



Dairy Extension

Educating the dairy industry on today's and tomorrow's dairy technologies.

Composting Bedded Pack Barns for Dairy Housing

The Concept

A composting bedded pack dairy barn may be a reasonable, economically feasible alternative type of dairy housing facility for Minnesota dairy producers wanting to upgrade or modernize their milking herd facilities. This housing system may provide a good option for *smaller dairies* wishing to expand or upgrade their dairy cattle housing as well as for *larger herds* who feel they need more comfortable special needs housing. It is basically a loose housing type of facility bedded with fine, dry sawdust. There is a feed alley separated by a four-foot high wall from the bedded pack. The bedded pack is stirred at least two times per day to facilitate the composting process. Excellent milk cow prep is also essential to achieve exceptional milk quality.

Composting Bedded-Pack versus Conventional Bedded-Pack

It must be pointed out there is a difference between a composting bedded pack and a conventional manure bedded-pack where bedding (usually sawdust or shavings) is added frequently as a means of covering a soiled bedding surface.

- The composting bedded pack is actively managed to rapidly compost the manure and urine. Microorganisms, including bacteria and fungi, break down organic matter into simpler substances. The effectiveness of the composting process is dependent upon the environmental conditions present within the composting bedded pack (i.e. oxygen, moisture, temperature, amount of organic matter, and the size and activity of microbial populations).
- The essential elements required by the composting microorganisms are carbon,

nitrogen, oxygen and moisture. If any of these elements are lacking, or if they are not provided in the proper proportion, the microorganisms will not flourish nor generate adequate heat.

- Achieving high temperatures within the pack is important to killing pathogens and keeping the pack surface dry. Temperature is directly proportional to the biological activity within the composting bedded-pack. As the metabolic rate of the microbes accelerate, the temperature within the bedded-pack increases. Maintaining a temperature of 130°F or more for 3 to 4 days favors the destruction of weed seeds, fly larvae and pathogens and converts organic matter into compost that is odor and pathogen free.



4 ft. high wall separates bedded pack and feed alley

Facility Design

(Note: Current design recommendations are based on the experiences of Minnesota dairy producers that have compost barns).

Composting bedded pack barns require proper design, location, and exceptional

management to provide a well ventilated, dry place for cows to lie down. Compost barns have a concrete feed alley, a composting bedded pack, a four foot high wall separating the pack and feed alley, and four foot high walls around the other three sides of the bedded pack area.

- Composting bedded pack barns are the same width as three-row drive-by freestall barns.
- The bedded pack is sized to provide a compost bedded pack area of 80 ft²/cow (a 52' x 115' barn with a 12' wide feed alley can house 57 milk cows).
- The bedded pack area can have a clay base.
- To remove heat and maintain a dry bedding surface excellent ventilation is a MUST. Barns are curtain-sided naturally ventilated. Barns need to be located in an open area where summer winds can blow through the open sidewalls and ridge in warm weather. Curtains block the wind in cold weather.
- Sidewall height is recommended to be higher than that for a freestall barn to accommodate the lost space of the sidewall opening due to the manure pack walls. Minnesota barns have 14-foot sidewalls but some owners would go to 16-foot for their next barn to provide better access for bedding trucks.
- Barns have open ridges that range from 1 to 3-inch per 10 ft of building width.
- Mixing fans are important to blow air downward toward the middle of the composting bedded pack. They need to be hung high enough to provide room for stirring equipment at the maximum bedded pack height.



- Waterers are located in the feed alley separated by distance or a wall from the composting bedded pack to minimize wetting of the pack and to keep the waterers cleaner.
- Minnesota barns have 3 ft. eave overhangs to minimize the chance of roof runoff and rain being blown onto the bedded pack.

Bedding

- Fine wood shavings or sawdust is the bedding material of choice. Fine particles facilitate easier handling and mixing, and speed bacterial growth that increases temperatures sufficient to inactivate the pathogens.
- Other types of bedding may not work satisfactorily, but until more research has been done, only the use of fine particulate wood shavings or sawdust is recommended.
- A semi load of fine wood shavings typically last between 18 and 40 days, before additional bedding is needed.
- Hot and humid or wet weather will require more frequent application of fresh bedding.
- Fresh bedding is added when the bedded pack becomes moist enough for it to stick to the cows after they rise from laying on the bedded pack.

Management of the Bedded Pack

Proper pack management requires twice daily stirring, sufficient bedding, and plenty of ventilation to keep the pack dry. Bedding needs to stay dry for the benefit of keeping cows clean and SCC low.

- To begin a composting bedded-pack, spread the bedding material a foot or more deep over the intended bedded pack area.
- The bedded-pack needs to be aerated to prevent the pack from becoming anaerobic which causes the decomposition rate to significantly slow down and microflora to begin growing. Anaerobic decomposition does not reach the temperature necessary to kill pathogens and may also create unpleasant odors.



- Stirring the pack two times a day at a depth of 10-12 inches is a MUST. *It is THE key management step* to the whole Composting Bedded Pack concept. This not only removes manure and urine from the bedding surface, it incorporates oxygen into the pack allowing a faster aerobic decomposition important to optimizing the composting process.
- Stirring takes place while the cows are out of the barn being milked.
- The bedded pack can be stirred using a skid steer loader, with a front mounted adapted cultivator or tines mounted on the front.
- Stirring also provides a fresh surface for cows to lie on after returning from the milking center and eating.

Manure Management

The composting bedded pack is typically cleaned out and land applied as part of a manure management plan in the fall after corn silage is removed. This allows time for a new pack to accumulate and begin composting before cold

weather sets in. All or some of the bedded pack can also be removed in the spring before fields are planted to make sure there is sufficient space for pack accumulation during the summer.

Care must be taken when removing the bedded pack during clean out, or during pack stirring when the bedded pack is less than 1 ft deep, to avoid disturbing the clay base. The concrete feed alley is scraped twice a day and stored in an approved manure storage unit until land applied according to a manure management plan. A mini-pit for short-term storage could be considered in some cases.

Benefits of Compost Bedded Pack Facilities

There are four important benefits that producers seem to be realizing from composting bedded pack facilities.

1. Excellent cow comfort. This benefit can lead to more cow longevity in the herd.
2. Producers are reporting a reduced somatic cell count (Note: At present, there is no detailed research on the effect of composting on mastitis pathogens).
3. There is a realization that these first two benefits lead to higher milk production.
4. Reduced investment in building and manure storage costs, although bedding costs will more than likely be higher than with a free-stall facility. All these factors are important to every dairy producer and the dairy farm's profitability.



Economics

There are a number of economic considerations regarding making a decision on building a compost bedded pack facility.

- There should be some labor savings on manure handling. Although the pack must be stirred twice a day, this chore usually takes only five to ten minutes. Feed alleys must also be scraped but that task only takes a few minutes as well. Also, cleanout is fairly simple since the dairy operator would be dealing with a dry product that can be handled without a lot of expensive equipment. Therefore, when comparing this system to others being used, it can amount to a lot of time saved spent on manure management every year.
- Assume a semi-load of good quality sawdust will cost between \$750 and \$850 per load. Depending on the time of the year, a load of sawdust will need to be added to the barn compost every three to five weeks. In the winter time or during wet times of the year, sawdust will need to be added more often. In the summer or during dryer times of the year, a load can last five weeks or more. This is assuming a stocking rate of around 80 square feet resting space per cow. This calculates out to \$0.35 to \$0.60 per cow per day. Using an average of \$0.50 per cow space per day, this amounts to \$182.50 per cow per year or \$13,687.50 for a herd of 75 cows.
- Savings due to keeping cows in the herd longer for more lactations. This means more voluntary culling, based on milk production and other profitability factors rather than on lameness or feet and leg problems.



Compost Bedded Pack Housing with outside feeding



Compost Bedded Pack Housing with Drive-thru feeding

Summary

The apparent benefits of a compost bedded pack facility don't just happen, but are the result of incorporating consistent and careful management into the operation each and every day. It still takes the application of a consistently effective pre-milking cow prep procedure. Teat surfaces must be clean before milking units are attached. And, as is the case with any dairy herd, milking procedures can have a large impact on bulk tank somatic cell counts (BTSCC) and it is no different with a compost barn facility.

More research needs to be done on why this type of housing system seems to be working. Is it the facility or the management of the facility? It appears that with careful management the composting bedded pack barn concept can work well. And, this may be beneficial to many dairy farm families who want to continue to dairy and remain profitable.

Information in this fact sheet is a summary of four articles written by University of Minnesota Extension Dairy Team members Dr. Kevin Janni, Extension Ag. Engineer; Dr. Jeff Reneau, Extension Dairy Scientist, and Wayne Schoper, Extension Educator for Brown and Nicollet Counties. Edited by Neil Broadwater, Regional Extension Educator-Dairy (March, 2005)

