Dairy Australia
Your Levy at Work

Designing a calf housing system

Introduction

There is no single "right" way to rear calves and no "best" housing system. Good management is essential to the success of any system. However, badly designed and managed housing systems can definitely pose risks to calf health, welfare and growth rates.

A well-designed housing system, whether it is a set of temporary pens under a hayshed or a purpose-built facility, will minimise these risks and make management easier.

Initial planning

The health and welfare of the calves are paramount when planning calf housing:

- Review relevant legislation and industry guidelines to ensure compliance with best practice and standards for the welfare of calves
- Ensure that housing design complies with the principles of disease control programs such as bovine Johne's disease

Good sources of information include:

- industry and government animal health and welfare websites (e.g. Dairy Australia, DAFF, your state DPI)
- cattle veterinarians
- government extension advisors
- milk factory field officers

Factors to consider:

Cost	Shed capacity	Location	Labour
Ventilation	Air space	Cleaning & disinfection	Flooring
Bedding	Pen design	Roof design	Preparation and storage
Temperature & humidity	Pen size	Biosecurity	Social contact

Cost

When planning your calf housing system, consider initial capital, operating, maintenance and repair costs, and durability of the system. Systems with lower initial costs may have higher maintenance and repair costs, and be shorter lived e.g. plastic cladding will have a much shorter lifespan than aluminium cladding.

Shed capacity

Overcrowding should be avoided, but under-use is inefficient especially for purpose-built buildings.

Allow enough space for all calves at maximum capacity plus an allowance for destocking and complete sanitation between batches, i.e. operate at only 75 percent capacity, so that 25 percent of the space is vacant, on a rotational basis, at all times (Hanson, 2003).

How much room does a calf need?

Allow at least 1.5 m^2/calf for group housing or 2.0 m^2/calf for individual pens.

These space allowances should be considered as an absolute minimum.

Increasing the area of individual pens from 2.3 to 4.1 m^2 reduces airborne bacteria count by half.

Larger calves and those that do not have access to outside paddocks may need a greater area (2.5 m^2/calf) to carry out normal behaviour.

Location

Locate calf rearing facilities to protect calves from sun, rain, wind and extreme temperatures. Also consider the needs of workers. Orientate housing to provide protection from prevailing winds and shade from the sun in hot weather, but also allow wet areas to dry out in cold, wet weather.

Location of calf rearing facilities should also take into account:

- proximity to extra bedding materials
- availability of water and electricity
- convenience
- easy disposal of effluent or bedding material (ensure effluent does not leave the property, or adversely affect air, soil, water resources, community amenity)
- ease of handling and treating calves
- drainage and access
- protected from farm effluent

Labour

Labour is the second largest expense in calf rearing, so the housing system needs to be as labour efficient as possible without sacrificing animal health or performance.

Roof design

Roof pitch

A pitch of at least 1:4 is required for air movement.

A pitch of 1:3 is recommended in warmer climates.

Ridge openings

A continuous open ridge of 50-75 mm/3m of shed width should be provided.

For sheds wider than 6m in northern Australia, an open ridge space of 300mm + 50mm per 3m shed width is recommended.

Eave overhang

Open-sided sheds should have an overhang of 900mm.

White or opaque roofing will reflect more radiation and be cooler than transparent or translucent materials.

Ventilation

Ventilation is the exchange of stale air with fresh air, and is measured as a rate (volume per unit time). Ventilation requirements depend on design, orientation and location of the facility. Ensure the ventilation system allows even air exchange through the whole building, especially at calf level. An ammonia smell indicates insufficient ventilation.

Passive ventilation is usually the most economical solution. Allow sufficient windows, doors and vents, or use open building designs that still provide protection from the elements. Sidewall curtains can be used but may need to be repositioned up to 10 times per day during changeable weather.

Minimise draughts by locating air inlets for ventilation systems above calf height. Young calves start to shiver at 8 °C when exposed to draughts even if their coats are dry and they are well fed. Draughts greater than 0.5 m/s close to the animal will predispose to respiratory disease.

Fully enclosed housing systems need forced or powered ventilation. This may also be used as a cooling system. Supplemental positive pressure ventilation systems, similar to those used in piggeries, can be very effective in reducing respiratory disease in calf sheds. A fan at one end draws water-cooled air through the shed.

Air space

Allow a minimum air space of 10m^3 per 100 kg liveweight or 6 - 8 m^3 per calf. Avoid having large numbers of calves in the same airspace by keeping smaller groups in separate rooms or buildings. Increasing air space reduces exposure of housed calves to air pollutants: doubling the air space has the same effect on the concentration of airborne bacteria as a sixfold increase in ventilation rate (air exchange rate). However, a large air space within a shed does not guarantee good ventilation.

The smaller the air space per animal the more sophisticated the ventilation system must be. Low ceilings are a risk for respiratory disease and a low iron roof will radiate heat onto calves in summer, increasing risk of heat stress.

How to calculate air space (m^3 per calf)

$$\frac{\text{shed length x width x height (in metres)}}{\text{number of calves}}$$

Cleaning & disinfection

Continuous flow systems, where calves are continuously entering facilities without a rest period, are likely to have more disease problems. Calf housing should be completely cleaned between batches of calves. When designing your facility, ensure there is enough space to disinfect and rest facilities before introducing new animals.

Cleaning involves removing used bedding and dirt and allowing pens to dry out. Ensure the design allows easy access for machinery required for cleaning and avoids corners that are difficult to clean. Direct sunlight aids the decontamination of surfaces. Use materials that are easily cleaned and disinfected for pen construction. Wooden surfaces are harder to disinfect than metal. Concrete flooring is easier to clean than dirt floors.

Remove stubborn dried organic matter by pressure cleaning before treating with disinfectants. Be aware that high pressure washing may cause pathogens to become airborne and may spread infection to neighbouring pens.

Flooring

Calves may be housed on a solid floor (concrete or earth base) with bedding, or on raised mesh or slatted floors which allow faeces and urine to pass through. Slatted floors have been associated with foot and leg problems in calves. Concrete floors have the advantage of being able to be hosed, but should have a smooth finish with minimal cracks. Use heavy grade cement that can bear the weight of heavy machinery and will not deteriorate when pressure-washed. Locate any wet areas (e.g. where water buckets and milk feeders are located) at the bottom of a slope for drainage.

Mesh or slatted floors can be used providing:

- draughts are prevented
- the floor is not be too slippery for calves to stand and move securely
- the spaces do not cause injury through sores or trapping hooves
- the space underneath is cleaned out and there is sufficient access to do so

Rubber mats will improve calf comfort on these floor types.

Bedding

Soft bedding at least 15cm deep should be provided. In cold weather (< 10 °C) calves should be able to nestle deeply in the bedding so that their legs are not visible. Long straw is the warmest bedding material for calves, followed by rice hulls and wood shavings. Sand does not provide enough thermal insulation where calves need to be kept warm. Calves may also consume sand and this can lead to health concerns.

Bedding materials suitable for solid floors:

- straw
- rice hulls
- wood shavings
- sawdust
- shredded newspapers

Note: tanalised sawdust or wood shavings are toxic and should not be used.

Pen design

Pens are microclimates within sheds, so a well-ventilated shed does not guarantee good ventilation at calf level. Pen walls should be at least 1 m high, but avoid having individual pens enclosed by four solid panels as this reduces ventilation at calf level and dramatically increases airborne bacteria counts. For open housing systems, such as temporary pens constructed in a hayshed, perimeter walls should be solid up to 1m in height.

Either use panels that are solid up to 50 cm height then open (mesh) or use solid panels between calves and mesh for the ends. The gap between the panel and the ground should be <20 cm otherwise young calves may slide or roll underneath.

For open pen sides, sheepyard mesh is sufficient. Pens should not be covered on top to prevent cold stress; instead provide additional bedding.

All fittings in the calf shed must be easily cleaned and free of projections that may injure calves or handlers. Remember that wooden surfaces are harder to disinfect than metal.

Provide a hospital area to isolate sick calves. Use a separate pen for sick animals or quarantine the pen containing the sick calf with partitions.

Social contact

Calves should be housed within sight and sound of other calves. In individual pens, calves should be allowed uninterrupted visual contact with other calves at the front of pens. Either use panels that are solid for the bottom 50 cm and then open (mesh) or use solid panels between calves and mesh for the ends.

Temperature/Humidity

The temperature at which a calf begins to feel cold stress depends on:

- bedding surface
- draughts
- whether the coat is wet or dry
- how well fed the calf is
- the age of the calf

The ideal conditions for a calf

Ideal temperature is 17 °C.

Ideal relative humidity is 65 %.

A dry, healthy calf that is eating normally and not subjected to draughts can comfortably tolerate a temperature range of 0-20 °C. A dry but poorly fed calf will start shivering at 12°C and a poorly fed calf with a wet coat, subjected to draughts will start shivering at 19 °C.

In hot weather, ensure that sufficient shade is provided for calves to prevent heat stress.

Feed and water

Consider which feeding system you prefer (bucket feeding, teat feeders, calfeterias, automatic feeding systems) before designing the housing system, as not all housing and feeding systems are compatible.

Ensure feed and water containers are:

- Easily accessed - barriers may be required to reduce competition
- Placed near outside of the pen to minimize contamination by urine and manure and prevent liquid feed and water from wetting bedding material. This also reduces the risk of pathogens entering the pen on footwear or equipment
- Convenient to use, to reduce labour inputs
- Easy to remove for cleaning

The recommended minimum trough space is 35cm per calf

Biosecurity

Housing design should limit the need for staff to enter individual pens for feeding and daily husbandry procedures. Systems should be in place to limit or control access of unauthorised people and vermin to reduce the risk of disease transfer.

Preparation and storage

The feed preparation area should be vermin proof and dry and located near the calf housing. Hot water should be readily available for mixing milk formula and cleaning equipment.

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