Watering Facilities for Managed Grazing Systems

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Grazing Lands Specialists
Figure 7  When water is limited, milk production is also limited. When an animal consumes food, body fluids pass into the ruman to assist in the digestion process. If these fluids are not replaced, the net result is dehydration and a loss of milk production. When water is not limited, fluids pass out of the ruman to rehydrate the animal and for milk production.
Watering Facilities for Managed Grazing Systems

- Determining Need
- Quality for the Animals
- Placement
- Tank Size and Shape Considerations
- Things to Avoid
Livestock Watering Facts

• Very Few Scientific Trials with Results published on this

• Very Little Information on Any Livestock besides Cattle

• More Scientific Data on Dairy Than Beef

• Cattle - About 2/3 of their body is Water - Essential
Determining Need

1. How Much?
2. Under what climatic conditions?
3. How Fast?
4. Animal Behavior Impacts?
HOW MUCH WATER DO YOU NEED TO SUPPLY?

HOUSING/MILKING FACILITY

GRAZED FORAGE (80% WATER)

LIVESTOCK DAILY WATER NEEDS

DEW

PASTURE WATER SYSTEM
## Determining Need

### How Much?

<table>
<thead>
<tr>
<th>Animal</th>
<th>Gallons water</th>
<th>Range</th>
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<tbody>
<tr>
<td>Dairy Cow</td>
<td>20</td>
<td>(15-25)</td>
</tr>
<tr>
<td>Beef Cow Pair</td>
<td>15</td>
<td>(12-20)</td>
</tr>
<tr>
<td>Yearling</td>
<td>10</td>
<td>(6-14)</td>
</tr>
<tr>
<td>Horse</td>
<td>10</td>
<td>(8-14)</td>
</tr>
<tr>
<td>Sheep</td>
<td>2</td>
<td>(2-3)</td>
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</tbody>
</table>
## Water Intake from NRCS and Land Grant University Sources in U.S.
### Gallons Per Head Per 24 Hour Period

<table>
<thead>
<tr>
<th>Livestock Type</th>
<th>NRCS Range and Pasture Handbook</th>
<th>NRCS MI and WI</th>
<th>NRCS OH, IN, IL</th>
<th>Virginia Tech</th>
<th>University of Vermont</th>
<th>Purdue University</th>
<th>University of Wisconsin</th>
<th>Ohio State University</th>
<th>1955 Yearbook of Agriculture (from studies in 40’s and 50’s)</th>
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<tbody>
<tr>
<td>Growing Steers /Pregnant Heifers</td>
<td>6-18</td>
<td>15</td>
<td>12</td>
<td>8-12</td>
<td>20</td>
<td>12-20</td>
<td>8-10</td>
<td>8-10</td>
<td>Dry Dairy Cows - 10.8</td>
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<tr>
<td>Beef Cow/Calf Pair</td>
<td>6-18</td>
<td>15</td>
<td>12</td>
<td>8-12</td>
<td>20</td>
<td>12-20</td>
<td>8-10</td>
<td>8-10</td>
<td>4.2 - 8.4</td>
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<tr>
<td>Horses - General</td>
<td>8-12</td>
<td>15</td>
<td>12</td>
<td>8-12</td>
<td>12</td>
<td>8-14</td>
<td>8</td>
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<tr>
<td>Sheep - General</td>
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<td>4</td>
<td>2-3</td>
<td>3</td>
<td>2-3</td>
<td>1</td>
<td>1</td>
<td>0.6 – 1.6. On good pasture almost none</td>
</tr>
</tbody>
</table>
Determining Need

• Under What Climatic Conditions?
Table 5.1 Daily water intake of dairy heifers under various temperature conditions.

<table>
<thead>
<tr>
<th>Air temp. (degrees F)</th>
<th>lb water/lb TDN</th>
<th>lb TDN/day</th>
<th>gal water/day</th>
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<tbody>
<tr>
<td>35</td>
<td>4.7</td>
<td>10.3</td>
<td>5.8</td>
</tr>
<tr>
<td>50</td>
<td>5.2</td>
<td>9.2</td>
<td>5.7</td>
</tr>
<tr>
<td>70</td>
<td>7.2</td>
<td>9.2</td>
<td>7.9</td>
</tr>
<tr>
<td>80</td>
<td>9.0</td>
<td>8.8</td>
<td>9.5</td>
</tr>
<tr>
<td>90</td>
<td>22.2</td>
<td>6.6</td>
<td>17.6</td>
</tr>
<tr>
<td>95</td>
<td>24.8</td>
<td>6.4</td>
<td>19.0</td>
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</table>
Thermoneutral Zone of Cattle

- TNZ is when cattle are comfortable when certain weather conditions are ideal for their bodies to function and grow with the least amount of inhibitors.

- Conflicting U.S. Information
  - Beef Cattle data shows both
    - 45°F to 74°F and 20°F to 70°F
  - For Dairy Cattle
    - 41°F to 68°F
  - Sheep?
  - Horses?
# U.S. and Canada Studies on Temperature Effect on Water Intake

In U.S. Gallons

Note: Wt. of Cattle Unknown and Relative Humidity is Unknown

<table>
<thead>
<tr>
<th>At Daytime High to Next Temp. Break</th>
<th>40.2 °F</th>
<th>50.4 °F</th>
<th>58.3 °F</th>
<th>70.3 °F</th>
<th>80.2 °F</th>
<th>90.3 °F, CN dept of ag. got these at 81°F</th>
<th>≥ 88 °F or HOT hot” not defined on VT website“</th>
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</thead>
<tbody>
<tr>
<td><strong>Canada Dept. of Ag.</strong></td>
<td></td>
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<tr>
<td>Beef Pregnant Heifers</td>
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<tr>
<td>Beef Cows at Peak Lactation</td>
<td>10.0</td>
<td>10.1</td>
<td>11.6</td>
<td>12.4</td>
<td>15.6</td>
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<tr>
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<td>7.4</td>
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<td>12.6</td>
<td>14.5</td>
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<td>17.9</td>
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<td>Beef Cows at Peak Lactation</td>
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<td></td>
<td></td>
<td></td>
<td>20-25</td>
</tr>
</tbody>
</table>
150 Dairy Cow herd with 17,070 pounds RHA production
Orchardgrass, brome, alfalfa, ladino clover, other grasses
1999 was a drought year at this farm
No water tank at the barn, only in the paddocks
100 gallon tank, 1.25” diameter pipe, full flow valves.
60% of water drank was done so in first 60 minutes entering the paddock
Water Temp in tank was 43.2°F to 103.4°F in 1999, 43.9°F to 98.6°F in 2000.

Paddocks - 1.2 to 2.7 acres
Flow was 7.0-9.3 GPM and static pressure was 33-43 PSI at the tank.
Air Temp. was max. 89.5 °F at 76% Relative Humidity. Low was 52.5°F at 93.8% RH.
1999 Maximum drank per head per day was 7.86 gallons. Least drank per head per day was 0.25 gallons. Average in 1999 growing season was 5.21 gallons per head per day. 2000 was 11.0, 1.5 and 6.0 gallons per head per day respectively.
Measured water content of forage consumed was 79% water (in drought year!).
Thermal Heat Index

• Cattle shed heat
  – primarily through evaporation from the skin and through respiration (breathing)
  – The higher the humidity and the less amount of wind (speed) the harder for the animal to get rid of the heat.

• On high end of TNZ
• Heat Stress in Livestock is a combination of Temperature, Relative Humidity, and Wind Speed
• The Mesonet Cattle Stress Index is a tool that is used the measure the THI (but leaves out wind speed!)
• Anything at 71 THI or below is in the TNZ (until freezing conditions mentioned later)
Figure 21  The amount of heat stress a cow feels depends on the combination of temperature and humidity.
Thermal Heat Index

- THI of 72 through 79 is Mild Stress – H2O intake slight+
- THI of 80 through 89 is Moderate Stress or the animals are “Distressed”. Management actions should be taken to help the livestock relieve the heat, such as shade and providing lots of water.
- A THI of 90 or More puts the livestock under Severe Stress and all measures should be taken to cool them. Besides providing water and shade, use misters, mister fans, or other measures. A few percentage points (increase) change in RH at this level and the heat could be fatal to them. I could not find records of this happening in the East Region.
<table>
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<th>Actual Temp</th>
<th>MPH</th>
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<th>40</th>
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<th>0</th>
<th>-10</th>
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<td>-85</td>
<td>-102</td>
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</tbody>
</table>
Average Number of Days with an Average Maximum Temperature of 90°F or More (+ avg. THI score) and Average Wind Speed

<table>
<thead>
<tr>
<th>Max. Temps mostly occur in July; Wind in July-Aug.</th>
<th>Central and Western UP</th>
<th>Eastern UP</th>
<th>Northern Lower</th>
<th>Central Lower</th>
<th>Southern Lower</th>
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</thead>
<tbody>
<tr>
<td>Hot Days</td>
<td>4  THI=74</td>
<td>2  THI=72</td>
<td>4  THI=75</td>
<td>6  THI=77</td>
<td>9  THI=76</td>
</tr>
<tr>
<td>Wind</td>
<td>No data available</td>
<td>7.7 – 8.5</td>
<td>7.0 – 7.8</td>
<td>6.7 – 7.5</td>
<td>7.5 – 8.8</td>
</tr>
</tbody>
</table>
Recommendations Based on These Findings

- Water Intake for Livestock in a Managed Grazing System, when applied according to our 528 standard, should be credited by the water (as high as 80%) in the grazed forages.
- When Livestock drink water (have access) from a water source at the barn/parlor/yarding area, this should be included when calculating the water supplied to the animals when designing the tank size in the paddock.
- When Livestock are expected to be in ‘Moderate Heat Stress’ THI (or Higher) for a only a few days of the total grazing season, a contingency plan of action should be followed for those few days. We do not recommend sizing the tank for only 1% of the grazing season for example.
- When Livestock are in ‘Moderate Heat Stress THI (or Higher) for several days (AL ex. - 25% or more of the Grazing Season), High Water Intake Rates should be used in the tank designs.
Determining Need

• How Fast?
Cattle Watering Facts

- They drink 1 to 2 gallons per minute
- They drink for 2 to 3 minutes per drinking event
- So they can drink 6 gallons per drinking event per animal
Figure 14  There are two opposite approaches to dispensing water. One is providing a large trough with a low flow of water to replenish draw down by cows. A contrasting approach is a small tough with a quick recharge capability, which allows more management flexibility due to the trough’s portability.
Determining Need

• Animal Behavior Impacts?
Cattle Watering Facts

• 2% to 5% of the herd will come at a time to drink if the water source is within this distance – Note: shade, minerals, salt, topography factors.

• >10% of herd (25% or more) will come when the distance is greater than this

• This factor has a strong impact on properly sizing the tank.
Watering Facilities for Managed Grazing Systems

- Quality for the Animals
WATER SOURCES

- WELLS
- STREAMS/CREEKS
- WETLANDS
- PONDS
- SPRINGS
Quality of Water Is Very Important to the Cattle

- Bulletin F-4275 from Oklahoma State Univ. is Very Good. It will be posted along with this presentation.
- Assess Water Quality for:
  1. Odor and Taste
  2. Physiochemical properties (TDS and TDO, hardness)
  3. Toxic Compounds
  4. Excess Minerals or Compounds
  5. Presence of Bacteria (fecal coliform)
Figure 5–34  Spring development showing collection system, pipeline to and from trough, and trough

- Gravel to top of tile
- Concrete or clay wall below tile
- 4-inch drain tile
- Collection basin (18-inch sewer tile recommended)
- Inlet sewer tile sealed joints
- Antiseep cut-off wall
- Trench to intercept water

Pipeline

Overflow pipe

Overflow pipes

Stand pipes

Inflow

Trough

Paved area

No fence is needed if the collector tile has about 3 feet of cover and the spring area will dry up
Watering Facilities for Managed Grazing Systems

Placement
Tank size and Shape considerations
General Guide lines.

• Locate troughs on high ground with good drainage
• At permanent watering locations the surrounding ground should be protected.
Cattle Watering Facts

- Cattle will need 24 – 30 inches of ‘head’ space on a linear tank based on 5% of the herd watering at once.
- They need 18 to 24 inches on a circular tank.
- Prefer moderate temperatures of water (63 – 82 °F) instead of very cold or very hot.
- Depth of at least 3 inches – prefer to put muzzle 1 to 2 inches in the water to drink.
- Optimal height of tanks - 24 to 32 inches.
4 Paddocks sharing One tank

8 Paddocks sharing Two tanks

12 paddocks sharing Three tanks
Watering Facilities for Managed Grazing Systems

• Things to Avoid.

"Hold up, Niles. It says here, ‘These little fish have been known to skeletonize a cow in less than two minutes.’ ... Now there’s a vivid thought."