Adjusting energy level in the diet for cold stress

Ron Lemenager, Extension Beef Specialist
Purdue University, Department of Animal Sciences

During the winter, cold stress can be both a nutritional and management issue. Cows consuming low to moderate quality forages late in gestation, or during early lactation, may not be able to eat enough forage to meet the increased energy requirements caused by cold stress. Putting out another big round bale of low to moderate quality hay typically will not meet the cow’s increased energy requirements. The energy requirements of a cow increase in direct proportion to wind chill. If cows are housed in an open lot, their energy requirements are not based on thermometer temperature, but rather wind chill temperature. If wind breaks are provided, thermometer temperatures become more useful. Wind breaks may be more cost effective in the long term compared to the cost of supplementing expensive high energy feeds.

**Thumb rule 12:** For each 10°F drop below a wind chill of 30°F, the energy requirements increase 13% for cows in good body condition with a dry, winter hair coat; and 30% for thin cows, or cows with a wet or summer hair coat.

**Example.** Assume a 1200 lb base-weight, BCS 5 cow during the last trimester of gestation is in a -10°F wind chill environment. The cow has free choice access to moderate quality hay that analyzes 85% DM and a good quality commercial vitamin/mineral supplement. How much pelleted soybean hulls will be needed per day to meet this increased requirement? Table 11 shows the crude protein and energy values for the feeds and this cow’s requirements.

Table 11. Crude protein (CP) and net energy for maintenance (NEₘ) values.

<table>
<thead>
<tr>
<th>Item</th>
<th>Dry matter basis</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CP, %</td>
<td>NDF, %</td>
<td>NEₘ, Mcal/lb</td>
</tr>
<tr>
<td>Moderate quality forage</td>
<td>11.7</td>
<td>54.5</td>
<td>.53</td>
</tr>
<tr>
<td>Pelleted soybean hulls</td>
<td>12.0</td>
<td>--</td>
<td>.88</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cow requirements</th>
<th>CP, lb</th>
<th>NEₘ, Mcal/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>2.3</td>
<td>12.0</td>
</tr>
</tbody>
</table>

*aFrom Table 2, scale weight of this 1200 lb, BCS 5 cow in late gestation is about 1290 lb.*
Step 1. Calculate the increase in energy required above maintenance (Table 11) for this cow under cold stress using Thumb Rule 12.

A wind chill factor of -10°F is 4 units of 10 below 30°F, therefore:

4 x .13 = 52% increase in energy required above maintenance

12 Mcal NEₘ/day required x .52 increase = 6.24 Mcal NEₘ/day increase in energy needed above maintenance due to cold stress

Step 2. Calculate the total energy required per day for this 1200 lb cow under cold stress.

12 Mcal NEₘ/day requirement + 6.24 NEₘ/day increase = 18.24 Mcal NEₘ/day

Step 3. Calculate how much hay this cow would be expected to consume using Thumb Rule 4 and the 54.5% NDF forage analysis.

Note: The crude protein (DM basis) in hay (11.7%) and soybean hulls (12%) both exceed 10% CP for cows in late gestation (Thumb Rule 8), therefore, no additional protein supplementation is needed.

120 ÷ 54.5 = DMI of 2.2% of her body weight/day

1200 lb x .022 = 26.4 lb of hay DM/day

Step 4. Calculate how much energy this cow would be expected to consume per day.

26.4 lb of hay DM x .53 Mcal NEₘ/lb of hay = 13.99 Mcal/d

Step 5. Calculate the deficiency in energy intake per day.

18.24 Mcal NEₘ required/day – 13.99 Mcal NEₘ/day provided by hay = 4.25 Mcal NEₘ deficient/day

Step 6. Calculate the amount of a high energy feed needed to meet this deficiency using SBH.

4.25 Mcal NEₘ/day deficiency ÷ .88 Mcal NEₘ/lb in SBH = 4.83 lb SBH (DM basis)
Caution: Corn (1.01 Mcal NE\textsubscript{m}/ lb) was an optional high energy feed, but the amount needed \((4.25 \div 1.01 = 4.2\text{ lb of corn})\) would exceed Thumb Rule 10 of 0.3\% of body weight \((1200 \times .003 = 3.6\text{ lb})\) on a DM basis.


\[
4.83\text{ lb of SBH (DM basis)} \div .90 = 5.4\text{ lb of SBH (as-fed basis)}
\]

Adjusting energy in the diet to increase body condition.

Thin cows require more energy than moderately conditioned cows to maintain body temperature and an acceptable level of productivity. It is possible to program cows to gain weight and body condition to reach a body condition score of 5 by a target date using Tables 2 and 4.

Example. Assume a typical 1200 lb cow in a BCS 4 at the beginning of the last trimester of gestation consuming moderate quality forage with a goal of having this cow calve in a BCS 5 in 90 days. How much pelleted soybean hulls will be needed per day to meet this increased energy requirement? Table 10 shows the crude protein and energy values for the feeds and this cow’s maintenance requirements.

Note: This BCS 4 cow would weight about 1180 lb at this point in the production cycle (Month 10, Table 1), but she should weigh about \(1180 + 80 = 1260\) if she was in a BCS 5 (Thumb Rule 1). She has the volume and capacity to eat like she was a 1200 lb, base-weight cow (Thumb Rule 5).

Table 12. Crude protein (CP) and net energy for maintenance (NE\textsubscript{m}) values.

<table>
<thead>
<tr>
<th>Item</th>
<th>CP, %</th>
<th>NDF, %</th>
<th>NE\textsubscript{m}, Mcal/lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate quality forage</td>
<td>10.7</td>
<td>54.5</td>
<td>.53</td>
</tr>
<tr>
<td>Pelleted soybean hulls</td>
<td>12.0</td>
<td>--</td>
<td>.88</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CP, lb</th>
<th>NE\textsubscript{m}, Mcal/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.9</td>
<td>12.0</td>
</tr>
</tbody>
</table>

\*From Table 2, month 11 of the production cycle, month 8 of pregnancy.

Step 1. Calculate the energy required above the maintenance requirement per day for this cow to move from a BCS of 4 to 5 in 90 days using Table 4.
It will take a total of 158 Mcal NE\textsubscript{m} above the maintenance energy requirement to change from a BCS 4 to a BCS 5, therefore:

\[ 158 \text{ Mcal NE}_m \div 90 \text{ days} = 1.75 \text{ Mcal NE}_m/\text{day} \text{ to move one BCS in } 90 \text{ days} \]

Step 2. Calculate the total energy required/day for this cow.

\[ 12 \text{ Mcal NE}_m/\text{day} \text{ required} + 1.75 \text{ Mcal NE}_m/\text{day} = 13.75 \text{ Mcal NE}_m \text{ needed per day} \]

Step 3. Determine hay intake using the Thumb Rule 4 and the hay’s NDF value from Table 12.

\[ 120 \div 54.5\% \text{ NDF} = \text{DMI of } 2.2\% \text{ of body weight/day} \]

\[ 1200 \text{ lb cow} \times 0.022 = \text{DMI of } 26.4 \text{ lb/day of hay} \]

Step 4. Calculate how much energy will be consumed from the forage daily.

\[ 26.4 \text{ lb/day of hay dry matter} \times 0.46 \text{ Mcal NE}_m/\text{lb} = 12.14 \text{ Mcal NE}_m/\text{day} \]

Step 5. Calculate the daily energy deficiency.

\[ 13.75 \text{ Mcal NE}_m \text{ required/day} - 12.14 \text{ Mcal NE}_m \text{ provided by hay intake/day} = 1.61 \text{ Mcal NE}_m/\text{day deficient} \]

Step 6. Calculate the amount of SBH/day needed to balance the energy requirement.

\[ 1.61 \text{ Mcal NE}_m \text{ deficient/day} \div 0.88 \text{ Mcal NE}_m/\text{lb of SBH} = 1.83 \text{ lb/day of SBH (DM basis)} \]

Step 7. Convert from a DM basis to an as-fed basis using Thumb Rule 9 for feeding.

\[ 1.83 \text{ lb/day of SBH (DM basis)} \div 0.90 = 2.0 \text{ lb/day of SBH (as-fed basis)} \]

\textit{Caution:} Thin cows should be identified shortly after weaning when the cow is in the middle third of gestation and the nutrient requirements are low. As cows progress into late pregnancy and on into lactation, it becomes more difficult to formulate practical and economical forage-based rations that will provide a significant increase in weight and BCS. A little supplementation when requirements are low, that can be fed in small
quantities over a longer period of time, is more economical than trying to make large changes in a short period of time when requirements are high.