Using Cow Body Condition Score to Develop a Feeding Program
(Rush, 1991; Range Beef Cow Symposium XII)

We have a 1,300 lb cow that we scored as BCS 4 at weaning (Nov. 1st) and we want her to be at BCS 5 at calving (Feb. 1st). We are feeding her mature alfalfa hay (12% CP, 0.50 Mcal/lb NE\textsubscript{m}, 0.12 Mcal/lb NE\textsubscript{g}, 59% NDF) and 4 lbs of barley (13% CP, 0.92 Mcal/lb NE\textsubscript{m}, 0.62 Mcal/lb NE\textsubscript{g}). The following worksheet will help us to determine if our feeding program will allow her to gain the body condition we want her to by calving (1 BCS).

1. Determine weight gain needed by cow for BCS change. An average of 80 lb gain is needed for each condition score change. (An additional 100 lb gain of the fetus will occur)

(Number of BCS changes x 80 lb) = Weight gain needed to change BCS, lb

(Weight gain to change BCS, lb) + (100 lb) = Total weight gain needed, lb

\[1 \text{ BCS change} \times 80 \text{ lb} = 80 \text{ lb gain needed to change BCS}\]

\[80 \text{ lb} + 100 \text{ lb} = 180 \text{ lb total weight gain needed}\]

2. Determine the average weight of the cow (not including fetal weight) during the feeding period (this will be used to determine the maintenance requirements).

\[
\frac{[\text{Current wt, lb} + (\text{Gain needed to change BCS, lb} + \text{Current wt, lb})]}{2} = \text{Average cow wt, lb}
\]

\[
\frac{[1,300 \text{ lb} + (80 \text{ lb} + 1,300 \text{ lb})]}{2} = 1,340 \text{ lb}
\]

3. Calculate ADG (not including fetal wt gain). (Wt gain needed, lb) / (Days to calving) = ADG

\[
\frac{80 \text{ lb}}{(\text{Nov. 1st to Feb. 1st}; 92 \text{ days})} = 0.87 \text{ lb}
\]

4. Determine the daily NE\textsubscript{m} required (Mcal/day) for the cow (based on average body weight not including fetal weight; Table 1).

\textit{From question #2; Her average weight (without the fetus) will be 1,340 lb, so we'll use 1,350 lb in Table 1; her NE\textsubscript{m} requirement is 9.48 Mcal/day}

5. Locate daily NE\textsubscript{c} required (Mcal/day) for fetal growth (used if during last trimester of gestation; Table 1).

\textit{Nov. 1st to Feb. 1st is the last trimester of gestation, so we need to identify the NE\textsubscript{c} requirement from Table 1; 2.15 Mcal/day}

6. Locate daily NE\textsubscript{l} required (Mcal/day) for lactation (used if during lactation; Table 1).

\textit{She will not be lactating, so we will not use the NE\textsubscript{l} requirement.}

7. Determine total daily NE\textsubscript{m} requirement (Mcal/day) for the cow by adding NE\textsubscript{m}, NE\textsubscript{c} & NE\textsubscript{l}. 
From questions #4 and #5; $NE_m + NE_c = 9.48 \text{ Mcal/day} + 2.15 \text{ Mcal/day} = 11.63 \text{ Mcal/day}$

8. Determine the $NE_g$ requirement per pound of weight gain needed (Table 2).

\[ \left[ (NE_g \text{ at original BCS, Mcal/lb}) + (NE_g \text{ at target BCS, Mcal/lb}) \right] / 2 = NE_g, \text{ Mcal/lb wt gain} \]

*Cows in lower body condition are more efficient at gaining weight, and therefore need less energy per lb of weight gain (See Table 2). As she increases in body condition, she becomes less efficient and the amount of energy needed to put on weight increases.*

*She is originally at a BCS 4 and her target BCS is a 5. From Table 2:*

\[ (1.73 \text{ Mcal/lb}) + (2.30 \text{ Mcal/lb}) / 2 = 2.02 \text{ Mcal/lb} \]

9. Determine the daily $NE_g$ requirement for the cow.

(ADG needed, lb) x (NEg, Mcal/lb weight gain) = $NE_g$ requirement, Mcal/day

*From questions #3 and #8; 0.87 lb x 2.02 Mcal/lb = 1.76 Mcal/day needed to gain body condition*

10. Calculate the $NE_m$ and $NE_g$ values (Mcal/lb) of the ration to be fed.

*Given in the introduction; Mature alfalfa hay (0.50 Mcal/lb NEm, 0.12 Mcal/lb NEg, 59%NDF), 4 lbs of barley (13% CP, 0.92 Mcal/lb NEm, 0.62 Mcal/lb NEg)*

*Use hay NDF to estimate DM forage intake: 120/59 = 2.03% of BW(use her average total BW with the fetus to determine intake).*

\[ [(1,300 lb) + (1,300 lb + 80 lb + 100 lb)] / 2 = 1,390 lb \]

\[ 1,390 lb \times 0.0203 = 28.2 \text{ lb forage DM} \]

Total intake = 28.2 lb forage + 4 lb barley = 32.2 lb

\[ (28.2 \text{ lb forage} / 32.2 \text{ lb total}) \times 100 = 87.58\% \text{ forage} \]

\[ 100 - 87.58\% = 12.42\% \text{ supplement} \]

\[ (0.8758 \times 0.50 \text{ Mcal/lb NE}_m) + (0.1242 \times 0.92 \text{ Mcal/lb NE}_m) = 0.55 \text{ Mcal/lb NE}_m \]

\[ (0.8758 \times 0.12 \text{ Mcal/lb NE}_g) + (0.1242 \times 0.62 \text{ Mcal/lb NE}_g) = 0.18 \text{ Mcal/lb NE}_g \]

11. Calculate the amount of ration needed per day to meet maintenance requirements.

(Total daily $NE_m$ requirement, Mcal) / ($NE_m$ in ration, Mcal/lb) = lb ration for maintenance

*From questions #7 and #10; (11.63 Mcal) / (0.55 Mcal/lb) = 21.1 lb/day for maintenance*

12. Calculate the amount of ration needed per day to meet the gain requirements.

(Total daily $NE_g$ requirement, Mcal) / ($NE_g$ in ration, Mcal/lb) = lb ration for gain

*From questions #9 and #10; (1.76 Mcal) / (0.18 Mcal/lb) = 9.8 lb/day for gain*

13. Calculate total amount of ration needed per day.

(lb ration for maintenance) + (lb ration for gain) = total amount of ration per day, lb
From questions #11 and #12; \((21.1 \text{ lb}) + (9.8 \text{ lb}) = 30.9 \text{ lb total diet needed}\)

14. Evaluate if this is within the cow’s intake limit by calculating predicted possible intake using Intake, \%BW = \((120 / \%NDF)\) and her average body weight including the fetus.

From introduction; \((120 / 59) = 2.03\% \text{ BW is predicted hay intake}\)
From question #10, total intake = 32.2 lb
From question #13, 30.9 lb total diet needed is within her predicted intake of 32.2 lb

15. Based on her predicted intake, her performance can be predicted. Calculate the amount of ration left over for gain (after maintenance requirements are met). \((\text{DM intake, lb/day}) - (\text{lb ration for maintenance}) = \text{lb ration left for gain}\)

From questions #14 and #11; \((32.2 \text{ lb predicted intake} - 21.1 \text{ lb for maintenance}) = 11.1 \text{ lb left for gain}\)

16. Calculate \(\text{NE}_g\) available for gain per day. 
\((\text{lb ration left for gain}) \times (\text{NE}_g\text{ in ration, Mcal/lb}) = \text{NE}_g\text{ available for gain, Mcal/day}\)

From question #15 and #10; \((11.1 \text{ lb} \times 0.18 \text{ Mcal/lb}) = 2.0 \text{ Mcal/day NE}_g\text{ available for gain}\)

17. Calculate the predicted gain. \((\text{Use } \text{NE}_g, \text{ Mcal/lb wt gain found in #8})\)
\((\text{NE}_g\text{ available for gain, Mcal}) / (\text{NE}_g, \text{ Mcal/lb wt gain}) = \text{predicted gain, lb/day}\)

From questions #16 and #8; \((2.0 \text{ Mcal}) / (2.02 \text{ Mcal/lb}) = 1.0 \text{ lb/day predicted gain}\)

18. Estimate condition score change.
\((\text{Predicted ADG, lb/day}) \times (\text{days until calving}) = \text{gain, lb (not including fetal wt)}\)
\((\text{Gain, lb}) / 80 = \text{condition score change}\)

From questions #17 and #3; \((1.0 \text{ lb/day}) \times (92) = 92.0 \text{ lb gain}\)
\((92.0 \text{ lb gain}) / (80 \text{ lb/BCS}) = 1.15 \text{ BCS}\)

Based on our calculations, she will gain a little more than 1 BCS.
Table 1. Net energy requirements of mature beef cows.

<table>
<thead>
<tr>
<th>Cow wt, lb</th>
<th>1000</th>
<th>1050</th>
<th>1100</th>
<th>1150</th>
<th>1200</th>
<th>1250</th>
<th>1300</th>
<th>1350</th>
<th>1400</th>
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<tbody>
<tr>
<td>NE&lt;sub&gt;m&lt;/sub&gt;, Mcal/day</td>
<td>7.57</td>
<td>7.86</td>
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<td>8.41</td>
<td>8.68</td>
<td>8.95</td>
<td>9.22</td>
<td>9.48</td>
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<tr>
<td>NE&lt;sub&gt;c&lt;/sub&gt;, Mcal/day for fetal growth&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.15</td>
<td>2.15</td>
<td>2.15</td>
<td>2.15</td>
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<td>2.15</td>
<td>2.15</td>
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</tr>
<tr>
<td>NE&lt;sub&gt;i&lt;/sub&gt;, Mcal/day average milk&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.40</td>
<td>3.40</td>
<td>3.40</td>
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<tr>
<td>NE&lt;sub&gt;i&lt;/sub&gt;, Mcal/day superior milk&lt;sup&gt;b&lt;/sup&gt;</td>
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<sup>a</sup> Energy required for the fetus during the last trimester of gestation, a weight gain of 0.9 lb/day.

<sup>b</sup> Energy required to support lactation. Average milk is 10 lb of milk/day; superior milk is 20 lb/day. Calculated as lb of milk x 0.34 Mcal/lb. This is added to NE<sub>m</sub> during lactation.

Table 2. Net energy for gain (NE<sub>g</sub>) in cows of varying body condition.

<table>
<thead>
<tr>
<th>Body condition score</th>
<th>NE&lt;sub&gt;g&lt;/sub&gt; Mcal/lb of weight gain</th>
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<tr>
<td>2</td>
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<td>3</td>
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