Designing An Automatic Feeding System

Iowa dairy producers are adapting new technologies to boost profitability, increase labor efficiency, and improve working conditions for family members and employees. In particular, automatic calf feeding systems are being adopted as they offer the opportunity to raise pre-weaned dairy calves with less manual labor than traditional systems while providing full growth potential. Proper planning enhances performance; this is especially true when remodeling or building new calf facilities for group-reared calves.

Four keys to successful group-rearing on computer controlled systems

Colostrum is priority one

The importance of colostrum in reducing mortality and morbidity has been known for decades and can be a costly mistake if not managed properly. One way to summarize key issues related to colostrum management is to focus on the four Q's:

- **Quality:** colostrum should contain >50 g/L IgG
- **Quantity:** 1st feeding 10-15% of birth weight (90 lb calf should receive 4 qts)
- **Quickly:** 1st feeding within 2-4 hours of life
- **Cleanliness (sQueaky clean)**: should contain <100,000 cfu/ml total plate count

Plentiful, well-bedded resting space with uninhibited access to milk, starter, and water

Allowing at least 35 sq ft per calf in a deep, clean bedded pen with straw will allow calves to use calories consumed for growth and health instead of shivering or fighting poor hygiene. The pen should allow for easy access to the feeding station to encourage calves to eat starter grain and drink water.

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Adequate ventilation for good air hygiene

Group-reared barns often struggle with air hygiene due to high moisture levels from urine, spilled water, and curtain controls. Curtain controls, if not managed with changes in temperature, can cause air quality problems in the barn. Well-ventilated barns will operate at only 1-5 degrees above the outside air temperature.

Chronic respiratory disease can be controlled by reducing stock density, improving ventilation, and minimizing relative humidity. It is important to keep newborn calves in isolated clean, well-bedded pens for 2-12 days, depending on management to help decrease the occurrence of disease, particularly respiratory disease and scours.

Management focused on calf care and computer feeder monitoring and maintenance

Group-rearing in a computerized feeder system requires detail-oriented employees who are cleaning lines, nipples, and circuits as well as closely monitoring the cleanliness of the calves. While technology can assist in identifying sick calves earlier; watching calves is still important.

Assess your current facilities

As dairies expand their milking herds, there are more calves to raise. Older buildings often sit idle when cows are moved to modern facilities. Consider the following factors to answer the question, "Is it worth converting my older facility to a calf barn or am I better off building new?"

Structural factors are very important. A qualified person should look at the facility before supporting walls or posts are moved or removed. If a post needs to be removed, steps should be taken to support the beam and maintain structural soundness. Cutting notches through structural components for clearance should be done with caution; a shallow notch can greatly weaken a beam.

Electrical service should handle any new equipment for the facility. Outdated systems should be upgraded for safety reasons, but be mindful as the costs for upgrading electrical systems can be a considerable expense.

Is there a **water supply** in the building? Check the condition and capacity to make sure it is large enough and does not need to be upgraded or replaced. Location of waterlines should be reviewed for new pen layouts.

Building ventilation is a big consideration. A poorly ventilated facility will result in long-lasting problems with calves, causing poor growth and lung damage. A mechanical ventilation system can be installed in most situations, but making it work properly can be complicated. Natural ventilation is also possible but tends to be much less effective than tube ventilation systems for small calves. The location of the building in relation to other structures should be considered as well as the degree in which building walls can be opened for air entry.

Convenience for caretaking is also important. Remodeling the building should result in a facility that makes it convenient to feed and bed animals. A separate room or area should be considered for cleaning equipment. Loading and unloading of calves should be easy for one person to lessen the labor load.

The biggest concern about repurposing a building is having adequate space. Does the facility have enough room for the calves? Has the standard of 35 sq ft of bedded space per calf been ignored and the calves have only half of that? Will the facility be easy to clean and bed to maintain a dry environment?

Concrete can also be a big factor. Removing concrete can be a lot of work. Remaining concrete needs to provide adequate drainage and good footing and not create issues caused by unevenness.

A question that should be asked about repurposing a building is **"What would I pay for this building if I had to buy it in the current condition and have to change it to meet my needs?"** This should make you take a harder look at the good points and the bad points of the building. Compare the costs of removing concrete and stripping the existing building to the price of a building of a new structure of similar size. If you are only saving the shell of the existing building, does the cost of gutting come close to the cost of

a new structure? The rule of thumb is to build a new facility when remodeling a building will cost two-thirds to three-fourths the price of building a new facility. This guideline takes into account compromises that will affect both the calves and their caretakers.

Repurposing a building into a calf facility can keep a building in service for many more years. By recognizing areas that might be compromised, this process can be very successful. A producer needs to weigh the costs of compromises against his calves and caretakers. The most important issue to consider is if the building will be able to effectively produce healthy calves that will become profitable cows.

Computer controlled barn design considerations

Sizing the facility

The number of calves to manage at any one time depends on the herd size and calving interval, conception rate, culling rate, death loss, and seasonal or cyclic patterns in calving. These factors should be considered to avoid overcrowding and minimize competition. Consider 25-40 percent more space than is needed to give pens rest periods between groups.

All in/all out vs. continuous flow

With an all in/all out system, it is easier to control disease, keep more uniform groups, and reduce competition as the calves will be of similar size and age. This type of system will make it easier to clean and sanitize between groups of calves, although it requires a larger number of calves and more pens and nipples to feed them.

A continuous flow system is easier to implement with a lower number of calves and pens. The system can also allow a pen design for small and large calves, which reduces competition around the feeder. However, pens are never empty for cleaning and bedding which can be a disadvantage.

Barn orientation is very important, especially if you are going to use natural ventilation. The ideal situation is to have the building oriented so the length of the building is on the east–west axis with the sidewalls opening to the south and north. This will allow the predominant wind from the south in the summer to fully enter and exit the building while keeping the sun on top of building instead of inside the building.

The building should be at least 50 feet from another building or windbreak to prevent breezes from being blocked. If it is near structures that are taller than one story, this distance should be greater. Charts are available to determine the optimal distance for adequate air flow.

It is good to have calf buildings located so that air coming into the building isn't passing through areas with mature cattle, manure storage, or other spaces that could compromise air quality. This holds true for both natural and mechanical ventilation.

Lighting is important for managing calves. Without proper lighting it becomes difficult to recognize conditions and health issues in the facility. Light intensity is recommended to be at least 15 foot candles at calf height. A Color Rendition Index (CRI) of 80 is recommended to be able to discern colors correctly.

Service alley requirements vary with the design of the facility. Care should be taken that it is wide enough for vehicles and equipment, and stored items such as feed or bedding. Other facility designs may include observation alleys around pens or alleys to help move calves. Adding an alley to allow access to all pens without requiring passage through other pens will save time and effort in the long run.

Feed and water location and space requirements

Feeding stalls should be located within 3 ft of lines between the feeder and nipple. Feeding stalls should be solid sided and of minimal width to discourage multiple calves from trying to access the feeder at the same time. Do not restrict the area leading up to the feeding stall and be sure to provide plenty of fresh clean water. Clean waterers daily and place them several feet away from the starter bunk, no higher than 28 inches from the floor. Long, narrow pens will create a barrier with resting calves, preventing those at the back of the pen from easily accessing feed and water. For best results, locate feeding stalls on elevated curbs and in locations that allows for easy manure removal and easy draining and clean-out.

Milk prep room

Locate the milk prep room near the calf housing. This allows for easy access to feed storage, cleaning sink, health records, water heater, and a refrigerator/freezer. This area can house the auto feeder machine, provide space for a milk pasteurizer, and sinks for cleaning feeding equipment. Take careful consideration when planning the milk prep room to allow for the greatest air flow through the barn.

Feed and bedding storage areas should be included in the facility. Starter mixes and milk replacer can be stored in the milk prep room away from areas where water is used. Having bedding stored close to where it is needed makes it more convenient when it is needed. Storage areas should be located away from high traffic areas to protect feed and bedding supplies and not interfere with traffic. If there is space, having room to store and access complete pallets of feed or unload bedding will save time.

Manure handling and storage needs to be considered as well. It is wise to have access doors and gating situated to allow skid loaders or loader tractors to operate easily as areas are cleaned and waste is removed. It should be possible to clean each pen individually without interfering with other pens. If the manure is going to be stockpiled or hauled out, the stacking or loading area should be readily accessible.

Ventilation

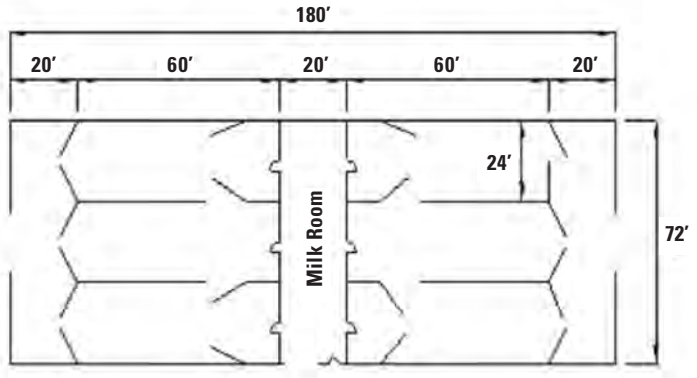
Proper ventilation is very important to maintain healthy calves, to control heat and moisture, remove gases and contaminants, and provide a comfortable environment for the calves. Preventing drafts on calves is the biggest challenge. During cold weather, air speeds should not exceed 50-60 feet per minute at calf level, while exchanging air in the building 4 times per hour is recommended. A positive pressure tube is often used to provide consistent air flow during cold weather in both mechanically- and naturally-ventilated facilities. As the temperature goes up into the 40 to 70° F range during mild weather, the air exchange should increase to 15 times per hour for the building or 50 cubic feet per minute (cfm) of fan capacity per calf, if using fans. During hot weather when the temperature is above 70° F, the recommendations are 40-60 air changes per hour or 100 cfm of fan capacity (per calf). This system tends to be the best option for success.

If using natural ventilation, the building needs to be opened up as the temperature increases. For calves less than 2 weeks old, the top curtain should start to open when the temperature is in the low 40 degree range. It should open progressively or as needed until the temperature reaches the low 70 degree range. After the top curtain is fully open, the bottom curtain can be fully opened as the temperature reaches the mid-70 degree range. If there is a one-curtain system that opens from the top, it can start opening at the same temperature, but not reach fully open until the mid-70 degree range. If the one-curtain system opens from the bottom, opening the curtain should be delayed until the mid-40 degree range and reach fully open when the temperature reaches the mid-70 degree range.

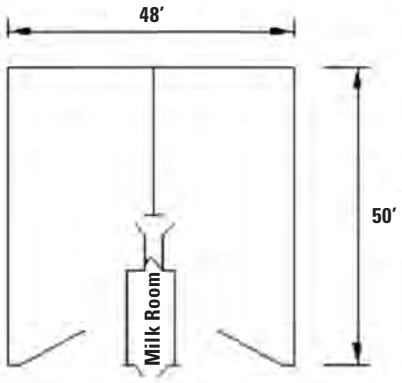
For older calves both curtains can be opened as the temperature reaches the lower-50 degree range. One-curtain systems can start opening in the 30 degree range and be fully open by the mid-50 degree range. Adjustments should be made based on existing winds and conditions within the facility.

Example pen layout

Example 1. 6-pen layout designed to house 180 calves. This allows adequate space in each pen, service alley around the pens, and milk room to house auto feeders and other storage.



Example 2. 2-pen layout to house 60 calves utilizing one auto feeder machine. This allows adequate space for the calves and provides a milk room to house auto feeder and supplies.



Acknowledgements

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Sources: Dairy Freestall Housing and Equipment, MWPS-7 Eighth Edition