Compost Dairy Barns: An Alternative Dry Manure Housing System

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18 January 2008

Compost Dairy Barn
- First one in Minnesota built in 2001
- Used to house dairy
  - Milking herd
  - Dry cows
  - Special needs

Compost Dairy Barn (CDB)
- Replace freestalls with composting bedded pack

Archived presentation available at http://lpe.umn.edu/archive2.html
Information sources

- Information & recommendations based on producer experience
- Some research studies
- University of Minnesota website
  http://www.extension.umn.edu/dairy/
- Newsletters
- Presentations
- Articles

Compost Dairy Barns

- Excellent cow comfort
- Reduced Somatic Cell Count (SCC)
- Increased milk production

CDB are not like conventional bedded pack

- Organic bedding accumulates
- Anaerobic
- Ideal temperature, moisture and pH for pathogens*
- Reputation for promoting mastitis*

*Ward et al., Vet Record (2002)

CDB are not bedded with compost

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CDB Keys to Success

1. Provide 80 ft\(^2\) per cow or more of pack area
2. Use fine, dry sawdust or wood shavings for bedding
3. Aerate and stir the pack twice a day 10 inches deep or deeper to keep it aerobic and fluffy

4. Add bedding when it begins to stick to the cows
5. Enhance biological activity and ventilation to remove moisture
6. Use excellent pre-milking cow preparation

Compost Dairy Barn Layout

At 80 ft\(^2\)/cow this 200-ft x 40-ft pack area can house 100 cows (1,400 lb each)

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**Layouts**
- Drive-by
- Drive through
- Feed bunk

**Composting bedded pack**
- Open bedded area
- Aerobic, biologically active pack
- Pack aeration and moisture management are critical

**Composting bedded pack**
- Serves as manure storage
- Built on packed earth in MN
- Surrounded by 4-ft high walls

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**Recommended pack area**

- 80 to 100 ft²/cow for 1,400 lb cows
- 65 ft²/cow for 1,000 lb Jerseys

**Stirring and aerating the bedded pack is critical**

- Hypothesis
- Physical & biological processes important

**Stirring physically**

- Mixes manure and urine into pack
- Freshens surface
- Aerates and fluffs pack
- Aids drying

Archived presentation available at http://lpe.unl.edu/archive2.html
Biological impact of stirring

- Aerated pack enhances aerobic processes
- Generates heat
- Heat helps drying
- Composting inactivates pathogens, viruses, weed seeds, & fly larvae

Pack moisture control

- Without evaporation 6 in. dry sawdust becomes saturated in about 7 days
- A wet pack
  - Compacts,
  - Reduced aeration,
  - Slow biological activity,
  - Slow heat production &
  - Slow moisture evaporation

Stirring and aerating

- 2x per day or during each milking
- 10 to 12 inches deep, or more
- Avoid compaction

Archived presentation available at http://lpe.unl.edu/archive2.html
Deep stirring & aeration
- Occasional deep tillage
- Keeps more pack aerobic as pack accumulates
- Avoid disturbing packed earth

Bedding management
- Start with 12 to 18 inches of fluffy, fine, dry, sawdust or wood shavings
- Add bedding when pack sticks to cows
- Add 4 to 8 inches every 2 to 5 weeks or smaller amounts every few days
- Pack can get wet fast
- Handle semi-loads of bedding
- Avoid cedar

Feed mangers
- Covered drive-by
- Drive-by
- Drive through

Archived presentation available at http://lpe.unl.edu/archive2.html
**Feed alley**
- 12-feet wide, like freestall barns
- Concrete
- Scraped 2x per day
- Sloped to drain water away from pack
- Wall separates from pack

**Walkways**
- Cow and equipment access between pack and feed alley
- 10 to 12-ft wide
- Used to add fresh sawdust
- Minimum two per pen
- Every 120 to 160 ft.

**Waterer options**
- Adjacent to feed platform
- Adjacent to resting space
- Do not place waterers in the pack area
- Provide 2-ft tank perimeter for 15 to 20 cows (MWPS-7, 2000)

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**Ventilation**

- Air exchange is critical for moisture removal
- **Recommend**
  - 14 to 16 ft sidewalls
  - 3-ft eave overhang
- Mixing fans common
  - Drying pack surface
  - Cooling cows

**Post frame or hoop barn**

**Manure handling**

- Composting bedded pack provides storage
- Smaller external manure storage
- Mini pits inside or outside
- Producers estimate 25 to 35% manure is voided in feed alley
- Concrete alley scraped 2 times/day
- Pack material is land applied in fall & spring
- Follow nutrient management plan

Archived presentation available at http://lpe.unl.edu/archive2.html
Mini pit manure storage

Outside

Inside

CDB Manure Nutrients

<table>
<thead>
<tr>
<th>Total Nitrogen</th>
<th>0.99%</th>
<th>2.54%</th>
<th>1.09%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphate (P₂O₅)</td>
<td>0.36%</td>
<td>0.34%</td>
<td>0.28%</td>
</tr>
<tr>
<td>Potash (K₂O)</td>
<td>0.70%</td>
<td>0.84%</td>
<td>0.74%</td>
</tr>
<tr>
<td>Samples (Barns)</td>
<td>9 (7)</td>
<td>12 (12)</td>
<td>48 (8)</td>
</tr>
</tbody>
</table>


CDB Carbon:Nitrogen Ratios

<table>
<thead>
<tr>
<th>Average</th>
<th>15.5</th>
<th>19.5</th>
<th>--</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>12.2 to 20.2</td>
<td>15.0 to 21.1*</td>
<td>11.2 to 20.9</td>
</tr>
</tbody>
</table>


* Net release of plant-available nitrogen is delayed at C:N ratios above ≈ 15 in solid manure (Qian and Schoenau, 2002)
* Some fields have indicated immobilized nitrogen for one to two months (Schuper, 2007)

Archived presentation available at http://lpe.unl.edu/archive2.html
Excellent Cow Prep a MUST!

Mastitis Bulk Tank Culture Results

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strep ag</td>
<td>0</td>
</tr>
<tr>
<td>Staph aureus</td>
<td>68</td>
</tr>
<tr>
<td>Non-ag Strep</td>
<td>175</td>
</tr>
<tr>
<td>Coliforms</td>
<td>195</td>
</tr>
<tr>
<td>Staph spec</td>
<td>210</td>
</tr>
</tbody>
</table>

Bulk tank culture results need to look like these

Safety issues

- Dust from dry, fine sawdust or wood shavings
- Respiratory health
- Eye irritation
- Equipment air filters
- Ammonia levels

Compost Dairy Barns

- Use dry fine wood shavings or sawdust
- Bedding management is critical
  - Stir and aerate pack 2x per day
  - Add dry sawdust when pack sticks to cows
  - Compost heat & ventilation helps remove moisture
- Excellent pre-milking cow prep
- ≥ 80 ft²/cow composting bedded pack

Archived presentation available at http://lpe.unl.edu/archive2.html
Dairy Extension

For fact sheet, articles, and newsletters go to

http://www.extension.umn.edu/dairy/

Questions?

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