The Calf's Environment

Background

Regardless of the type and age of cattle or type of housing the accommodation must provide for the animal's most basic needs if animal performance is to be maximised and welfare standards met. Air space is just as crucial as floor area. Pneumonia is especially common in housed animals and the disease can often be avoided if buildings are not overcrowded, are well ventilated and well drained, and animals of different age groups are not mixed together.

With dairy units it is not uncommon for young stock to be housed in cubicles, although straw yards are more common in beef units. There are advantages and disadvantages with both housing systems, but if the adult cow is being housed in cubicles then there may be advantages to housing the heifer replacements in suitably sized cubicles.

Calf Accommodation

Regardless of regulations or quality assurance schemes, calves require a clean, dry bed in well ventilated but draught free (<2m/sec) conditions. They can be housed individually or in groups. Calf pens should be large enough to allow calves to groom themselves, lie down and stretch their limbs and rise without any difficulty and must allow visual and tactile contact with animals in adjoining pens/hutches. Therefore pen divisions must be perforated, i.e. allow calves to see and touch one another. Not to do so may have cross-compliance reverberations as this is a requirement of legislation! Calves must be group housed from 8 weeks of age, unless an animal is kept in isolation on the advice of the veterinary surgeon. ***Whether they are housed individually or in groups calves require a clean, dry bed in well ventilated but draught free conditions***

The width of the individual stall/pen for a calf from birth to 8 weeks of age must be at least equal to the height of the calf at the withers, as measured in the standing position. The length shall be at least equal to 'the body length of the calf, measured from the tip of the nose to the caudal edge of the pin bone' multiplied by 1.1. In practice this means pens at least 1.5 x 0.75m, but preferably 1.8 x 1.0m.

Table 1: Space allowances for group housed calves

Mass of calf (kg)	Approximate age (months)	Minimum (statutory) area (m^2/calf)	Recommended area (m^2/calf)
45	0	1.5	2.0
46-99	0-2	1.5	3.0
100-149	3-5	1.5	4.0
150-199	5-7	2.0	5.0

No more than 12 calves are recommended in any one group; sick calves can be easily identified and treated when they are in small groups. There should be no more than 30 calves sharing the same air space and they should not share that space with older cattle. Air space is critical; with a minimum of $6m^3$ air space per calf at birth which increases to

$10m^3$ by 2 months of age and then at least $15m^3$ by 6-7 months. The greater the number of calves in a single air space, the greater is the risk to health. A calf with respiratory disease can shed millions of infectious organisms from its lungs into the atmosphere..

Temperature

Cattle are homeothermic animals and need to maintain a constant body temperature of around 38° C. The Lower Critical Temperature (LCT) is the temperature below which an animal must burn extra energy to keep warm, i.e. feed is channelled away from growth/production to keeping warm. At temperatures above the Upper Critical Temperature (UCT), cattle will sweat in an attempt to dispel the excess heat and the animal will become heat stressed, which can lead to death of the animal. As cattle sweat at only 10% of the human rate they are much more susceptible to heat stress.

The body temperature can be affected by air temperature, radiant temperature, wind speed and relative humidity together with animal factors such as size of animal, coat thickness, feed level and type, body condition, etc. A newborn calf needs to be kept in a temperature of no less than 7°C if it is not to suffer. By one month of age a calf can comfortably withstand temperatures around freezing point. It is important though that calves are kept out of draughts, as this decreases the LCT quite considerably. However, rarely are low temperatures a problem in UK conditions with housed animals, quite the converse with the main issue relating to high temperatures and humidity within a building.

At grazing, the story is different due to the compounding effects of rain and wind. Rain in particular can lead to serious mortality rates at grazing, if some form of protection is not offered to young calves. With the calf at its LCT, just 0.10inch rain can increase calf mortality by 2-4%. The rates are even higher in calves that have not received adequate amounts of colostrum.

Building Ventilation

Dust and gas can have adverse affects on the health of the calf and young animal which extend through to lactation and slaughter. Not only does dust irritate the respiratory tract and mucous membranes it leads to permanent damage to the lungs and encourages micro-organisms. Ammonia at levels of 25ppm will irritate the mucous membranes and also make the animal more vulnerable to respiratory diseases. Studies show that ammonia levels in the first 4 months of life severely impact on the age at first calving. Although carbon dioxide is not poisonous at levels above 3000ppm it adversely affects cattle due to less oxygen being present. Hydrogen sulphide is highly toxic with levels above 50ppm known to kill cattle - the main cause of this problem being agitation to below ground slurry stores.

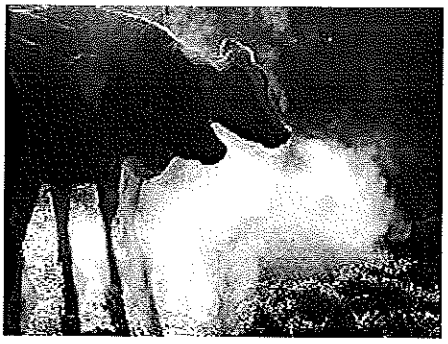


Fig 4: Adequate ventilation is essential to reduce noxious gases and dust

Not only is air space critical but so is the ventilation rate, which is the amount of air replaced within a building in a given time. The aim is a minimum air change within a building of 10 times each hour, increasing in the summer up to around 60 air changes per hour. The purpose is to keep the air fresh. Studies from the USA show that higher humidity and mean temperatures within the calf housing results in a delayed first calving. It is probable that this would also appear as slower live weight gains in fattening cattle.

In the housed environment a constant supply of fresh air is essential in preventing respiratory and other diseases together with improving production. Good ventilation removes stale, damp air which helps ensure that viruses and bacteria cannot survive for long outside the animal. Ventilation should never be restricted in an attempt to raise air temperature. In the vast majority of situations natural ventilation is adequate. However, if artificial (fan) ventilation is required then it must only be controlled manually or by humidity sensors, never by a thermostat.

Almost all infection occurs by direct aerosol spread between calves, so it is vital that there is good ventilation to allow for removal of infectious organisms. Similarly an increase in humidity will favour viral/bacterial survival.

Natural Ventilation

Natural ventilation is the most efficient and least expensive system for providing an optimum environment within a building. The objective of the ventilation system must be to provide a continuous stream of fresh air to every housed animal at all times of the day or night. Buildings will naturally ventilate best when they are sited at right angles to the prevailing wind direction. In the UK the prevailing wind is generally from the south-west but is influenced by local geographical conditions.

To ensure adequate ventilation, it is important that the building is designed to:

· Remove excess heat;

· Remove excess water vapour;

· Remove micro-organisms, dust and gases;

· Provide a uniform distribution of air;

· Provide correct air speed for stock.

In the UK, wind speed is above 1m/sec for more than 95% of the time. This means that for the majority of time, there is sufficient generating force to provide the necessary air changes within a correctly designed building by natural ventilation. For the remaining time, the building relies on the stack effect to replace foul air with fresh air.

Heat produced by the livestock naturally rises. If it is unable to escape from the building at the highest point (at the ridge), it will condense and remain within the building raising the humidity levels. As the air cools, it will fall back onto the bedding, increasing the moisture content and creating a suitable environment for bacteria to flourish. At a relative humidity above 75% pathogens and viruses can survive for several minutes which increase their spread from animals to animal. However at RH levels below 75% viruses die very quickly after exhalation. With many calf houses the humidity is such that viruses can survive for around 40 minutes creating a reservoir of infection in the air which means the disease is rapidly spread.

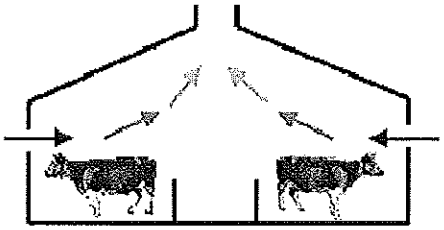


Fig 5: Natural ventilation by the stack effect

Natural ventilation requires the right balance of inlets and outlets. If the warm air is able to exhaust from the ridge of the building, this draws fresh air into the building through the side inlets. This air change ensures the stack effect is maintained. The inlet and outlet areas should be about 0.05m² and 0.04m² per calf respectively, with the outlet being at least 1.5m above the ventilation inlet.

The pitch of the roof can influence how well the stack effect is established. A roof profile of 1:4 and 1:3 are ideal. However, the pitch of a roof will always be a compromise between ventilation and overall ridge height, especially with span buildings. It is essential that there are adequate outlets in the ridge of the building. An open ridge is generally between 0.3-0.4m wide and should be un-restricted. As a useful rule of thumb, there should be 5cm of ridge opening for every 3.0m of building width. Although cranked open ridges are still commonly fitted, they only offer around 20% of the required outlet.

The design of a successful natural ventilation system is complex and requires account to be taken of the span of the building, the location of the building relative to other buildings or obstructions (buildings and trees disrupt airflows for a distance of 5-10 times their height), the pitch of the roof, the stocking rate, mass of each animal and the bedding system.

Summary

- **Most calves are housed in less than adequate conditions**
- **Ventilation is critical**
- **The more humid the environment the greater the risk of spread of disease from calf to calf**
- **There are legal minimal for space allowances at certain ages/size**
- **Calves weighing up to 100kg must have at least 1.5m^2 of space - greater is better**

- **Calves may only be kept in pens for the first 8 weeks of life and must be able to touch and see their neighbours. Thereafter they must be grouped housed**
- **Calves must be have a dry and comfortable bed to lay on**

Livestock Insulation

Livestock insulation is one of the most priority jobs for maintaining and supporting high standard of living environment for livestock and other animals. Properly insulated livestock houses will manage the amount of heat, moisture, cold and condensation to be transmitted between the indoor atmospheres and outside. It will also help to control the rust, mold and growth of the fungus inside. However on the other side livestock insulation will cause wastage of time, money and efforts and also consume large amount of unwanted energy that requires for cooling or heating inside atmosphere.

The most important need of livestock insulation is to prevent unwanted temperature transmission that can cause serious issue for any barn that resides animals like cows, buffalos, horses, poultry, ships, goats and other animal during the harsh summer and warm period of the calendar. Most of the time heat transmission inside any close atmosphere happens due to the transmission of radiant heat through walls and roof of barn or any other structure. It happens even more for the buildings that are made with the larger amount of steel or other metal. Not only this but absent of livestock insulation also cause increase in humidity, decreasing air flow and sudden temperature rise or lost during the different time of the day and night. Not concentrating much on the livestock insulation for thermal heat loss or gain, the barn inside will suffer a lot and this can even result into drop of performance.

Aerolam Insulations offers wide range of livestock insulation materials and foils made from aluminum and polyethylene bubbled film. This material is also available into different variants of single bubble insulation and double insulation for better control over the heat penetration. Such material for thermal insulation is made from the pure aluminum foil sandwiched with bubbled polyethylene film. The air packed bubbled structure of polyethylene film helps a lot for preventing the heat transfer as the tight air response lesser in temperature change and works as a thermal barrier. While the aluminum foil works as a reflective barrier and reflects almost 97% or sun radiant heat back to the atmosphere. Thus the combination of polyethylene film and aluminum foil works best for livestock insulation for any type of barn and animal houses.

BENEFITS OF LIVESTOCK INSULATION

- Multiple usages for thermal insulation based on the requirement. It can be applied on the roof, attics, walls and crawl.
- Light weight and easy to install. Comes with features of do it yourself process.
- Insulation material does not contain any kind of toxic material or any other harmful chemicals that affects animals and their eco system.
- Longer durability and higher ROI based on the energy saving.
- Blocks up to 97% or radiant heat. Also blocks moisture, wet air and fungus.
- Non carcinogenic and environment friendly material.
- Odorless.
- Effective moisture control.
- Saves energy consumption, money spent on heating or cooling barn or livestock houses.
- Helps environment by reducing the greenhouse gases.

For those who are looking for better livestock insulation material, single bubble and double bubble insulation foil by Aerolam Insulations can be a right choice by providing proper reflective thermal insulation that meets your needs and avoid unwanted energy consumption