Compost Dairy Barn Design Comments
Developed for Field Day at David Gray Dairy

Joseph M. Zulovich, Ph.D., P.E.
Extension Agricultural Engineer

The compost barn at the David Gray Dairy provides only the resting and loafing area for the lactating cows. The rest of the lactating housing infrastructure includes the feeding facility with headlocks and milking center with accompanying anaerobic lagoon and flush system which all existed before the compost barn was constructed.

General Compost Resting Area Sizing Comments

- Compost resting area should be at least 100 ft² per cow milking 50lbs/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’ for every cow entrance to allow cows to enter bedding pack area from feeding area/facility. For Gary’s facility - This minimum transition area is assumed to be the width of the 12’ wide cow alley connecting the facilities by 20’ long which is the assumed distance from edge of barn at floor level to top of bedding pack at maximum or resting depth. This ‘transition area’ should not be considered as part of the resting area.

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 cows.
- 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.

University of Missouri, Lincoln University, U.S. Department of Agriculture and Local Extension Councils Cooperating

EQUAL OPPORTUNITY/ADA INSTITUTIONS
**General Facility and Building Design Comments**

- **Barn layout options** – A variety of barn layouts can range bedding pack area only to include bedding pack, waterers and feeding. Dairies that already have feed and water facilities can add a bedding pack option. Dairies that have no existing 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. However, one should consider how freestalls can be arranged in a bedded pack barn if freestalls were needed in future.

- **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.

**Resources for more information**

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


- **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/](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](http://www2.ca.uky.edu/agc/pubs/id/id206/id206.pdf)