Calf Barn Ventilation – a Breath of Fresh Air

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Proportions of Calf Raising Cost

Veterinary & Medicine 5% = $16
Variable = 15% = $49
Feed = 34% = $111
Labor & Mg. = 47% = $153
Fixed = 4% = $13

(Total Cost = $326/calf)

Calf Housing Costs
(Birth to Weaning)

<table>
<thead>
<tr>
<th>Housing Type</th>
<th>Cost per calf ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Pens</td>
<td>$200</td>
</tr>
<tr>
<td>Home Built Calf Hutch</td>
<td>$300</td>
</tr>
<tr>
<td>Purchased Hutch</td>
<td>$350</td>
</tr>
<tr>
<td>Greenhouse Calf Barn</td>
<td>$25</td>
</tr>
<tr>
<td>Calf Barn</td>
<td>$750</td>
</tr>
<tr>
<td>Calf Barn</td>
<td>$1,000</td>
</tr>
</tbody>
</table>

Hutches

Winter Housing

Summer Housing

Compliments of K. Nordlund, 2007

Calf Housing
Hutches with protection for worker
Defining Terms

Ventilation = Air Exchange
= Bad Air Out & Good Air In

Air Circulation = Moving Air within Barn
≠ Ventilation

Draft = ?

Natural ventilation uses the forces of nature to cause air exchange.
Wind is the primary force.

Natural Ventilation Design (Cow Barns)

Natural Ventilation - Winter
Locate Alleys Under Open Ridge
Minimize Water In Stalls or Pens
Factors to Optimize Respiratory Health of Calves in Naturally Ventilated Barns in Winter

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Naturally ventilated calf barns

Compliments of K. Nordlund, 2007
Field Trial to Examine Respiratory Risk Factors in Calf Barns


Selection criteria for barns:
• Natural ventilation
• Single calf pens
• Minimum of 15 preweaned calves
• Current health status “typical” for barn
• Trial conducted Jan-Mar 2004

Data collected
• Respiratory scores -15 or more nursing calves
• Airborne bacterial counts (Total cfu & coliform) in pens and alleys
• Ammonia in pens
• Temperature & humidity – inside and outside
• Bedding depth and dry matter
• Building and inlet dimensions
• Animal counts
• Outdoor wind speed & direction, etc…..

Calf Respiratory Scoring Criteria

<table>
<thead>
<tr>
<th>Score</th>
<th>Rectal Temp. (Â°F)</th>
<th>Cough</th>
<th>Nasal Discharge</th>
<th>Ocular Discharge</th>
<th>Ear Droop</th>
<th>Head Tilt</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100-100.9</td>
<td>None</td>
<td>Normal</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>1</td>
<td>100-100.9</td>
<td>None</td>
<td>Normal</td>
<td>None</td>
<td>One</td>
<td>Both or</td>
</tr>
<tr>
<td>2</td>
<td>100-100.9</td>
<td>None</td>
<td>Normal</td>
<td>None</td>
<td>One</td>
<td>Both or</td>
</tr>
<tr>
<td>3</td>
<td>&gt;= 103</td>
<td>None</td>
<td>Copious</td>
<td>None</td>
<td>Both or</td>
<td>Head Tilt</td>
</tr>
</tbody>
</table>

Cumulative Score = 5 = Respiratory Illness

Scoring system developed by Dr. Sheila McGuirk

Findings
• There were lots of sick calves
• Avg prevalence (RS=5+) = 27%
• Under-diagnosed in industry
• Enzootic calf pneumonia

Lago et al., J Dairy Sci 89:4014, 2006
These appear to be well ventilated barns!

Why do we have endemic calf pneumonia?

Maybe the barns are ventilated and the pens are not?

Differences in gases? NH3? CO2? Bacteria?

Typical values

• Outdoor air: 100 – 1,000 cfu/m^3
• Clean office air: 1,000 - 2,000 cfu/m^3
• Well-ventilated barn: 10-15,000 cfu/m^3

Median barn ventilation rate was 5.5 changes per hour (range 0-93) *

* assistance of Brian Holmes and David Kammel

• Pen air NH3 avg 2 ppm (0-4)
• Alley cfu/m^3 associated with barn ventilation rate \( P<.0001 \)
• Pen cfu/m^3 were NOT associated with barn ventilation rate
• Pens are microenvironments within the barn
Findings:
Total airborne bacterial cfu/m³ in PEN associated with prevalence of respiratory disease  \( P \leq 0.003 \)

Association is not causation…

Key factors for respiratory health

1) Solid panel between calves  \( P<0.003 \)
2) Nesting in deep bedding  \( P<0.002 \)
3) Low airborne bacteria counts  \( P<0.003 \)

Lago et al., J Dairy Sci 89:4014, 2006

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Lago et al., J Dairy Sci 89:4014, 2006

Thermoneutral zone
Newborn calf: 50-78°F
Month old calf: 32-73°F
Study conditions 19-54°F

Compliments of K. Nordlund, 2007
Nesting score = 1
Legs entirely visible when lying down

Nesting score = 3
Legs generally not visible when lying down

Key factors for respiratory health
1) Solid panel between calves
   $P<0.003$
2) Nesting in deep bedding
   $P<0.002$
3) Low pen airborne bacteria counts
   $P<0.003$
   Total bacterial counts significant
   Coliforms (EMB) not significant

Factors for ↓ air bacteria in pens
1) Lower temperature   $P<0.003$
2) Larger pens         $P<0.02$
   > 30 square feet
3) Fewer solid sides = more
   ventilation          $P<0.006$

How do we lower airborne bacterial counts?
Endemic calf pneumonia
2-yr old barn
Originally 4’ x 8’ pens, but panels removed to yield 8’ x 8’ pens

After supplementation, respiratory disease treatments estimated to be 25% of previous years
**Technical points**

- Fans mounted in wall, not inside barn
- Sized at ~15 cfm / calf
- One tube per ~25 ft of building width
- Custom-punched holes so the air exits at ~ 800 fpm
- Holes punched at 4 & 8 o’clock or 5 & 7 o’clock, depending on height of tube

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**A summary....**

- Preventing chilling by enclosing the pen is the wrong way to go
- Opening all sides to improve ventilation is the wrong way to go
- Place a solid panel between each calf
- Control chilling with DEEP straw and calf blankets from Nov-March
- Reduce airborne bacteria with bigger pens, fewer sides, and.....
- Supplemental positive pressure ventilation

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**Positive Pressure Duct**

![Diagram of Positive Pressure Duct with labels for Barn End Wall, Fan Intake, Fan Unit, Perforations, Duct, Trajectory of Air Stream, Hole Angle, Height, Alley Width, Pen Length, and Horizontal Distance.](image)
Duct Arrangements – Narrow Barns

Duct Arrangements – Wider Barns

W1 Ideal Calf Pen

Not to Scale