Feedlot Systems Comparison

Dan Loy
Extension Beef Specialist

Outline—Feedlot Systems

• Cattle comfort issues
• Types of systems
  – General characteristics (advantages and disadvantages)
  – Performance comparisons
  – Cost comparisons
  – Environmental Considerations
  – Bedding and manure management
Lower Critical Temperature

<table>
<thead>
<tr>
<th>Coat Description</th>
<th>LCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer or wet</td>
<td>59</td>
</tr>
<tr>
<td>Fall</td>
<td>45</td>
</tr>
<tr>
<td>Winter</td>
<td>32</td>
</tr>
<tr>
<td>Heavy winter</td>
<td>18</td>
</tr>
</tbody>
</table>
**Effective Temperature**

<table>
<thead>
<tr>
<th>Wind Speed</th>
<th>-10</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calm</td>
<td>-10</td>
<td>0</td>
<td>10</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>-16</td>
<td>-6</td>
<td>3</td>
<td>13</td>
<td>23</td>
</tr>
<tr>
<td>15</td>
<td>-25</td>
<td>-15</td>
<td>-5</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>30</td>
<td>-46</td>
<td>-36</td>
<td>-26</td>
<td>-16</td>
<td>-6</td>
</tr>
</tbody>
</table>

*Maintenance Requirements increase .7% for each degree of cold stress.*

---

**WIND Control**
Effects of Mud on Performance

<table>
<thead>
<tr>
<th>Mud depth</th>
<th>Intake reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-8 inches</td>
<td>5-15%</td>
</tr>
<tr>
<td>12-14 inches</td>
<td>15-30%</td>
</tr>
</tbody>
</table>

Plus: reduced insulation value of hair coat and increased energy cost for walking

NRC (1981, 2001)
• Affected by effective ambient temperature
  • Air temperature
  • Solar radiation
  • Air movement
  • Contact surfaces
  • Precipitation
Heat Stress Solutions

#1 - Shade, #2 - Sprinklers
Predictable Environment

ISU Beef Feedlot Systems Manual (PM-1867)
Five Systems Analyzed

- Earthen lot with no shelter…windbreak only
- Earthen lot with a shed for shelter
- Concrete lot with a shed
- Total confinement with solid concrete floor
- Total confinement with slatted floor

Earthen Lot with Shed
Concrete Lot with Shed

Complete Confinement Building
Complete Confinement Building with Solid Floor

Change In Feed Intake
Open Lot vs. Confinement
Change In Feed/Gain  
Confinement vs. Open Lot

Change In Feed/Gain  
No Shelter vs Shelter
Assumptions Common to All

- Fencing Costs = $10/foot
- Bunk Costs = $20/foot
- Concrete cost costs = $200/yd^3
- Earth volumes for settling basin and detention basin construction = volume of liquid to handle

- 150 head per pen
- 1 foot of bunk space per head
- 1 gate per pen
- 1 waterer per pen
- 100% of rainfall runs off
- Environmental control facilities designed per DNR regs (for once a year pumping)
Earthen Lot Assumptions

• 12 ft concrete apron along length of bunk
• 150 sq ft concrete pad around waterer
• 3 Ton/yr-hd solid manure each year
• Lot with windbreak
  – 250 sq feet per head lot space
  – 30 sq feet per head mound space
  – Windbreak = $15/ head

Earthen Lot Assumptions

• Lot with shed
  – 225 sq ft/head outside, 25 inside
  – No concrete inside building
  – Building cost = $6.50/sq ft
Concrete Lot Assumptions

- 20 sq ft/head inside, 30 outside
- No feed alley
- No roof water gets on lot
- 4.5 ton/yr/hd solid manure
- Weekly scraping or oftener

Complete Confinement Building

- Total roof means no liquid manure to haul
- Total solid concrete floor
- 3 ton/yr/hd solid manure
- Solid hauling cost = $1.50/ton
- 5 lb. bedding/day. Bedding cost = $30/bale
Complete Confinement Building with Slatted Floor

- No solid manure to haul
- Liquid manure = 2727 gal/space/hd/yr
- Hauling cost = $0.15/gal

ADG Assumptions

<table>
<thead>
<tr>
<th></th>
<th>Open</th>
<th>OL/S, PC</th>
<th>Conf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yearlings</td>
<td>3.1</td>
<td>3.27</td>
<td>3.02</td>
</tr>
<tr>
<td>Calves</td>
<td>2.8</td>
<td>2.95</td>
<td>2.72</td>
</tr>
</tbody>
</table>
**F/G Assumptions**

![Bar Chart](chart.png)

<table>
<thead>
<tr>
<th></th>
<th>Open</th>
<th>OL/S, PC</th>
<th>Conf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yearlings</td>
<td>7.4</td>
<td>7</td>
<td>7.2</td>
</tr>
<tr>
<td>Calves</td>
<td>7</td>
<td>6.7</td>
<td>6.85</td>
</tr>
</tbody>
</table>

**Rations**

- Flexible feed storage
  - Modified Distillers
  - Ground hay
  - Dry corn
  - Supplement
Economic Analysis

- Initial investment
- Annualized costs
- Cost per head
- Yardage
- Environmental structures costs
Ownership and Operating Costs (nonfeed) per Head
(Two Turns of Yearling Steers)

Cost of gain with 2 turns of yearlings
**Cost of gain with one turn of calves**

- Earthen Lot w/Windbreak
- Earthen Lot w/Shed
- Concrete Lot w/Shed
- Confinement Solid Floor
- Confinement Slatted Floor

**Breakeven Yardage Charge at 85% Capacity**

- Earthen Lot w/Windbreak
- Earthen Lot w/Shed
- Concrete Lot w/Shed
- Confinement Solid Floor
- Confinement Slatted Floor
Breakeven Yardage Charge minus Manure Value (85% Capacity)

Initial Investment

- Earthen lot with windbreak has lowest initial investment
- Adding a shed doubles the costs
- Concrete with shed comparable to earthen lot with shed when environmental structures included
- Confinement highest investment
Overhead and Operation

- Earthen lot advantage for small lot
- Earthen lots without shed or concrete lot were lowest cost for large lot
- Confinement had higher costs
- Yardage ranges from $.50-90/head/day

Cost of Gain

- Incorporates animal performance
- Yearlings and calves similar
- Small lot - earthen or concrete lots
- Large lots - concrete lot
- Confinement has higher cost of gain
Environmental Structures

- Not needed on confinement
- Lowest for concrete lot with shed
  - 60-80% the cost of earthen lot structures
- Relative cost of structures
  - $140 was largest initial investment
  - Maximum annual cost less than $6/head

Size of Feedlot

- Subject to assumptions
  - Many costs were linear
- 750 head lot
  - Already capturing most economies of scale
  - Environmental savings may be short lived. Are you a Medium CAFO?
- 5000 head lot
  - Economies of scale
  - Environmental and overhead
Hoop Buildings (3 year summary)

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Hoop</th>
<th>Feedlot</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pens</td>
<td>--</td>
<td>18</td>
<td>18</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Head (start)</td>
<td>hd</td>
<td>712</td>
<td>716</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Head (end)</td>
<td>hd</td>
<td>709</td>
<td>715</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Days on test</td>
<td>d</td>
<td>103</td>
<td>103</td>
<td>.9</td>
<td>0.62</td>
</tr>
<tr>
<td>Initial weight</td>
<td>lb</td>
<td>904</td>
<td>905</td>
<td>11</td>
<td>0.94</td>
</tr>
<tr>
<td>Final weight</td>
<td>lb</td>
<td>1,311</td>
<td>1,350</td>
<td>11</td>
<td>0.32</td>
</tr>
<tr>
<td>Gain</td>
<td>lb</td>
<td>407</td>
<td>421</td>
<td>7</td>
<td>0.16</td>
</tr>
<tr>
<td>Avg. daily gain</td>
<td>lb/d</td>
<td>4.0</td>
<td>4.1</td>
<td>0.6</td>
<td>0.19</td>
</tr>
<tr>
<td>Avg. daily feed intake</td>
<td>lb/d</td>
<td>27.5</td>
<td>27.5</td>
<td>0.3</td>
<td>0.98</td>
</tr>
<tr>
<td>(100% dm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed/gain (100% dm)</td>
<td>lb/lb</td>
<td>6.9</td>
<td>6.7</td>
<td>0.1</td>
<td>0.17</td>
</tr>
<tr>
<td>Final mud score</td>
<td>1–5</td>
<td>1.9</td>
<td>2.2</td>
<td>0.1</td>
<td>0.02</td>
</tr>
</tbody>
</table>

(1=clean, 5=dirty)
Hoop Buildings (3 year summary)

Table 2. Carcass characteristics of yearling steers in a hoop confinement barn and semi-confinement lots.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Hoop</th>
<th>Feedlot</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot carcass</td>
<td>lb</td>
<td>813</td>
<td>818</td>
<td>6</td>
<td>0.59</td>
</tr>
<tr>
<td>Yield</td>
<td>%</td>
<td>62.0</td>
<td>60.6</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Fat thickness</td>
<td>in.</td>
<td>0.43</td>
<td>0.43</td>
<td>0.01</td>
<td>0.92</td>
</tr>
<tr>
<td>Kidney/pelvic/heart fat</td>
<td>%</td>
<td>2.4</td>
<td>2.4</td>
<td>0.01</td>
<td>0.99</td>
</tr>
<tr>
<td>Ribeye area</td>
<td>in.</td>
<td>13.2</td>
<td>13.1</td>
<td>0.1</td>
<td>0.38</td>
</tr>
<tr>
<td>Marbling score1</td>
<td></td>
<td>1031</td>
<td>1027</td>
<td>.5</td>
<td>0.61</td>
</tr>
<tr>
<td>Choice or better</td>
<td>%</td>
<td>75.4</td>
<td>74.3</td>
<td>2.7</td>
<td>0.78</td>
</tr>
<tr>
<td>Yield grade, 1 and 2</td>
<td>%</td>
<td>63.4</td>
<td>62.9</td>
<td>2.7</td>
<td>0.94</td>
</tr>
</tbody>
</table>

1Marbling score scale: slight = 900, small = 1000, and modest = 1100.
SDSU Opportunities Farm

<table>
<thead>
<tr>
<th></th>
<th>Open</th>
<th>Partial</th>
<th>Monoslope</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMI (lb.)</td>
<td>24.5</td>
<td>24.5</td>
<td>24.3</td>
</tr>
<tr>
<td>ADG (lb.)*</td>
<td>3.55</td>
<td>3.67</td>
<td>3.62</td>
</tr>
<tr>
<td>F/G*</td>
<td>6.90</td>
<td>6.67</td>
<td>6.71</td>
</tr>
</tbody>
</table>


Shelter provided 1.8% increase in ADG and 2.8% improvement in F/G (year round). Most performance responses were in cattle closed out in the 1st and 2nd quarters.

Deep bedded vs open lots (closeout comparison)


<table>
<thead>
<tr>
<th></th>
<th>Open Lots</th>
<th>Deep Bedded</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMI, lb.</td>
<td>22.4</td>
<td>22.5</td>
</tr>
<tr>
<td>ADG, lb.</td>
<td>2.89</td>
<td>3.02</td>
</tr>
<tr>
<td>F/G</td>
<td>7.94</td>
<td>7.46</td>
</tr>
</tbody>
</table>

Pastoor et. al. (2012).

4.5% improvement in ADG, 6.3% improvement in FE to bedded housing
Mats for Slats? (progress report—3reps)

<table>
<thead>
<tr>
<th></th>
<th>Rubber mats</th>
<th>Concrete slats</th>
<th>P&gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMI, lb.</td>
<td>20.8</td>
<td>20.2</td>
<td>.54</td>
</tr>
<tr>
<td>ADG, lb.</td>
<td>3.08</td>
<td>2.86</td>
<td>.41</td>
</tr>
<tr>
<td>F/G</td>
<td>6.76</td>
<td>7.04</td>
<td>.42</td>
</tr>
</tbody>
</table>

Euken et. al. 2013 (in press)

Manure Applicator Certification

If you have a combined total of more than 500 animal units of livestock in confinement (liquid or dry manure) at one site:

You must be certified to handle or apply the manure and file a manure management plan. Certification sessions are held in January-February. Contact your Extension Ag Engineer for details, http://www.agronext.iastate.edu/immag/mac.html
Key to Competitiveness with Confinement

Injecting liquid manure as a crop nutrient source.

IOWA STATE UNIVERSITY
Extension and Outreach