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Abstract

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FREESTALL DESIGN AND MANAGEMENT FOR COW COMFORT

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Summary

The design and management of freestall facilities are critical in maintaining cow comfort and high milk production. Dairy producers should be conscious of the factors affecting cow comfort in freestall facilities. These factors include: ventilation, water availability, feed availability, stall design, and stall bedding. Dairy producers should strive to have lactating cows standing to be milked; standing to eat; or lying down, chewing her cud, and producing milk. Managers who take this approach will improve both cow comfort and milk production.

(Key Words: Freestall, Management, Cow Comfort.)

Selecting Freestall Housing

Selecting the type of freestall housing is an important decision that should be made with the lactating cow in mind. The climate in Kansas allows several options when selecting freestall housing for lactating dairy cows. Some of the options include 2-row, 3-row, 4-row, or 6-row freestall barns. The advantage of 2-row or 4-row freestall barns is access to feed and water. The advantage of 6-row barns is cost; however, producers should be concerned about the level of heat stress and the limited feeding area. Producers building 6-row barns should seriously consider mechanical ventilation. It is essential that freestall barns are constructed properly and stall dimensions are correct. Figure 1 shows the recommended dimensions for constructing freestalls.

Freestalls need to be inviting for the cow to choose to lie in them. Freestalls that are not comfortable for cows usually fail in one of four following areas: 1) lunge space, 2) neck rail positioning, 3) bedding or cushioning, or 4) air or vision.

Lunge Space

The first reason a freestall may fail is lack of lunge space. A cow needs forward or side lunge space to maneuver in and out of the stall easily. There should be no obstructions in front of the stall above the brisket board if cows are expected to lunge forward. If stall length is limiting, consider wide dividing loops that allow cows to lunge to the side. The length of freestalls varies with their orientation. Single rows of stalls located against a wall need to be a minimum of 8 ft in length. This will allow the cow to lunge forward. When a double row of stalls (head to head) is used, the minimum stall length should be 7.5 ft, provided there is no obstructions that will prevent the cows from lunging forward. Recommended stall width ranges from 45 to 48 inches. Producers in warmer climates should use a 48-inch-wide stall to increase the spacing between cows.

Neck Rail Positioning

The neck rail must not interfere with the cow entering the stall. That is, it should be far enough back (66 inches) and high enough (44 inches) that the cow can enter the freestall completely with all four feet. Then she can kneel forward and lie down. If the neck rail is too far back, the cow cannot bring her back feet into the stall, and she must lie half in and half out of the freestall. If the neck rail is too low, she also hits her neck on the rail as she

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tries to rise. Producers using mattresses often increase the neck rail height to 46 inches.

Bedding or Cushioning

Bedding or cushioning is also very important to encourage freestall use. Hard stalls provide very little incentive to choose them over the alleys. The bedding can be anything that provides 4 inches of cushion, absorbs moisture, prevents friction, and does not promote the growth of bacteria. Common beddings include sand, mattresses, composted manure, and wood shavings or sawdust.

When sand is used, with a 4 in minimum, it can be both a base and bedding. Sand provides great cow comfort, drains well, and helps keep cows very clean. Sand will not support bacterial growth. In addition, when a cow steps out of the stall and kicks sand onto the alleys, it improves cow footing. Sand is the "gold standard" for cow comfort; however, a quality sand free of small rocks or pebbles must be used. The major problem is sand in the manure systems. As much as 35 to 50 lb per cow per day will be added to the manure. The only sound advice for sand-laden manure is to plan on sand settling and then removing it from the manure system.

Mattresses can provide a satisfactory base and adequate cushioning. A mattress can be filled with a variety of materials: sawdust, shavings, straw, hay, or ground rubber. The mattress, when properly filled, only provides cushioning. Producers still need to add adequate amounts of dry bedding on top of the mattress to help keep the surface dry and to reduce friction on the hocks. Mattresses are easily the second best things that can be used for a freestall surface, and they may be the best choice for a manure system that cannot handle sand.

Many producers have successfully used composted manure from a solid separator as freestall bedding. If this option is chosen, good facilities and equipment are required to handle and compost the manure for high quality bedding.

Selecting a proper bedding type is important; however, the success of using the bedding will be determined by the producer's ability to keep stalls full of bedding and properly groomed. This will entice cows to use the stalls on a regular basis.

Air or Vision

Properly ventilating freestall areas is extremely important in maintaining cow comfort. Remember that cows under heat stress dissipate heat through their respiratory tract. We can help the cow with this process by providing ventilation in the stalls. Field observations also indicate that cows prefer stalls and barns that are open and allow them to observe what is happening around them. Avoid structures that hamper air movement or hamper visibility.

Ventilating Freestall Barns

Freestall housing should be constructed to provide good natural ventilation. Sidewalls should be 12 ft high for monoslope roofs or 14 ft high for Gable roofs to increase the volume of air in the housing area. Ideally the sidewalls should be 75 to 100% open. Fresh air should be introduced at the cow's level. Curtains on the sides of freestall barns allow greater flexibility in controlling the environment around the cow. Because warm air rises, steeper sloped roofs provide upward flow of warm air. Roof slopes for freestall housing should range from 4/12 to 6/12. Roofs with slopes less than 4/12 may have condensation and higher internal temperatures in the summer. Providing openings in addition to alley doors on the end walls will improve summer ventilation. Gable buildings should have a continuous ridge opening to allow warm air to escape. The ridge opening should be 2 inches for each 10 ft of building width. Naturally ventilated buildings should have a minimum of 1.5 to 2× building width between structures.

In the midwest, freestall barns are typically oriented east to west to take advantage of sun angles and provide afternoon shade. Producers who orient barns north to south will have to construct an overhang on the west side adequate to shade stalls in summer afternoons.

Freestall barns should be located as close to the milking center as possible without restricting ventilation. The goal is to reduce the distance cows have to walk to and from the milking parlor. Field observations indicate that distance from the gate of the housing area to the gate of the holding pen should be a maximum of 1200 ft for 2× milking, 900 ft for 3× milking, and 700 ft for 4× milking.

Reducing Heat Stress

In addition to a cooling system in holding pens, cooling can be provided to freestalls by adding fans and a sprinkler system. Care must be taken to prevent the bedding in the stalls from becoming wet. Typically, a sprinkler system could be located over the lockups, and fans could be used over the freestalls, lockups, or both. The sprinkler system can be put on a timer to reduce water usage. Producers can use either 180° (half-circle) or 360° (full-circle) nozzles. The 180° nozzles work well next to feed lines or bunks to prevent feed from becoming wet. Nozzles that emit from 7 to 30 gal/hr generally are used to conserve water. Producers need to experiment with nozzle type, nozzle size, nozzle spacing, and operating water pressure to determine which nozzles work best in their dairies. Sprinklers need to be operated intermittently using automatic timers to regulate cycle length. Frequently, sprinklers are on for 2 to 3 min per 15 min. The cycle can be adjusted depending on the level of heat stress. Freestalls oriented north to south need sun screen material along the west side to reduce heat load in the building. Orienting freestall housing east to west generally is recommended in the midwest.

Insulating Freestall Barn Roofs

Insulating the underside of the roof probably began because of poorly ventilated barns that failed to remain warm in the winter. When you try to keep barns warmer than 5° to 10° above the outside temperatures, condensation occurs with dripping. Rather than providing more ventilation and lowering the temperature inside the barn, farmers put insulation under the roof. Insulation may stop the condensation, but it ignores the real problem of poor ventilation. Insulation is sometimes added under the pretense that it will provide cooler summer temperatures. This ignores the fact that insulation, in summer or winter, will retain the heat produced by the cow herself. The answer to condensation and moisture is not insulation, but more ventilation. When a building starts dripping, it is time to open it up more. Today's new naturally ventilated freestall barns should be simply a sunshade in the summer and a wind break in the winter. The cold, naturally ventilated freestall barn should have: 1) no insulation; 2) an open ridge and sides; and 3) end walls and sidewalls that can be opened completely.

Water Availability

You should remember that high producing dairy cows can consume between 30 and 50 gallons of water per day. Water should be provided to cows leaving the milking parlor. In parlors that are double 25's or smaller, one trough 8 ft long is usually sufficient. In freestall housing, water should be located at all crossovers, allowing one waterer or 2 ft of tank perimeter for every 10 to 20 cows.

Number of Crossovers

Crossovers should be provided every 60 to 80 ft, or a row of 15 to 20 stalls. Crossovers are typically 12 ft wide. Oftentimes, producers reduce the number of crossovers in freestall barns to reduce construction costs. This is not a good alternative from the cow's point of view. Reducing the number of crossovers limits access to feed and water. It also reduces the total length available to construct the feedline. Very few producers stock freestall barns at one cow per stall. The tendency is to

overstock freestall facilities. Therefore, cows suffer when the number of crossovers is reduced.

Groups of Cows

Typically, large dairies have eight strings or groups of milking cows. They also include pens for slow milking cows, mastitis cows, fresh cows, dry cows, and springers. The slow milking pen should have capacity for 2% of the milking cows. The fresh pen and mastitis pen should each have the capacity for 1% of the milking cows. A minimum of two dry cow pens and one pen for springers is usually constructed. Lactating cow pens should be sized so that one group of cows can be milked in 60 min when milking 2x, 45 min when milking 3x, and 30 min when milking 4x.

Conclusions

Providing comfortable freestall housing is critical in obtaining high milk production. Unfortunately, correctly designing and building freestall facilities is only one part of the equation. Maintaining cow comfort in freestalls is a daily job that requires a lot of dedication and hard work.

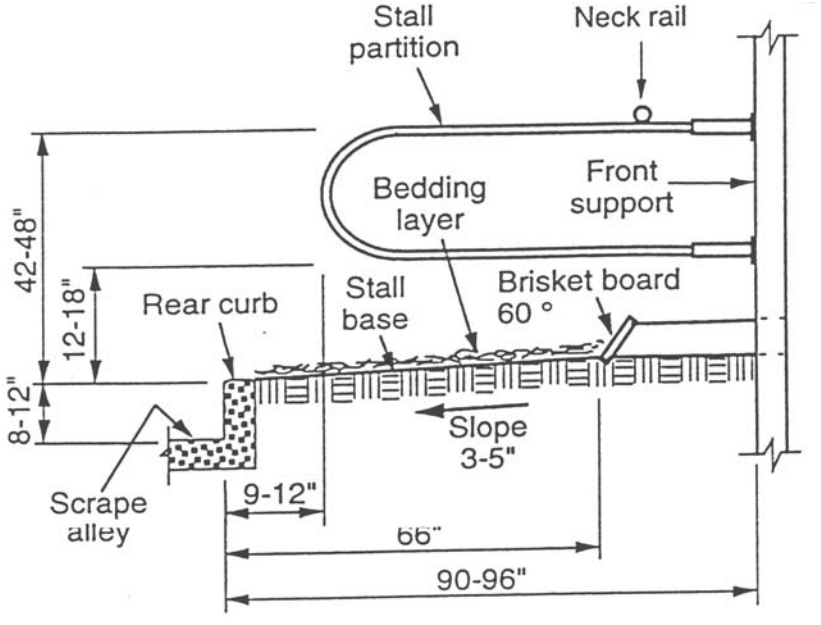

Figure 1. Freestall Components and Dimensions.

Source: Dan McFarland, Extension Engineer, and Robert Graves, Professor,
Department of Agricultural and Biological Engineering,
The Pennsylvania State University, University Park