COLD STRESS

IN COWS

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Getting cows through the winter

Body condition going into the winter is one of the most important factors affecting winter feeding costs. Cows in body condition 3 to 3.5 allows for more flexibility in rations as well as some room to lose condition in winter without seriously compromising performance. Feed costs increase in winter for all cows but are even higher for thin cows as they need to gain weight during the winter to ensure trouble free calving and low calf mortality. Cows that need to gain weight from a body condition score (BCS) of 2 to 3 during winter will require an extra 1,600 lbs of hay and 900 lbs of corn.

Winter feeding in a delicate balance between managing the feeding program and body condition of cows. This is made more difficult by the extent to which cows are subjected to cold stress.

What is cold to a cow?

When temperatures start to decline in winter, particularly as we get into the single digits and approach 0°C, producers need to think about what effect that is having on cow productivity and efficiency. Cows are warm-blooded and need to maintain a constant core body temperature. The normal rectal temperature for a cow is 38°C (101°F).

Animals kept within a range of environmental temperatures known as the thermoneutral zone, do not need to expend extra energy to maintain their body temperature. Temperatures below the lower end of this range, the lower critical temperature, result in cold stress in cows. Cold stressed cows increase their metabolic rate to supply more heat. However, this increases dietary requirements, particularly energy.

Typically, critically lower temperatures for beef cattle are affected by a number of factors. Considering coat only the following temperatures are important to note (Table 1).

Table 1. Lower critical temperatures for beef cattle, assuming no wind chill.

<table>
<thead>
<tr>
<th>Coat description</th>
<th>Lower Critical Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>°F</td>
</tr>
<tr>
<td>Summer coat or wet coat</td>
<td>59</td>
</tr>
<tr>
<td>Fall coat</td>
<td>45</td>
</tr>
<tr>
<td>Winter coat</td>
<td>32</td>
</tr>
<tr>
<td>Heavy winter coat</td>
<td>18</td>
</tr>
</tbody>
</table>

Cattle, like humans, experience the “effective temperature” which takes into account both the air temperature and the wind chill. Wind chill charts for cattle may differ depending on what cow parameters are taken into account (Table 2).
Table 2. Wind chill factors for cattle with winter coats*. (values in the table are the effective environmental temperature)

<table>
<thead>
<tr>
<th>Wind Speed (kph)</th>
<th>Temperature °C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-18</td>
</tr>
<tr>
<td>0</td>
<td>-21</td>
</tr>
<tr>
<td>16</td>
<td>-24</td>
</tr>
<tr>
<td>24</td>
<td>-26</td>
</tr>
<tr>
<td>32</td>
<td>-29</td>
</tr>
</tbody>
</table>

*Assumes that the hair coat is clean and dry.

** When the temperature is -9°C and the wind speed is 24 kph, the effective temperature experienced by the animals is the equivalent of a still air temperature of -18°C.

It is important to recognize and adjust for the “effective temperature” when cows are exposed to wind / drafts and take the appropriate steps to help cows maintain body temperature and weight.

**Factors affecting animal’s ability to withstand the cold**

- **Acclimate.** Cattle do adjust or acclimate to colder weather by growing a longer thicker coat. This provides additional insulation against cold weather. The coat must be clean and dry to provide maximum protection to the cow.
- **Fat layer.** Cattle in good condition with a good fat layer are able to withstand the cold better than thin cattle.
- **Metabolic rate.** Cows will also increase their metabolic rate to increase heat production and help maintain body temperature. This usually increases appetite as well and cows eat more.

**The effects of cold stress on cattle**

Hypothermia occurs when body temperature drops well below normal. In general terms, mild hypothermia occurs with a body temperature 30-32°C (86 – 89°F), moderate hypothermia at 22-29°C (71 - 85°F) and severe hypothermia below 20°C (68°F). As rectal temperature drops below 28°C (82°F), cows are not able to return to normal temperature without assistance through warming and warming fluids.

As hypothermia progresses, metabolic and physiological processes slow down, blood is diverted from the extremities to protect the vital organs. Teats, ears and testes are prone to frostbite. In extremes, respiration and heart rate drops, animals lose consciousness and die.

Several experiments have been done to determine the effects of cold stress on important production parameters in cows. Some of these experiments show no or little effect on cows. However, some do not report the actual temperature during the trial while in others, the temperature was not cold enough to induce “cold stress”.

In most situations, a more insidious and costly problem occurs. Cows are subjected to an environment below the lower critical temperature, but without obvious signs of hypothermia. This increases the maintenance energy requirement of these animals as they adjust to the conditions and divert more energy to maintaining body temperature.

There are typically two responses to cold stress in cows, particularly those that spend a significant part of late pregnancy in the coldest months of the year.
1. Cows have access to higher quality feed and / or increase intake and therefore maintain body weight.

Cows increase feed intake in an effort to meet their energy requirements. Given the opportunity and gut capacity, cows will eat more feed to help meet their increased energy requirements. Practically, it is usually expedient to feed grain as well. This increases feed costs, increasing the cost of keeping cows. However, the expectation is that cows will maintain their body weight!

It is generally accepted that for every $1^\circ$C drop in temperature below the lower critical temperature, there is an approximately 2 percent increase in energy requirements. The amounts of additional feed required for a cow under cold stress can be calculated but as a rule of thumb, a cow with a dry winter coat should be fed additional feed (Table 3).

Table 3. Effective temperature and the additional feed required to meet the cow’s energy requirements – assumes a dry, clean winter coat.

<table>
<thead>
<tr>
<th>Effective Temperature ($^\circ$C)</th>
<th>Extra energy required (%)</th>
<th>Extra hay required (lbs/cow/day)</th>
<th>Extra grain required (lbs/cow/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1$^\circ$</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>-12$^\circ$</td>
<td>20%</td>
<td>3.5 – 4.0</td>
<td>2.0 – 2.5</td>
</tr>
<tr>
<td>-23$^\circ$</td>
<td>40%</td>
<td>7.0 – 8.0</td>
<td>4.0 – 5.0</td>
</tr>
</tbody>
</table>

Cows may not be able to eat the amount of extra hay required to maintain their body weight and will have to be fed additional grain to meet their energy requirements.

2. Cows don’t have increased feed quality and intake and lose body weight.

If cows are not fed additional feed or the quality does not allow them to eat enough to meet the additional energy requirements (not fed additional grain), body weight will be lost to produce the metabolic heat required to maintain body temperature. These cows lose weight as feed energy and body fat are diverted to maintain body temperature and vital body functions. Cows that start to lose weight soon enter a downward spiral – the more weight (fat) they lose the less insulation they have, the more susceptible they are to further cold stress, and lose weight even faster.

Cows and heifers in particular, that lose weight, calve in poor condition. The consequences are increased calving difficulties, an increase in the number of lighter weak calves and higher calf mortality. Cows have a reduced amount of inferior quality colostrum and lower milk production, increasing neonatal deaths and poorer growth rates in surviving calves. These cows usually have delayed return to estrus, longer days open and poorer reproductive success.

Key strategy in managing cold stress and energy requirements

The energy requirements of cows increase significantly during the third trimester. For example, the energy requirements for pregnancy alone in late gestation increase from 2.03 Mcal / day at 80 days prior to calving to 5.17 Mcal / day 40 days prior to calving. (See Figure 1 below). Calving season has an impact on energy requirements in late gestation. If late gestation overlaps with the coldest time of the year, then it will be more difficult to meet their energy requirements. The more concentrated rations are more expensive. These cows are also at greater risk of losing weight if they cannot meet their energy requirements.

One strategy is move the calving season later in the spring / early summer so that cows do not spend late lactation (high energy requirement) in the coldest months of the year. It is easier and more economical to meet the energy requirements of cows that are not subjected the compounded energy requirements of pregnancy and cold stress.
Key management factors to limit the effects of cold stress

One way to reduce cold stress and its effects on cows is to shift the calving season to later in the spring. This has the potential of lowering the over wintering feed requirements and costs. However, there are a number of factors to consider to help get cows through the winter as efficiently as possible.

- **Monitor the weather.** Monitor temperature and increase feeding in response to cold weather. Cows in the last trimester require additional grain feeding during periods when the effective temperature falls below the lower critical level.
- **Protect animals from the wind.** Wind markedly reduces the effective temperature, increasing cold stress on animals.
- **Bed cows well.** Provide adequate dry bedding. This makes a significant difference in the ability of cattle to withstand cold stress.
- **Keep cows clean and dry.** Wet coats markedly reduce the insulating properties and make cows more susceptible to cold stress. Mud caked coats also reduce the insulating properties of the hair.
- **Provide additional feed.** Feed more hay and grain. If wet feeds are fed, make sure they are not frozen.
- **Feed an Ionophore.** Feed Rumensin to beef cows. This will help improve feed utilization – cows derive more energy from the ration. This is particularly important as cow’s energy requirements increase and / or they are fed poorer quality hay.
- **Provide water.** Make sure cows have ample water available at all times. Limiting water will limit feed intake and make it more difficult for cows to meet their energy requirements. Frozen troughs and excessively cold water seriously limit water intake.

We can’t control the weather but we can do everything reasonably possible to reduce the effects of cold on cows. This will help reduce costs, reduce winter weight loss and improve production efficiency.