude protein (fresh) and 11.2 MJ ME/kg fresh from purchase. Maintain on this ration until the animals are 340 kg live weight (or approximately 4 months prior to slaughter). Rations can be purchased from feed manufacturers or mixed up on farm. Both can be as effective provided they meet the protein and energy requirements outlined above. Simple home mixes can be more cost effective if the facilities exist for storing and mixing the rations. The key message is to keep the rations simple and to price around for the least cost ration which meets the requirements for a bull finishing system. Examples of some simple home mixed rations are given below:

Table 13: Ingredient composition (kg/tonne) of a 16% crude protein home mixed ration (growing phase) (120 to 340 kg liveweight)

Ration example (1)		**Ration example (2)**	
Ingredient	**Inclusion level (kg/tonne)**	**Ingredient**	**Inclusion level (kg/tonne)**
Rolled barley	500	Rolled barley	500
Soyabean meal	150	Soyabean meal	210
Molassed sugar beet pulp	200	Citrus pulp	135
Maize meal	125	Maize meal	130
Vitamins/minerals	25	Vitamins/minerals	25

Vitamin/minerals – to reduce the risk of urinary calculi the desired Calcium:Phosphorus ratio is at least 2:1

Table 14: Ingredient composition (kg/tonne) of a 13% crude protein home mixed ration (finishing phase) (340 kg to slaughter 500 kg liveweight)

Ration example (1)		**Ration example (2)**	
Ingredient	**Inclusion level (kg/tonne)**	**Ingredient**	**Inclusion level (kg/tonne)**
Rolled barley	535	Rolled barley	400
Soyabean meal	140	Soyabean meal	125
Molassed sugar beet pulp	200	Citrus pulp	250
Maize meal	100	Maize meal	200
Vitamins/minerals	25	Vitamins/minerals	25

Vitamin/minerals – to reduce the risk of urinary calculi the desired Calcium:Phosphorus ratio is at least 2:1

5.3 Grassland management

Objective: Maintain sward heights of 8 to 9 cm (grass cover 2600 to 2850 kg DM/ha) to achieve growth rates of at least 1.0 kg/day at grass with minimal concentrate supplementation for spring-born Holstein and continental cross Holstein bull calves from 15 weeks to housing (7 months of age). At lower sward heights supplement with 2 kg concentrates per head per day.

Reason: Grass heights less than 8 cm (grass cover < 2600 kg DM/ha) will produce growth rates less than 1.0 kg/day which will result in below target housing live weights.

Practice: Aim for sward heights of at least 8 to 9 cm (grass cover 2600 to 2850 kg DM/ha) at turnout. Swards must be well grazed during the early grazing season, as under-grazing will result in a build up of stemmy, low digestibility grass which reduces animal performance later in the season. A stocking rate of 15 animals per hectare from purchase until early June is recommended for young swards with 100 kg N/ha applied per year. Stocking rate can then be reduced to approximately 10 animals per hectare by bringing in an area of silage aftermath. The area which has been grazed from turnout should be topped to ensure that the quality of grazing available for the remainder of the season is as high as possible. Stocking rate is further reduced as the season progresses by bringing in aftermath

grazing after the second silage cut. Young bulls should be grazed in groups of 40 or less, away from breeding females and it is essential that no strange animals are introduced to a group of bulls after they are six months old. Set-stocking is recommended as this minimizes disturbance of the animals reducing the likelihood of behavioural problems.

Section 6: Housing

Housing for Beef Cattle

Space allowance

In planning accommodation for any animal, it is normal practice to determine size of pen in accordance with the weight of the animal when leaving the housed area. In addition there are specific recommendations on space allowances according to the type of housing provided as shown in Table 15.

Table 15: Space allowance recommendations for bulls, steers and heifers with a range of fllor types.

Type of accommodation	Bulls Area required (m^2/head)	Steers/Heifers Area required (m^2/head)
On straw bedding and feeding	5	4.6
On straw bedding for lying	3.8	3.4
Feeding in a separate area	1.4	1.2
Totally slatted	2.3	2.1

The minimum trough space required for feeding is 0.6m/head.

Ventilation

For any type of accommodation for bulls it is important to check the ventilation of the building. The most important aspect to achieve good ventilation is the outlet. In assessing the type and dimensions of the outlet before any recommendation can be given one should take into consideration the following

- dimensions of the building
- pitch (slope) of roof

- location of building in relation to other buildings, trees etc.
- orientation of the building in relation to the prevailing wind direction
- number of animals to be housed

Therefore it is difficult to provide general recommendations, however as a very rough guide the ridge opening should be 5cm (2") for every 3m (10') of building width. There are other factors which can affect these dimensions and professional advice should be sought. Also if the opening is directly above bedded areas that need to remain dry, the ridge needs to be protected by a raised centre ridge.

In some circumstances spaced sheeting can assist airflow in a building and is especially helpful if the building is wide and the roof pitch low. The opening needs to be kept to a minimum to reduce ingress of rain and in some circumstances where the bedded area must remain dry; this option may not be suitable. The total area of the openings can count towards the area of outlet, which is helpful in wide buildings.

As a rule of thumb the air inlet area should be four times that of the outlet area. This ensures the 'stack effect' will carry unpleasant gases and moisture generated by cattle to the open ridge. There are a range of options for inlets, space board, ventilated cladding, mesh screen etc. Some designs provide a more even air distribution within the building, especially on the prevailing wind side.

Bulls housed during the summer months will require accommodation which provides good ventilation. One option which will assist summer housing is an open fronted house. If the building orientation is such that one side faces the prevailing wind, then the opposite side may be designed as a full side opening. If the area inside the house beyond this opening needs to be kept dry (straw bedding) then the roof should extend beyond the external wall to reduce the risk of rain blowing in. However if this is a slatted area, there may not be the same need for the overhang. Alternatively, a mesh screen can be fitted which can be opened or closed accordingly.

Where the ventilation in existing buildings is not good enough, buildings should be adapted by improving air inlets and outlets, or by using mechanical equipment (such as a fan).

There are some general questions on ventilation to consider at Annex B.

Floor types

Where the indoor floor type is either concrete slats or solid concrete, there should be some type of protection. Rubber covers can be added to slats but consideration should be given in selecting the correct solid rubber cover to ensure the surface is not slippery and runoff under the mat is possible.

Straw bedding is an option for solid floors. It is advisable to designate a feed area and a lying area when using straw bedding. The feed area could be slatted or solid floor with a mechanical scrapper. For health and safety reasons, it would be essential to provide a permanent division between the two areas with a gated area which can be closed to shut the bulls off the bedded area to allow safe cleaning/bedding of the lying area. Straw should be replaced at a maximum of 6 week intervals and only dry straw used. In this system the area around the gates from the feed area to the bedded area tends to require cleaning more frequently and hence the design should allow safe access to these areas.

Outside areas

An alternative for bulls housed during the summer months is to provide access to an outside wood chip area. In considering this option, the location of any proposed housing in respect of altitude and the prevailing wind direction will have a big impact on the decision. On exposed sites there should be a windbreak around the woodchip area.

Any unroofed outside area must have the facility to collect runoff. If this area is covered with woodchips/bark, then the runoff must be caught while the woodchip remains in position. For bulls the recommended space allowance on woodchip is $10m^2$ – $12m^2$/head. It is important that Northern Ireland Environmental Agency (NIEA) is consulted before constructing a woodchip pad designed for out wintering bulls. The runoff from any outside area must be accounted for in the total slurry storage volume calculation. Bulls will need to be removed from any housing with underground slurry storage during mixing of the slurry. An outside area would be beneficial during such operations.

Isolation pens

Hospital/isolation pens are an essential component of any cattle unit. They should be located away from healthy stock, with a separate entrance that is wide enough for an animal to be easily moved by a tractor/handler/cattle trailer into or out of the pen. These pens should be easily reached so that the animals can be checked regularly. Hospital/isolation pens should have drinking water freely available and feeding facilities. Ideally, pens should have facilities to restrain any animals. All slurries/farmyard manures must be stored separately from all other storage systems on the farm.

Health and Safety Issues

Slurry removal from underground tanks.

Special care should be taken when slurry is removed from tanks below slats, to avoid fouling the air with dangerous gases which can kill both humans and animals. Ideally, slurry tanks should be emptied when the building is not in use. Where it becomes necessary to remove slurry from below ground tanks when cattle are housed, all stock should be taken out of the building. Therefore there will be a requirement for a system to move bulls safely into other pens outside the building where the slurry is being removed. Buildings should be well ventilated during this procedure

Fire

Where cattle are housed, it is a priority for the owner and all staff to know what to do if there is a fire. Expert advice on all fire precautions is available from your local fire-prevention officers.

Safe handling of bulls

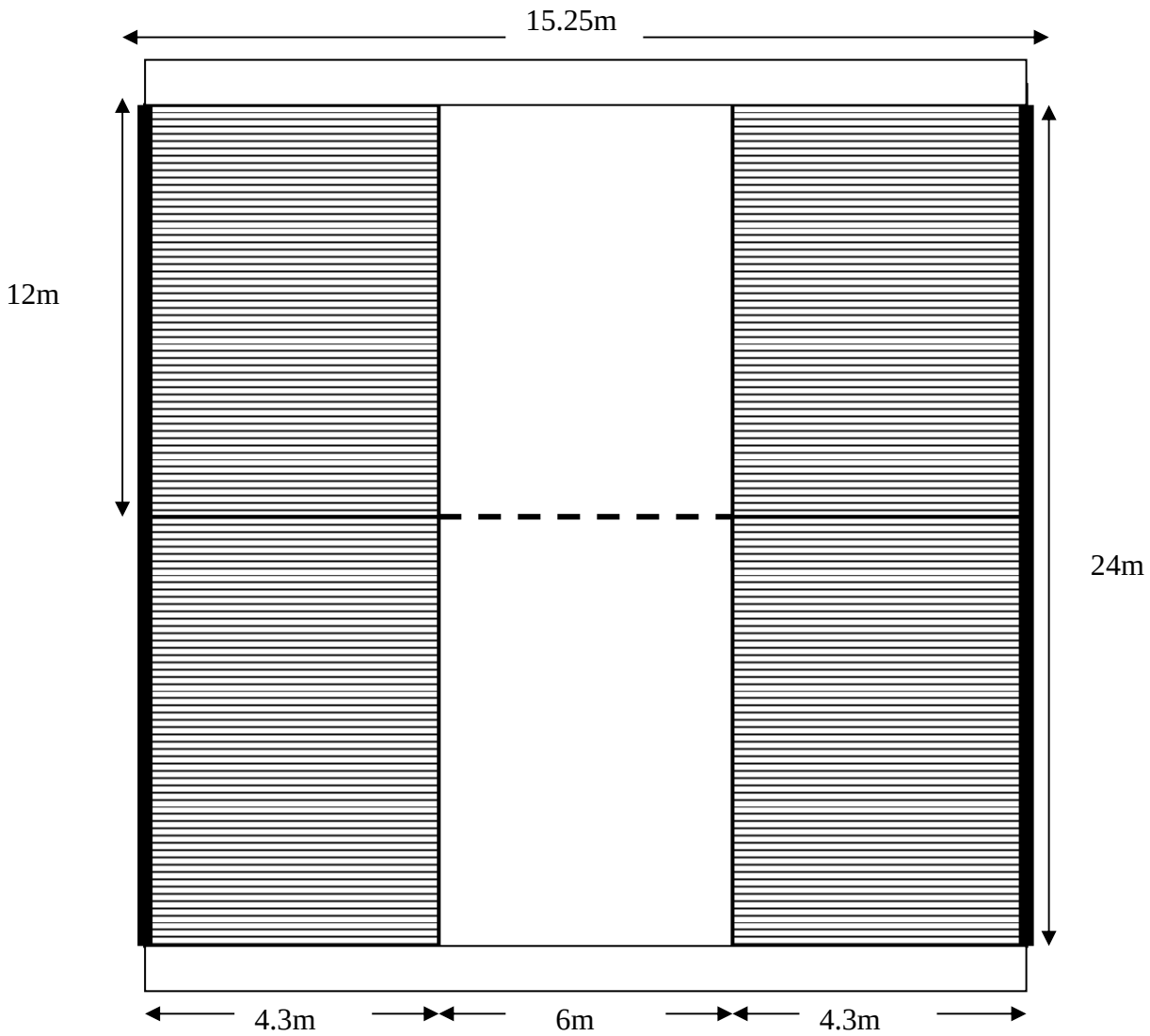
There must be a safe system for moving bulls to and from handling facilities. The handling facilities themselves must be robust for the handling of bulls and a safe system of work must be in place. When bulls are housed there are conditions required to meet Health and Safety

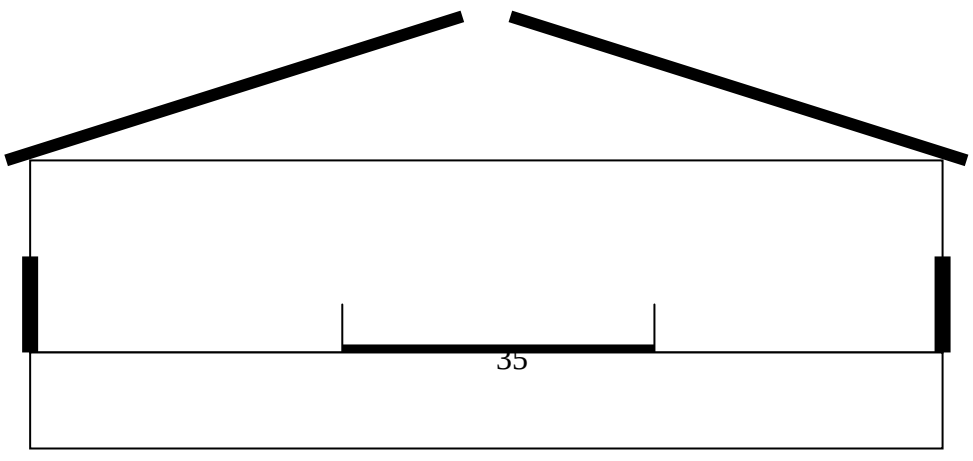
requirements, including signage. Below are links to relevant documents from the Health and Safety Executive and if in any doubt they should be consulted.

http://www.hse.gov.uk/pubns/ais35.pdf

Some different layouts

1. Fully Slatted accommodation for 80 bulls





In this system, each pen division can accommodate 20 bulls at 500kg weight. Also the length of the feed passage equates to the necessary 600mm per head. Ideally as each pen either side of the feed passage holds 40 bulls there should be some division in the air space within the house. In practice this is very difficult to achieve.

Proper ventilation is a critical factor in any livestock housing. It is essential that the design includes on open or raised centre ridge. The required gap at the open ridge depends on various factors e.g. the location of the building, the slope of the roof, the width of the building, the height difference between the inlets and outlet etc. As a guide the opening should be 5cm for every 3m of building width, so for the width of 15.25m, an opening of 30cm is required.
Any opening of this dimension above an area where bulls would be lying will require a raised ridge.

The area below all of the floor area is a slurry tank. To comply with Health and Safety recommendations, the tank extends a minimum of 1.5m at each end to allow safe mixing.

Slurry production

80 x 0.18 = 14.4m^3/head/week
14.4 x 22 weeks = 317m^3 storage required.

Tank capacity

14.46 x 26.4 x 2.1 = 812m^3

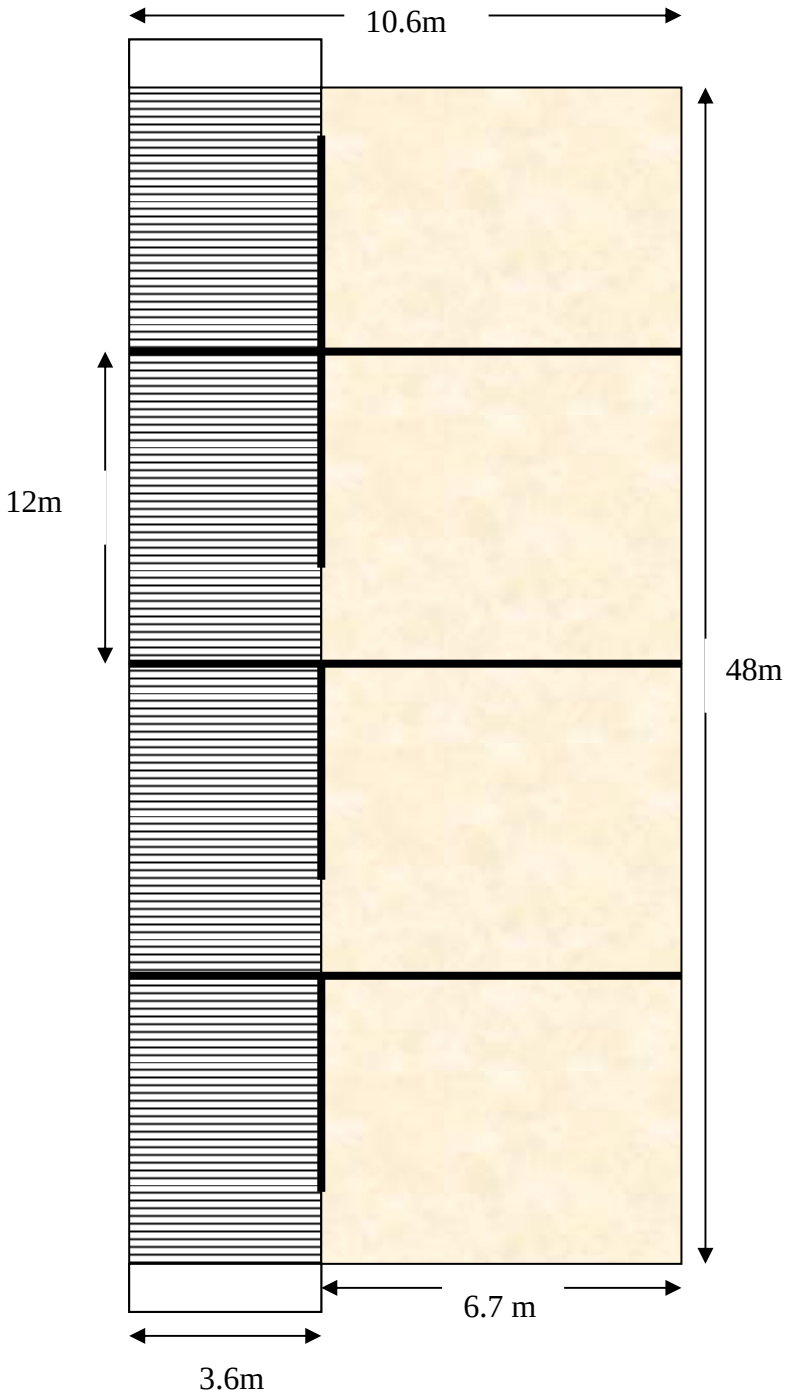
This design will need an area to hold the bulls while the slurry is being mixed.

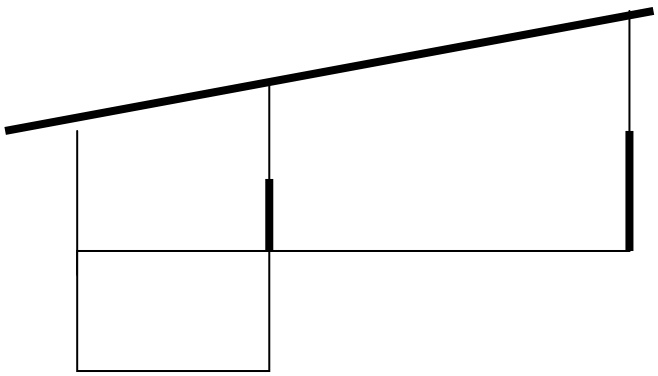
Approximate Costs

Tank, complete with cover	£75,000
Supply and erection of building	£17,500
Walls and screed over feed passage	£10,000
Gates, electric, water etc.	£10,000

Planning fees and associated costs		£ 1,500
	TOTAL	£114,000
Cost per head	£1,425	

2. Straw bedded with separate feed area; Mono-pitch





In this system, each pen division can accommodate 20 bulls at 500kg weight. Also the length of the feed passage equates to the necessary 600mm per head. In this design as two pens hold 40 bulls there should be some division in the air space within the house at 24m. In practice this is very difficult to achieve.

In this system, the area where the bulls will enter the straw bedded area will become mucky and may require cleaned more often than that for the removal of the remaining straw.

Area required for straw bedding

The recommended straw bedded area is $3.8m^2$/head

20 x $3.8m^2$ = $76m^2$.

Width of straw bedded area will be 6.7m allowing for a 150mm wall on the outside and a division from the slatted area.

12m x 6.7m = $80.4m^2$

Volume of slurry

Slurry production for 80 bulls for 22 weeks is $317m^3$
However as straw bedding is available only 50% or $158m^3$, of this is required for slurry storage. However there will need to be allowance for runoff from bedded area and washings.

Tank capacity

47.4m x 3m x 2.1m = $298m^3$

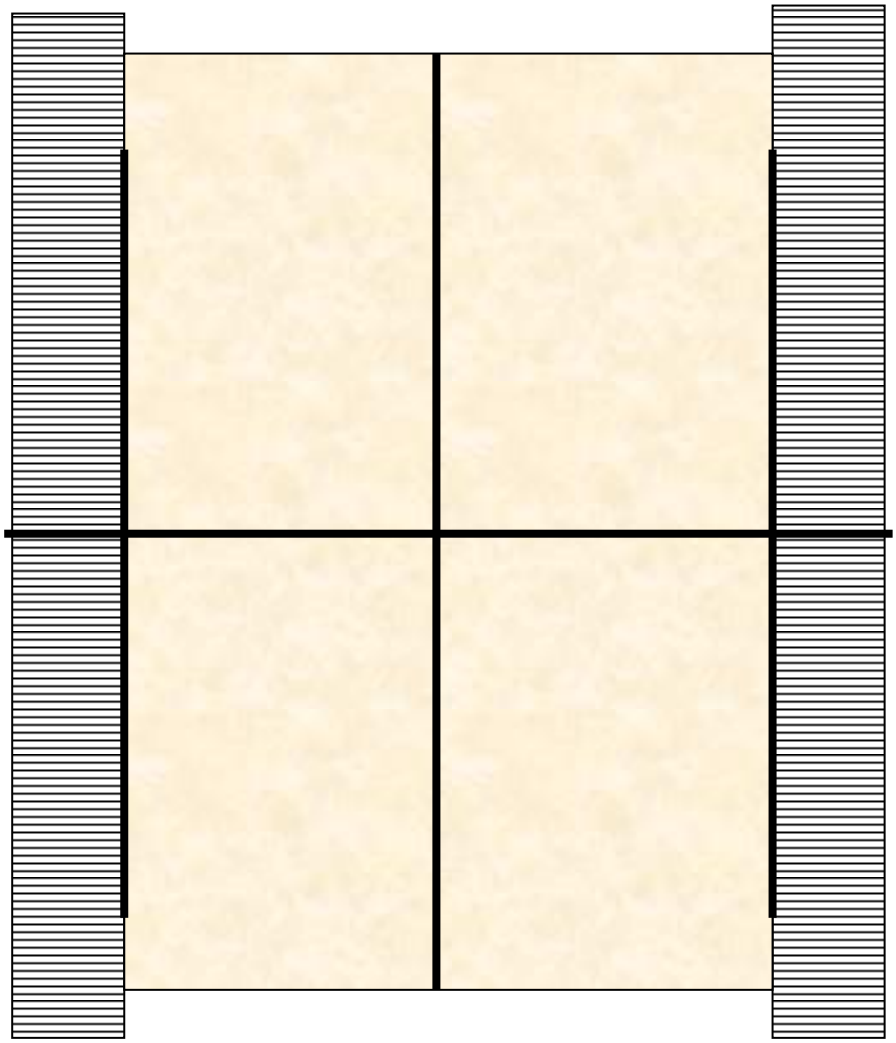
Approximate Costs

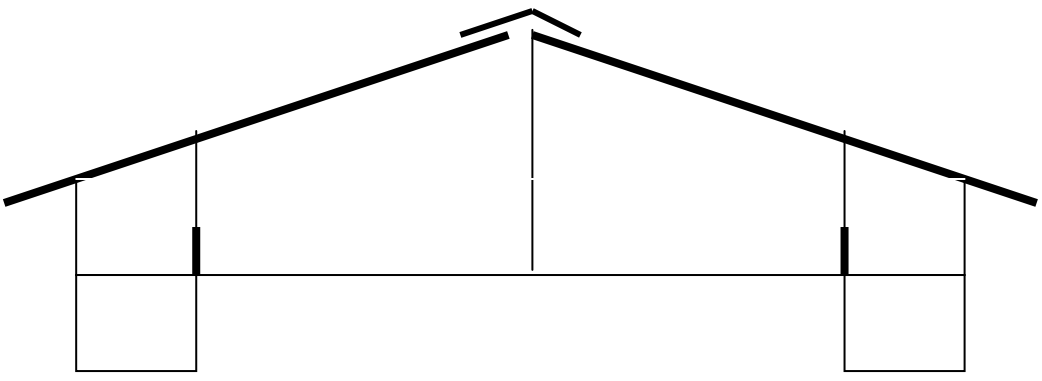
Tank, complete with cover	£37,000
Supply and erection of building	£23,000
Floor and walls	£20,000

Gates, electric, water etc.		£10,000
Planning fees and associated costs		£ 2,500
		_____
	TOTAL	£92,500
Cost per head	£1,156	

There are no costs included for the straw bedding, time or equipment to remove the manure and storage area for the manure.

3. Straw bedded portal frame with separate feed area.





Straw bedded portal frame with separate feed area

Example 3 is a similar layout. As the ridge for the outlet is over the straw bedded area, it will need to be protected.

In either design the type of slurry storage tank(s) is the most expensive part to construct. Alternatively the feed area could be scraped into one tank at one end.

In both of these designs there will need to be an area to hold the bulls while the slurry is being mixed unless scraped feed passages with a tank outside the building is installed.

Approximate Costs

As this building has increased in width, it can be designed as a clear portal frame or a propped portal, where there are steel uprights inside the building. The costs are based on a propped portal.

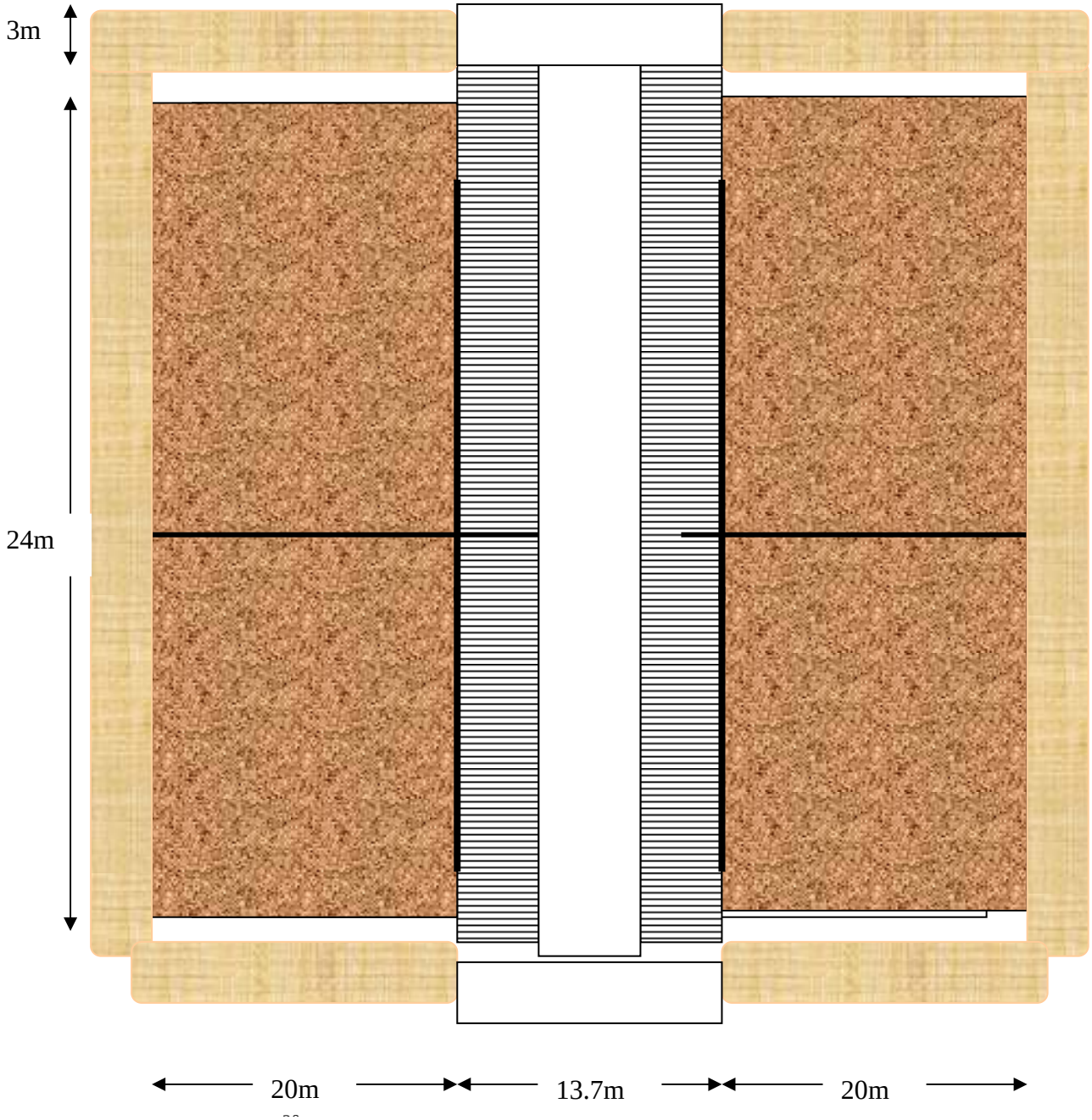
Tank, complete with cover	£50,000
Supply and erection of building	£27,500
Floor and walls	£20,000
Gates, electric, water etc.	£15,000
Planning fees and associated costs	£ 2,500
TOTAL	£115,000
Cost per head	£1,437

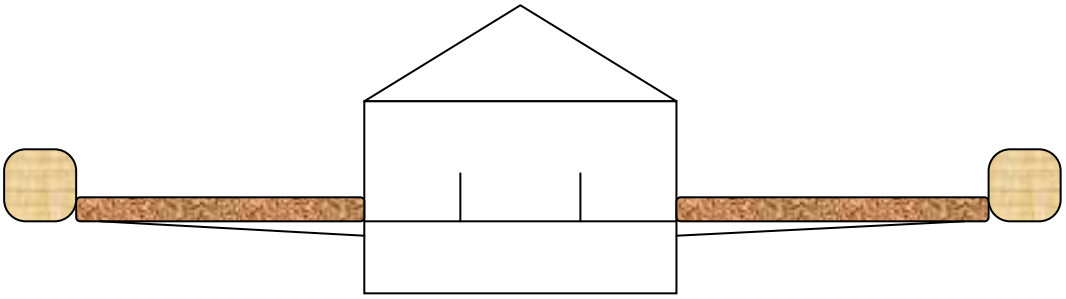
Alternative system with one tank and a scraper system.

Tank, complete with cover	£25,000
Supply and erection of building	£27,500
Floor and walls	£25,000
Gates, electric, water etc.	£17,000
Electric scrapers	£10,000
Planning fees and associated costs	£ 2,500
TOTAL	£107,000

Cost per head £1,337

4. Slatted feed area with outdoor woodchip corrals





In this system, each pen division can accommodate 20 bulls at 500kg weight. Also the length of the feed passage equates to the necessary 600mm per head. In this design the bulls have access to the outside woodchip area and come in onto the slats to eat.

Outside area

$12m^2$/head therefore 20 bulls need $240m^2$

To provide the recommended feed trough length of 12m a wood chip pen measuring 20m by 12m will be required.

Inside area

Assuming a 6m feed passage to accommodate tractor and diet feeder, then each side will have a 3.6m wide slat with the tank extending under the passage.

Storage volume required

Total woodchip area collecting rainwater is

$2(20 \times 24) = 960m^2$

Rainfall on area over 22 week period is 0.55m

$960m^2 \times 0.55 = 528m^3$

Amount of slurry produced can be reduced to 50% of total volume = $158m^3$

Total volume to collect for minimum 22 weeks storage = $686m^3$

If the shelter is provided by sloped earth banks it would be essential to ensure any runoff is not allowed to run onto the woodchip.

Storage volume available

To comply with Health and Safety recommendations, the tank extends a minimum of 1.5m at each end to allow safe mixing.

$26.4m \times 13.1m \times 2.1m = 726m^3$

This system would allow the bulls to be held on the woodchip while the slurry tanks are being mixed.

Approximate Costs

Tank, complete with cover	£60,000
Supply and erection of building	£15,000
Floor and walls	£10,000
Gates, fencing, drainage, electric, water	£15,000
Excavation and supply of woodchip	£ 5,000
Planning fees and associated costs	£ 2,500
TOTAL	£107,500

Cost per head £1,343

Annex A

General Notes on cattle housing

- Animals from 8 weeks to 6months of age should be kept in groups of no more than 20 and no more than 40 animals should share the same air space.
- To encourage good health particularly in young calves from when they arrive and up to 6 months of age they should be housed in a separate building and then move into a different house for the 7 month finishing period.
- Bulls should remain in the same group throughout their housed period.
- As group size should not change and if animals are to remain in the same house, pen dimensions must represent the recommended space allowance for weight of animals at slaughter weight.
- Alternatively pen construction could be designed to allow an extension as the animal weight increases. This may be important where bulls are housed on slats as it may be difficult to keep the area clean if the space allowance is excessive when the bulls are young.
- It is recommended that bulls have 10% greater space allowance than that recommended for beef cattle of same weight.
- Special consideration needs to be given to the ventilation especially for systems proposing that bulls are kept indoors at all times.
- If feeding meal there is a need for trough space for all animals at the same time.
- Method of feeding will determine dimensions of feed passages, trough length etc.
- Safe handling facilities must be available allowing minimal contact with the bulls.
- Slurry/Farmyard manure storage must comply with all relevant legislation and a minimum of 22 weeks storage is required.
- All mains electrical equipment should meet relevant standards and be properly earthed and out of the animals' reach.
- All new or extended buildings must adhere to current planning legislation.

Annex B

Assessing the ventilation of a livestock building by asking the following questions

1. Has there been a history of respiratory problems with animals in this building?
   Most farmers are aware of occurrences of respiratory diseases in certain cattle sheds. There may also be lots of cobwebs in the roof area indicating poor air movement.

2. Does the condition of the fabric of the building suggest that the building is prone to condensation?
   Discolouration of the tin, timbers black, signs of rust on tin especially at the joins.

3. Has there been any additional builds erected or landscaping near the building since its erection.
   Most common cause of reduced ventilation is the erection of lean-tos against the original building. A hedgerow with small trees in it when the building was erected has been allowed to overgrow.

4. Is the building naturally ventilated?
   Most cattle buildings are naturally ventilated by "stack effect". Heat energy from the animal warms the surrounding air, causing it to rise by convection. If there are high level openings the warm air will pass out provided it can be replaced by cooler air entering the building at a lower level. The amount of ventilation that occurs depends on;
   - *the provision of both outlets and inlets of adequate size, number and design.*
   - *the relative position of the inlets and outlets, the greater the height difference between the inlets and outlets the greater the ventilation.*

5. Is the building mechanically ventilated?
   Know the operating instructions and make sure equipment is maintained. The Welfare Regulations require that mechanical ventilation is checked daily. In addition an alarm system to alert a responsible person in the event of a ventilation system failure must be installed. The alarm must be tested every seven days.

6. Are there any temporary obstructions preventing fresh air entering the building or foul air leaving?
   Check that the openings of both natural and mechanical buildings are free from obstruction. Remember that stacked straw bales can obstruct the ventilation.

7. Is the present/planned stocking density correct in terms of number and liveweight of the animals?

   Animals with a lower bodyweight such as young stock have a proportionally higher ventilation requirement than heavier animals. Any building where there is a proposed change of use should have the ventilation checked.

8. If you enter the building when the animals are present, what is your impression of the atmosphere?

   Probably one of the best indicators of the efficiency of the ventilation system is that the air should smell fresh with no hint of ammonia.

Section 7: Potential health problems

Key health issues are

- Worms and fluke during grazing season
- Pneumonia
- Clostridial disease
- Acidosis
- Bloat
- Lice

• Stomach worms

Stomach worms cause inflammation of the stomach weight loss and diarrhoea. Stomach worms are most likely to cause disease in young calves, from mid July onwards in their first grazing season. Good pasture management can reduce the risk of infection and strategic dosing can be used to treat infected calves and prevent further contamination of pasture. Older cattle should be used to graze the most contaminated pastures (those grazed by calves the previous season) while younger calves graze clean pastures (those not used from the previous year, aftergrass, reseeded pastures etc).

• Lungworm infection

Lungworm infection (also known as hoose or husk) is a major cause of disease in the first grazing season and increasingly in the second and subsequent grazing seasons. Clinical signs may range from persistent coughing to severe pneumonia or death. As with stomach worms good grazing management is an important part of lungworm control with younger calves grazing clean pastures (those not used from the previous year, aftergrass, reseeded pastures etc). Strategic dosing used as required as outlined in the next paragraph (Control of stomach worms and lungworm).

Control of stomach worms and lungworm

Control programs for stomach worms and lungworm should be developed in consultation with your veterinary practitioner. The type of grazing system, stocking rates, previous

history of problems, clinical assessment and faecal testing should be considered when determining when to dose. The time interval between doses will also depend on the product used and whether the product has residual action. Annual rotation of anthelminthic groups is required to reduce the risk of developing drug resistant parasites. Calves should also be dosed around the time of winter housing to prevent parasite problems during the winter. The exact timing of this treatment will depend on the product used. Treatment for stomach worms, lungworm and fluke may also be required during the second grazing season if the calves have not developed an immunity to the worms during the first grazing season.

- **Liver fluke**

Liver fluke infection is caused by *Fasciola hepatica*. In calves liver fluke can cause reduced growth rates and possible increased susceptibility to bacterial infections. The risk of liver fluke infection is greater on wetter, heavier ground especially when a mild wet winter is followed by a warm, damp summer. Calves should be treated at housing or 3-4 weeks after housing depending on whether the product used is effective against just adult or both adult and immature fluke.

- **Pneumonia**

Pneumonia in cattle is a major problem from both an economic and welfare viewpoint. Outbreaks of calf pneumonia can have major costs due to treatment costs, deaths and production losses. Up to 40% of the financial impact of a pneumonia outbreak is due to the decreased live-weight gains obtainable in both those that show symptoms and those that do not after an outbreak.

Outbreaks of pneumonia are most common in housed cattle. Outbreaks occur more frequently in poorly ventilated houses, in stressed cattle particularly those kept at higher stocking rates. Still clammy weather can initiate outbreaks.

A number of different infectious agents can be involved in causing pneumonia. Many pneumonia outbreaks are initiated by virus infection (the most important viral infections are RSV, PI3, BVD and IBR). Bacteria and Mycoplasmas can then infect more easily in the

damaged lung increasing the severity of the pneumonia. Prompt treatment by a veterinary surgeon is essential to minimise deaths and the extent of lung damage.

The risk of pneumonia can be reduced by ensuring calf houses are well ventilated and draft free (see chapter on cattle housing). Stress can be reduced by avoiding mixing of animals of different age groups, preventing overcrowding and by allowing adequate feed space. Stressful procedures such as weaning, dehorning and castration should not be performed during higher risk periods such as immediately prior to housing. Feeding concentrate prior to housing improves performance from autumn grass and prepares the animals for a winter feeding programme.

Vaccination should be considered on farms with a history of pneumonia. A range of vaccines are currently available against important pneumonia agents. A vaccination program can be designed in consultation with your veterinary surgeon.

- **Blackleg**

Blackleg is an important cause of mortality in young cattle. Blackleg tends to occur more commonly during the summer months however cases occasionally occur in housed animals. Cases of blackleg tend to be acute and the affected animal is often found dead. In animals observed alive there may be stiffness and severe lameness on one leg. Individual animals may be affected although outbreaks involving multiple animals are also common. While blackleg is a bacterial disease frequently the condition is too far advanced for antibiotic treatment to be successful. Post-mortem examination may be required to diagnose the condition.

The disease can be effectively controlled by vaccination. The primary course of vaccination requires two doses of vaccine given 4-6 weeks apart with annual boosters required. Full protective immunity develops shortly after the second vaccine injection. Blackleg vaccine should be used on farms where blackleg has previously occurred.

- **Black disease**

Black disease is another important cause of mortality in young cattle. As with blackleg black disease is caused by clostridial bacteria. Black disease occurs in those areas where liver fluke infection occurs and as with blackleg it may affect single or multiple animals. Blackleg occurs most frequently in grazing cattle but may also affect housed cattle. Most cattle with black disease are found dead but affected animals seen live are dull, reluctant to move and frequently have a high temperature. The condition is frequently too far advanced for antibiotic treatment to be effective. Post-mortem examination may be required to diagnose the condition. Vaccination is an effective prevention and involves two doses of vaccine given 4-6 weeks apart. Vaccines exist which protect against both black disease, blackleg and other clostridial diseases.

- **Ruminal acidosis (grain overload)**

Ruminal acidosis is a condition commonly seen in housed cattle as a result of excessive intakes of grain. Rapid rumen breakdown of grain occurs particularly if it has been finely milled. This leads to an excess production of acids causing ruminal acidosis and indigestion and this may rapidly lead to dullness, dehydration, unsteadiness, diarrhoea, an inability to stand and eventually death. Ruminal acidosis is most commonly seen when cattle are first introduced to cereal based diets, in particular highly processed wheat or barley, but it is also seen when animals which are already accustomed to cereal based diets overeat. Veterinary treatment to correct the acidosis and dehydration is urgently required as affected animals can rapidly deteriorate. Gradual introduction of coarsely processed grain and the inclusion of adequate roughage in the diet will help prevent acidosis. Feed should continually be available to prevent excessive intakes by hungry animals.

- **Bloat**

Bloat is an easily recognised condition in which the rumen fills with gas due to an inability to belch and release the gas which is formed naturally in the rumen. Bloat is a serious condition and can cause death. There are two main types of bloat; gaseous bloat and frothy bloat.

Gaseous bloat occurs when the oesophagus is physically blocked by for example potatoes or where disease or other conditions affect the ability of the animal to relieve ruminal gas through the oesophagus. It may also be seen after ruminal acidosis. Gaseous bloat is best relieved by stomach tube and any underlying causes may require treatment to prevent recurrence.

Frothy bloat occurs when the gas build up in the rumen occurs as a frothy foam. Frothy bloat is most frequently seen at pasture and especially when the pasture is rich in clover. Passage of a stomach tube will fail to relieve frothy bloat but effective bloat drenches are available to disperse the foam and the gas. To prevent frothy bloat cattle should be allowed access to clover rich pasture when it is dry and the animals are not hungry. Initially cattle should be limited to 2-3 hours grazing clover rich swards increasing to full grazing over one week. When outbreaks occur it may be necessary to remove the cattle to alternative pasture.

- **Lice**

Young cattle are frequently affected by lice when housed. Both biting and sucking lice can cause problems for calves. Lice cause itching and irritation and sucking lice can cause anaemia. Infections are often more severe on malnourished animals and when animals are also affected by other disease. Lice can be treated by topical pour-on products or by injectable products. While the injectable products effectively control sucking lice they may have reduced effect against biting lice and cannot be totally depended upon to control biting lice.

Section 8: Economics of dairy beef systems

Interactive calculators are available at http://eservices.ruralni.gov.uk/onlineservices/Tools/Beef/Beef.asp for the following dairy beef systems:

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