COW-FOCUSED MANAGEMENT, PERFORMANCE, AND MILK QUALITY CONSIDERATIONS
Compost Bedded Pack Barn Concept

- Loose-housing with large, open resting area
- Potentially improved cow comfort
- Not your grandfather’s bedded pack barn!
- Intensively managed compost process
- Depends on aerobic digestion of sawdust, manure, and urine
- Compost temperature dries bedding
Compost Housing System

Gravatte et al., 2009
CLEAN COWS
PACK MANAGEMENT

- 1.5 to 2 feet of bedding to start, may take 2-4 semi-loads of sawdust
- New bedding (4-8”) 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)
- Leave 6-12” (top layer) of old material to help start microbial activity
- When cows are out of the barn during milking
- Start as soon as new sawdust is added
- Aerate at least 10-12”
- Stirring both lengthwise and crosswise may improve aeration
- Cultivator, tines, or roto-tiller
- Use caution with heavy equipment, may cause compaction
KEYS TO MANAGING A CBP BARN

Facility Design

Effective Composting

Adequate Ventilation

Stocking Density

Frequent Stirring
WHY DON’T ALL PACKS WORK?

- Barn design flaws
- Stocking density (too many cows!)
- Material used (straw, cedar)
- Stirring frequency/depth
- Inadequate/ineffective stirring
- Compaction from tractors
- Starting pack in the winter
- No curtains in winter
MANAGEMENT CHECKS

- **Temperature:** 110 to 150° F 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)
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
<table>
<thead>
<tr>
<th>Benefit</th>
<th>Count (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved cow comfort</td>
<td>28</td>
</tr>
<tr>
<td>Improved cow cleanliness</td>
<td>14</td>
</tr>
<tr>
<td>Low maintenance</td>
<td>11</td>
</tr>
<tr>
<td>Good for heifers, lame, fresh, problem, and old cows</td>
<td>10</td>
</tr>
<tr>
<td>Natural resting position (no stalls)</td>
<td>9</td>
</tr>
<tr>
<td>Improved feet and legs</td>
<td>8</td>
</tr>
<tr>
<td>Proximity to parlor (compared to pasture)</td>
<td>8</td>
</tr>
<tr>
<td>Decreased SCC</td>
<td>6</td>
</tr>
<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>
RESULTS AND DISCUSSION
HISTORICAL SCC

Providing housing typically improves the environment, which improves overall cow health.

CBP → improved ventilation, lying surface, and overall management

Most cows housed in freestall barn → CBP little impact on SCC

Kentucky mean DHIA SCC = 313,000 cells/mL (Norman et al., 2010)

Primary housing = CBP acts as primary housing facility
Special housing = CBP houses portion of herd, typically lame, fresh, or sick cows

1Primary housing = CBP acts as primary housing facility

Special housing = CBP houses portion of herd, typically lame, fresh, or sick cows
### RESULTS AND DISCUSSION

**DHIA DATA**

Changes in productive parameters for primary housing farms before and after moving into a CBP

<table>
<thead>
<tr>
<th>Parameter</th>
<th><strong>Before</strong>&lt;sup&gt;1&lt;/sup&gt;</th>
<th><strong>Transition</strong>&lt;sup&gt;2&lt;/sup&gt;</th>
<th><strong>After</strong>&lt;sup&gt;3&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily milk production, kg</td>
<td>29.3 ± 0.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>30.1 ± 0.3&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>30.7 ± 0.3&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Rolling herd average, kg</td>
<td>8,937 ± 79&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9,194 ± 73&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9,403 ± 74&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>SCC, cells/mL</td>
<td>411,230 ± 20,209&lt;sup&gt;a&lt;/sup&gt;</td>
<td>305,410 ± 19,704&lt;sup&gt;b&lt;/sup&gt;</td>
<td>275,510 ± 20,080&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>1</sup>Before represents the 12 m before moving into the CBP

<sup>2</sup>Transition represents the 12 m after moving into the CBP

<sup>3</sup>After represents the 13 to 24 m after moving into the CBP

<sup>4</sup>Different subscripts within a row denote a significant difference (P < 0.05)

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- **Transitioning from pasture or lot to housing**
  - Feed becomes closer and more accessible
  - May transition to total mixed ration

- Can achieve low SCC in CBP
  - Proper management and parlor procedures essential for maintain udder health

- Transition to total mixed ration results in better feed management
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
SCRAPING FREQUENCY EFFECT ON HYGIENE

![Graph showing scraping frequency effect on hygiene score]

Hygiene Score

<table>
<thead>
<tr>
<th>Scraping Frequency (Times/Day)</th>
<th>Hygiene Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1X</td>
<td>2.51</td>
</tr>
<tr>
<td>2X</td>
<td>2.05</td>
</tr>
</tbody>
</table>

P = 0.0086
Hygiene depends on management!
HYGIENE SCORING

- Four hygiene categories (Cook, 2007)
  - 1: clean, little or no evidence of manure
  - 2: clean, only slight manure splashing
  - 3: dirty, distinct pieces of manure
  - 4: filthy, confluent pieces of manure

- At least 50 cows per barn
  - If fewer than 50 cows, every cow was scored

- Cows randomly selected based on tag number (i.e. multiples of 3, even tag number)

[Image of hygiene scoring categories 1 to 4 with corresponding images of cows]

Hygiene Score Graphs

- Predicted Hygiene Score and Ambient Temperature
  
- Predicted Hygiene Score and Pack Moisture
  
- Predicted Hygiene Score and Mean of Surface and 10.2 cm Pack Temperatures
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.
<table>
<thead>
<tr>
<th>Bacteria</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escherichia coli</td>
<td>43</td>
<td>$13.31 \text{ log}_{10}\text{cfu/g}$</td>
<td>1.44</td>
</tr>
<tr>
<td>Coliform</td>
<td>43</td>
<td>$14.07 \text{ log}_{10}\text{cfu/g}$</td>
<td>1.30</td>
</tr>
<tr>
<td>Streptococcal species</td>
<td>43</td>
<td>$16.04 \text{ log}_{10}\text{cfu/g}$</td>
<td>1.63</td>
</tr>
<tr>
<td>Staphylococcal species</td>
<td>43</td>
<td>$17.54 \text{ log}_{10}\text{cfu/g}$</td>
<td>1.09</td>
</tr>
</tbody>
</table>
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

Addition of bedding material may reduce competition for carbon sources of bacteria and composting microbes

Bacteria likely flourish in warmer ambient conditions
CONCLUSIONS

- Managing the CBP moisture and temperature can improve cow hygiene, which may help in the prevention of mastitis
- Each bacteria acts differently in the composting environment (Streptococcal species most affected)
- Mechanism for reduced SCC in CBP cannot be explained by bacteria content:
  - Dry resting surface
  - Immune function???
  - Clinical mastitis incidence and milk culture study needed
- Future studies may examine fewer farms over a longer period of time to reduce farm to farm variation and account for ambient differences
RECOMMENDED FACILITY CHANGES

- Increase size or capacity of the barn (n = 15)
- Larger ridge vent (n = 5)
- Higher sidewalls and improved ventilation (n = 12)
- No posts in pack (n = 4)
- Add a retaining wall (n = 6)
- Change number or location of waterers (n = 4)
- Add Curtains (n = 5)
- Change location or size of feed bunk (n = 4)
- More fans (n = 5)
- Length of overhang or eaves (n = 3)
BUILDING DESIGN: NEW RECOMMENDATIONS

- Curtains in winter
- East-West orientation
- Ridge with cap
- Build for number of cows milking in winter
- Consider milk production and cow size
- Multiple entrances beneficial
- Start thinking about feed and water space early
- Be careful with fan sizing and placement
Think about summer and winter as different systems

Packs must be stirred twice per day every day, no exceptions

Don’t try to start packs in winter

Green sawdust is OK (just use more of it)

Stir pack when new bedding is added (don’t skip milkings)

Waiting until “bedding sticks to cow” is too late

Use e.coli vaccines (J5, J-VAC, or ENDOVAC-BOVI) as insurance

Best stirring strategy is roto-tiller 1X/ day with cultivator 1X/ day
QUESTIONS

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