

Compost Dairy Barn Design Comments

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A compost pack dairy barn provides a quality resting and loafing area for the lactating cows when properly designed and managed. However, the rest of the lactating facility infrastructure must exist and includes the feeding capabilities using headlocks or feeding fence with feed alley, manger and manure system; and milking center with accompanying waste management system such as an anaerobic lagoon and holding pen flush system.

General Compost Resting Area Sizing Comments

- Compost resting area should be at least 100 ft² per cow milking 50 lbs/day for warm and humid climates like Missouri.
- Need to provide an additional 10 ft² per cow for each 25 lbs of milk per cow per day above 50 lbs/day.
- Need to provide a 'transition area' to allow cows to enter bedding pack area from feeding area and other lactating cow facilities. This minimum transition area is a 'walkway' with a minimum 12' width by 20' long which is the assumed distance from edge of barn at feeding floor/ground level to top of bedding pack at maximum or resting depth. This 'transition area' should not be considered as part of the resting area.
- The number of 'walkway' access locations between bedded pack and feeding area and other lactating cow facilities will depend upon the overall facility system design of lactating cow system.

General Bedding Management Comments

- Base/foundation for bedding pack area can be compacted clay while concrete flooring may be required in transition areas.
- Initial bedding material base needs to be at least 12" deep when starting new pack.
- Bedding pack needs to be stirred to a depth of at least 4"-6" twice per day with either a cultivator or tiller to mix manure and help maintain moisture. Mixing best done when cows removed for milking.
- Add 4" to 6" for fresh dry bedding when bedding pack begins sticking to cow
- Moisture content of pack should run between 40% and 60% for optimum composting and cow cleanliness. If bedding pack can be made into a 'snowball' like ball, pack is too moist and more bedding needs to be added.

- *Bedding Selection* – Relatively fine sawdust and wood shavings work best because they can be easily mixed and have only a medium absorbency which is critical for pack moisture management. Highly absorbent bedding sources are not desirable because they hold moisture too well resulting in a wet, mucky bedding pack.
- *Air circulation* – Large diameter ceiling fans or large diameter circulating fans must be used year around to move air across the bedding pack to aid with drying. Fans need to be variable speed so air speed can be kept low during cold weather and kept high during warm and hot weather. Good air movement in hot weather helps with cow comfort.

General Facility and Building Design Comments

- ***Barn layout options*** – The variety of barn layouts can range from bedding pack area only to include bedding pack, waterers and feeding. Dairies that already have feed and water facilities can add a bedding pack barn to provide comfortable resting option. Dairies that have no existing feeding facilities need to develop a complete barn system to provide feed and water access along with the bedded pack resting area. Basically a complete bedded pack barn is like developing a freestall barn plan but substituting bedded pack areas for freestalls. Barn width and length can vary to fit needs of dairy operation. If headlocks are planned for the feeding barrier and for cow management, one needs to provide a minimum of 2' of barn length per cow to be housed in facility. Less than 2' per cow will result in not being able to catch all cows in headlocks at one time.
- ***Barn layout options when considering conversion to freestalls*** - One should consider how freestalls can be arranged in a bedded pack barn if freestalls are needed in future. The width of the bedding pack is the critical dimension to consider for freestall conversion. A bedding pack width of 30' to 36' when a feeding floor is included in the original bedded pack barn allows for easy conversion to two rows of freestalls alongside the feed alley. A bedding pack width of 40' is needed to convert to a three row freestall layout. When no feeding is initially included in a bedded pack barn, the barn width needs to be at least 40' to convert to a two row freestall systems and at least 48' to convert to a three row freestall systems. During the planning phase of a bedded pack barn that may be converted to freestalls, one should layout the freestall system before finalizing the plans for the bedded pack barn.
- Stem walls along the perimeter of the bedded pack area should be 4' high but can be only 2' high. Lower stem wall heights reduce the amount of bedding/manure storage in a facility. Stems walls are typically along the outside wall of structure when bedded packs are located along outside walls and located between the bedded pack area and the feed alley if feed access is provided in a barn. Remember to provide for several transition areas to allow cows to access the bedded pack.
- Barn sidewall heights above stem walls need to be at least 12' for barns up to 48' wide; 14' for barns up to 60' wide; and 16' for barns wider than 60 ft. A 12' minimum is necessary for bedding pack aeration. Higher sidewalls help ensure adequate natural ventilation during warm and hot weather. Curtains can be added to north and west walls to protect cows from cold winter winds.

- Structural design - The actual type of structure is not critical. Either a steel frame or wood structure would be acceptable. However, a clear span design is recommended such that no posts are located within the bedded pack portion of a barn.
 - Snow load - The design snow load for an agricultural building located in southern Missouri should be at least 20 pounds per square foot. The main issue is not necessarily snow load but ice load. A 25 pound per square foot snow load would be preferable.
 - Wind load - The design wind load for an agricultural building can be based on at least a 75 mph wind for southern Missouri. A 90 mph design wind load would be preferred.

Bedding Storage and Handling Comments

Bedding storage and handling needs to be addressed as a bedded pack dairy barn is planned. When bedding needs to be added, one will need 33 to 50 ft³ (about 1 to 2 yd³) per 100 ft² of bedded pack area. If a bedded pack area is fairly large, handling and applying fresh bedding will be a significant material handling opportunity. A variety of methods can be used to apply fresh bedding. The exact handling method for a given operation will depend upon where the bedding storage is located with respect to the bedded pack. Also consider how frequently bedding can be obtained when planning bedding storage. If bedding supply cannot be obtained very often, a fairly large storage capability will likely be needed to ensure fresh bedding is available when required. Not having an adequate bedding supply available when needed will likely result in adverse impacts on cow cleanliness and health.

Resources for more information

More information about designing and operating bedded pack dairy barns include but are not limited to the following resources:

- *Guidelines for Managing Compost Bedded-Pack Barns* by The Dairy Practices Council and can be found at <http://www.dairypractices.org/catalog/guidelines/barns/guidelines-for-managing-compost-bedded-pack-barns>
- *Compost Bedded Pack Barns for Dairy Cows* from University of Minnesota Extension and can be found at <http://www.extension.umn.edu/agriculture/dairy/facilities/compost-bedded-pack-barns/>
- *Compost Bedded Pack Barn Design – Features and Management Considerations* from University of Kentucky and can be found at <http://www2.ca.uky.edu/agc/pubs/id/id206/id206.pdf>
- Dairy freestall barn layouts have been developed as “Idea Plans” by Penn State Extension, Department of Agricultural and Biological Engineering and can be found at <http://abe.psu.edu/extension/idea-plans/dairy/freestall> on the web. Two and three row barns can easily be adopted as bedded pack barns with feed ally along one side. Four and six row barns can easily be adopted as bedded pack barns with a center drive through feeding layout.