Heat Stress
Consequences and Mechanics

Elanco Dairy Business
Tom Bailey, DVM, MS, ACT

Heat Stress

- Check the records
- Ask the cows, always ask the cows!
- Walk the herd – look and observe
  - What are the cows telling you?
- Consequences of heat stress
- Mechanics of heat stress
- Economics of heat stress

At what temperature do cows start to experience the effects of heat stress???

Temperature Humidity Index (THI)

THI > 72 = Heat Stress

Temperature Humidity Index (THI)

Easy way to measure and evaluate heat stress

Examples of Temperature Humidity Indexes (THI)

<table>
<thead>
<tr>
<th>°F</th>
<th>Humidity %</th>
<th>THI</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>45</td>
<td>73</td>
</tr>
<tr>
<td>90</td>
<td>45</td>
<td>80</td>
</tr>
<tr>
<td>90</td>
<td>75</td>
<td>86</td>
</tr>
</tbody>
</table>
Changes in maintenance requirements, dry matter intake, milk production and water intake with increasing environmental temperatures

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Maintenance, % of required at 50°F needed</th>
<th>DMI for maint. + 60 lb milk</th>
<th>Water intake, gal/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>86°F</td>
<td>111</td>
<td>42</td>
<td>37</td>
</tr>
<tr>
<td>95°F</td>
<td>120</td>
<td>43</td>
<td>37</td>
</tr>
<tr>
<td>104°F</td>
<td>132</td>
<td>45</td>
<td>23</td>
</tr>
</tbody>
</table>

Changes in maintenance requirements, dry matter intake, milk production and water intake with increasing environmental temperatures

1 James G Linn, U of Minnesota, Dairy Update Issue 125, February 1997, Nutritional Management of Lactating Dairy Cows During Periods of Heat Stress

Postpartum Heat Stress: Embryo Development

- Susceptibility to Heat Stress
- Heat Tolerant

Embryo Development

- Morula
- Early Blastocyst
- Expanded Blastocyst
- Morula
- Early Blastocyst
- Expanded Blastocyst
- Oviduct
- Uterus

Hansen et al 2005, Proceedings of the 7th Western Dairy Management Conference

- Day 1
- Day 1-2
- Day 5
- Day 6 - 7
- Day 8
- Day 9

Amb Temp — Env %RH — Cow Temp — Milking

102.2°F

126 Sired X2 Pregnancy Rate Summary by Date (Ex-C)

- Last Date of Bred
- Embryo
- Sire
- Eligible
- Eligible
- Required
- Rate

Utah - Pen 2 — 8 cows

- 7-18 to 7-21-07 (9am to 9am)

- Data by Bailey — Elanco Dairy Business

- Graph courtesy of Bateman’s Mosida Farm, Elberta, Utah, Ref # 2076
The MOST Hostile Environment on the Farm

Effects of Cooling Treatments on Body Temperature over 95 Minutes

Water, Air-flow and Time


Photo courtesy of John Sheets

Photo courtesy of Dr John Smith Kansas State University
Relationship of Respiration Rate and Body Temperature of Cattle

![Graph showing the relationship between respiration rate and body temperature of cattle. The graph includes a trend line with the equation $r = 0.73, P < 0.001$.]

68°F = 80 secs/12 min
83°F to 84°F = 80 secs/6 min
⅛ g nozzles

68F    80s/12 min
83F  80 /6
500 Cow Herd
Water for 150 Days

- Water on 90 m/d
- 15 gals/cow/d (1/2 g)
  (includes holding pen)
- 7500 gals/d
- 30% evaporates
- 5000 gals/d
- 750,000 for 150 d
- $0.02 for disposal
- $15,000
- 5 lb milk saved
- 150 d X 2500 = 3750 CWT
- 3750 X $13.00 = $48,750

500 Cow Dairy

- 2 freestall barns 250 ft long
- 2 Control Boxes @ $475.00 = $950.00
- 8 solenoids (1 in) @ $40.00 = $320.00
- 2 pressure reducers @ $80 = $160.00
- 1000 ft of 1" PVC pipe @ $1.50/ft = $1500
- 1000 ft angle iron @ $2.00 = $2000
- Nozzles @ $4.75 X 125 = $600.00
- Drill bits, tap, glue, unions, = $200.00
- Labor ?

Holding Pen

- Control Box = $475.00
- 1 Solenoid (1.5 in) = $75.00
- Pressure reducer 1.5 in = $100.00
- Pipe 1.5 in @ $1.75 X 150 ft. = $265.00
- 3 drop nozzles @ $48.00 = $144.00
  or
- 5 lawn sprinklers @ $20.00 = $100.00
- Misc = $150.00
- Labor ???

Heat Stress and Cows

- DMI reduction
- Loss of HCO3 with rumen acidosis
- Reproductive implications
- Premature replacement
- Lower production
- Milk fat depression
- Laminitis/lameness
- Lowered immune system
- Mastitis
- Transition disease (RP, DA, etc.)
- Lower body condition score (BCS)

Cow Comfort
Thank You