COMPOST BEDDED PACK BARNs AS A LACTATING COW HOUSING SYSTEM

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College of Agriculture
Compost Bedded Pack Barn Concept

- Loose-housing with large, open resting area
- Not your grandfather’s bedded pack barn!
- Intensively managed compost process keeps cows dry and clean
- Risks for mismanagement higher than stall barns
- More management/less labor than stall barns
**COMPOST BARNS TODAY**

- Minnesota: Foundation work, growth limited by bedding cost
- Kentucky: 80 to 90
- Israel: predominant system
- Brazil and Argentina: starting movement
- Netherlands, Denmark, Italy: active research and user groups
COMPOST BEDDED PACK BARN DESIGN

Should be 9-10 square meters per cow

Janni et al., 2007
Comfortable Resting Surface
Easy to lay down or rise from resting without restrictions associated with freestall loops
Cows of different breeds and sizes can be housed together easily.
Cows exhibit heat well because of improved footing compared to concrete.
NATURAL COW BEHAVIOR
When managed properly, compost bedded pack barns provide a dry resting surface for cows resulting in clean cows and udders.
Advantages

• Excellent cow comfort
• Low investment
• Good milk quality
• Manure handling

Disadvantages

• Sawdust availability
• Sawdust availability
• Higher variable costs
• Management ability
• Does not work well in retrofits
• Building footprint
Advantages
- Cow comfort can be excellent
- More environmental control
- More animals per square feet of barn
- Automation/management options

Disadvantages
- Poorly designed/maintained freestalls = poor cow comfort
- Concrete, loops, mattresses can be expensive
- Manure management
KEYS TO MANAGING A CBP BARN

- Effective Composting
- Adequate Ventilation
- Frequent Stirring
- Stocking Density
- Facility Design
PACK MANAGEMENT

- 0.5 to 0.6 m of bedding to start, may take 2-4 semi-loads of sawdust
- New bedding (5-20 cm) added when pack starts looking moist
- New bedding added every 1-8 weeks (more when humid or wet and in winter)
- Packs cleaned 1-2 times per year (fall & spring)
Stirring Equipment Examples
Stirring Equipment Examples
Sweeps or Shovels Increase Mixing
Roto-tillers break up clumps of bedding material
Uniform Bedding with Roto-Tiller
UK TILLAGE TOOL
Steam is Good But Doesn’t Mean Pack is Heating
Stirring in multiple directions or in circles increases air infiltration and helps break up clumps.
Too many posts within the barn can make pack stirring difficult
Heavy Tractors Compact Bedding Material
MANAGEMENT CHECKS

- Temperature: 43 to 66 °C or “just hot enough you don’t want to touch it”
- Moisture: 45 to 55% or can you form a ball without too much water
- Fluffiness: subjective (looking for give in bedding as you walk across it)
- Distribution of cows within barn
- Dirty cows (next to last resort)
- SCC or clinical mastitis (last resort)
Temperature Monitoring

Example of compost heating well with high temperature and dry material.

Example of compost heating well with high temperature.

Example of compost that is too wet with insufficient temperature.

Example of compost that is too dry with insufficient temperature.
A dedicated thermometer, easily accessible within the barn, is recommended.
Dry, Fluffy Compost
High moisture, clumps, lack of uniformity
2011 COMPOST STUDY

- 43 Kentucky farms (51 barns)
- October 2010 to March 2011
- Compost samples collected from 9 equally distributed locations throughout each barn to produce a composite sample
- Producer questionnaire
- DHIA data

PRODUCER CITED BENEFITS OF COMPOST BEDDED PACK BARNs

- Improved cow comfort (n = 28)
- Improved cow cleanliness (n = 14)
- Low maintenance (n = 11)
- Good for heifers, lame, fresh, problem, and old cows (n = 10)
- Natural resting position (no stalls) (n = 9)
- Improved feet and legs (n = 8)
- Proximity to parlor (compared to pasture) (n = 8)
- Decreased SCC (n = 6)

## Producer Cited Benefits of Compost Bedded Pack Barns

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased heat detection</td>
<td>6</td>
</tr>
<tr>
<td>Ease of manure handling</td>
<td>3</td>
</tr>
<tr>
<td>Increased dry matter intake (compared to pasture)</td>
<td>3</td>
</tr>
<tr>
<td>Increased production</td>
<td>3</td>
</tr>
<tr>
<td>Increased longevity</td>
<td>3</td>
</tr>
<tr>
<td>Fewer leg and teat injuries</td>
<td>2</td>
</tr>
<tr>
<td>Minimizes time standing on concrete</td>
<td>2</td>
</tr>
</tbody>
</table>

Culling rate before and after moving into a CBP barn used as primary housing

Calculated using 12 months before move in and 6 to 12 months after move in


Pairs with different letters are significantly different (p<0.05).
Hygiene depends on management!
Heat generated by composting process dries bedding material creating a drier lying surface.

Drier packs decrease hygiene score which may reduce exposure to mastitis pathogens.

Effective composting more critical to cow hygiene during winter.
Bacteria load high in all compost bedded packs

Coliform and Staphylococcal species seem to thrive in optimal composting conditions

Streptococcal species may be more susceptible to composting heat

Bacteria likely flourish in warmer ambient conditions

## INVESTMENT COSTS

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
<th>Minimum</th>
<th>Maximum</th>
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</thead>
<tbody>
<tr>
<td><strong>All Barns</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barn cost</td>
<td>$85,362</td>
<td>$10,900</td>
<td>$300,000</td>
</tr>
<tr>
<td>Cost/cow @ 9 sq meters/cow</td>
<td>$855</td>
<td>$215</td>
<td>$1,875</td>
</tr>
<tr>
<td><strong>Barns with Attached Feed Bunk</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Barn cost</td>
<td>$103,729</td>
<td>$30,000</td>
<td>$300,000</td>
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<tr>
<td>Cost/cow @ 9 sq meters/cow</td>
<td>$1,051</td>
<td>$421</td>
<td>$1,876</td>
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<tr>
<td><strong>Barns without Attached Feed Bunk</strong></td>
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<td></td>
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<tr>
<td>Barn cost</td>
<td>$51,454</td>
<td>$10,900</td>
<td>$155,000</td>
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<tr>
<td>Cost/cow @ 9 sq meters/cow</td>
<td>$493</td>
<td>$196</td>
<td>$833</td>
</tr>
</tbody>
</table>
DAILY BEDDING COSTS

Minimum = $0.01           Maximum = $1.44
University of Kentucky
New Dairy Housing Facility Investment Analysis Dashboard

Created By: Randi Black and Dr. Jeffrey Bewley
Contact: rablac3.com or jeffrey.bewley@uky.edu

This dashboard has been developed as a decision support tool for dairy farmers considering building a new dairy housing facility using their personal situation and housing goals. Everything in this dashboard is changable, allowing parameters to be set to those values appropriate for a particular situation or different from the default values. However, default values are those found in scientific literature or from expert opinion and can be used in situations when a value is not available for the farmer’s personal situation.

The white buttons are located throughout this dashboard and may be used to better define a particular input or output in this dashboard. Simply roll the mouse over the button to obtain additional information.

The reset button on this page may be used to reset all values to the defaults.

http://www2.ca.uky.edu/afsdairy/DairyHousingInvestment
The full extent of benefits are not typically realized immediately. Indicate the percentage of the full amount of benefits that will be experienced in each year.

Year 1
0% 100%
75%

Year 2
0% 100%
85%

Year 3
0% 100%
100%

Year 4
0% 100%
100%

Year 5
0% 100%
100%

Year 6
0% 100%
100%

Year 7
0% 100%
100%

Year 8
0% 100%
100%

Year 9
0% 100%
100%

Year 10
0% 100%
100%
### Annual Milk Yield Revenue Change

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue</th>
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<tbody>
<tr>
<td>Year 1</td>
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<tr>
<td>Year 2</td>
<td>$50,384.24</td>
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<tr>
<td>Year 3</td>
<td>$59,275.57</td>
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<tr>
<td>Year 4</td>
<td>$59,275.57</td>
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<tr>
<td>Year 5</td>
<td>$59,275.57</td>
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<tr>
<td>Year 6</td>
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<tr>
<td>Year 7</td>
<td>$59,275.57</td>
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<tr>
<td>Year 8</td>
<td>$59,275.57</td>
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<tr>
<td>Year 9</td>
<td>$59,275.57</td>
</tr>
<tr>
<td>Year 10</td>
<td>$59,275.57</td>
</tr>
</tbody>
</table>

### Annual SCC Bonus Revenue Change

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue</th>
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<tbody>
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<tr>
<td>Year 2</td>
<td>$12,255.30</td>
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<tr>
<td>Year 3</td>
<td>$12,395.25</td>
</tr>
<tr>
<td>Year 4</td>
<td>$12,395.25</td>
</tr>
<tr>
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<tr>
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<tr>
<td>Year 8</td>
<td>$12,395.25</td>
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<tr>
<td>Year 9</td>
<td>$12,395.25</td>
</tr>
<tr>
<td>Year 10</td>
<td>$12,395.25</td>
</tr>
</tbody>
</table>

### Annual Change in Lameness Treatment Cost

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost</th>
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<tbody>
<tr>
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<td>$354.0</td>
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<td>Year 3</td>
<td>$416.5</td>
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<td>Year 7</td>
<td>$416.5</td>
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<tr>
<td>Year 8</td>
<td>$416.5</td>
</tr>
<tr>
<td>Year 9</td>
<td>$416.5</td>
</tr>
<tr>
<td>Year 10</td>
<td>$416.5</td>
</tr>
</tbody>
</table>
WHY DON’T ALL PACKS WORK?

- Barn design flaws
- Stocking density (too many cows!)
- Material used (straw, cedar)
- Stirring frequency/depth
- Inadequate/ineffective stirring
- Starting pack in the winter
- No curtains in winter
Compost Bedded Pack Barn Design
Features and Management Considerations
Jeffrey Bewley, Animal and Food Sciences, Joe Tamara and George Dey, Biosystems and Agricultural Engineering, Randi Black, Animal and Food Sciences and Flavio Damasceno, Biosystems and Agricultural Engineering

Compost-Bedded Pack Barns in Kentucky
Jeffrey M. Bewley, Animal and Food Sciences, and Joseph L. Tamara, Biosystems and Agricultural Engineering

Kentucky Compost-Bedded Pack Barn Project
Randi Black and Jeffrey Bewley, Animal and Food Sciences; Joe Tamara and George Dey, Biosystems and Agricultural Engineering; and Flavio A. Damasceno, Agricultural Engineering, Federal University of Viçosa, Brazil

University of Kentucky
New Dairy Housing
Investment Analysis
The decision to build a housing facility is one that is not easy, nor is it to be taken lightly. This tool is to be used to help make that decision easier.

Choose between a new compost bedded pack barn and a new freestall barn using this simple to use net present value tool.

Use your current herd performance and management, coupled with predicted outcomes of the two housing facilities.

Based on a 10 year investment period and assumes barn has no salvage value.

Mouse over the white buttons for more information on an input or output:

Results not guaranteed. Calculations based on assumptions.
QUESTIONS

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