

Body Condition Scoring II: Using the Net Energy (NE) System to Improve Body Condition Score

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Assessing cowherd energy reserves throughout the year is critical to maintain production efficiency of in a cow/calf operation. Body condition scoring (BCS) provides a good estimate of energy status of a cow. Cows are assigned scores from 1 (emaciated and carrying virtually no fat) to 9 (excessively fat). Once the body condition of the herd has been determined, an increase in diet quality and energy density in thin cows (BCS 3 and 4) can be used to increase body condition (BCS 5 or 6).

The purpose of this guide is to help define the most commonly used system for expressing energy requirements for beef cows and energy concentration of feedstuffs, as well as using the system to improve cow body condition through evaluation of pasture or ration energy availability.

Net Energy System

A pound of gain on a thin cow is primarily made up of water and protein (muscle), whereas a pound of gain in a fat cow is mostly fat. An added pound of fat requires 2.25 times more energy than an added pound of muscle. Thus, a thin cow requires less energy to add a pound of gain than a fleshy cow.

The most commonly used system for expressing energy requirements in beef cattle and energy concentration of feedstuffs is the net energy (NE) system. This system expresses units of energy in megacalories (Mcal), separating units of energy required for daily maintenance (NE_m) from those needed for gain (NE_g). Energy required for varying stages of production, such as lactation (NE_l) and pregnancy (NE_p), can also be accounted for using the NE system. For practical purposes,

the efficiency of using energy for lactation and pregnancy is similar to using energy to meet maintenance requirements.

Tables 1 through 3 provide necessary information for producers to calculate NE requirements for cows of varying body weight (BW), production status, and body condition. Data in Table 1 displays NE_m requirements at different cow body weights. This base requirement is the amount of energy required to prevent weight loss in a stress-free environment. These values do not include necessary energy adjustments for environmental stress from heat, cold, wind, or mud, which increase maintenance requirements.

Stage of production can greatly affect energy requirements and influences a cow's ability to increase body condition. Table 2 displays added energy required during critical periods of lactation and pregnancy.



Table 1. Daily net energy of maintenance (NE_m) requirements for mature beef cows.

| | Cow Body Weight (lbs) | | | | | | | | |
|---|-----------------------|------|------|------|------|------|------|------|------|
| | 1000 | 1050 | 1100 | 1150 | 1200 | 1250 | 1300 | 1350 | 1400 |
| NE _m , Mcal/day ^a | 7.52 | 7.83 | 8.14 | 8.45 | 8.75 | 9.04 | 9.33 | 9.63 | 9.91 |

^a Maintenance requirements include allowance for activity, but do not include added energy for heat, cold, wind, or mud stress.

Table adapted from Buskirk et al., 1992. *Journal of Animal Science*

Table 2. Daily net energy of production (NE_l and NE_p) requirements for beef cows.

| Days after Calving | Lactation - Peak Milk (lbs) | | | | Pregnancy |
|--------------------|-----------------------------|------|------|-------|-----------|
| | 11 | 18 | 24 | 31 | |
| | ----- Mcal/day ----- | | | | |
| 0-21 | 2.42 | 3.87 | 5.32 | 6.77 | — |
| 22-42 | 3.40 | 5.44 | 7.48 | 9.52 | — |
| 43-63 | 3.58 | 5.73 | 7.88 | 10.00 | — |
| 64-84 | 3.36 | 5.37 | 7.39 | 9.40 | — |
| 85-105 | 2.95 | 4.72 | 6.49 | 8.26 | — |
| 106-126 | 2.49 | 3.98 | 5.47 | 6.96 | — |
| 127-147 | 2.04 | 3.26 | 4.48 | 5.71 | 0.33 |
| 148-168 | 1.64 | 2.62 | 3.60 | 4.58 | 0.63 |
| 169-189 | 1.29 | 2.07 | 2.85 | 3.62 | 1.17 |
| 190-210 | 1.01 | 1.46 | 2.19 | 2.83 | 2.03 |
| 211-240 | — | — | — | — | 3.33 |
| 241-280 | — | — | — | — | 5.17 |

Table adapted from NRC, 1996

Table 3. Net energy for gain (NE_g) values for mature beef cows with varying body condition scores (BCS).

| Present BCS | Desired BCS | | | | | | | | |
|-------------|-----------------------------|------|------|------|------|------|------|------|------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | ----- Mcal/lb of gain ----- | | | | | | | | |
| 1 | — | 1.14 | 1.31 | 1.47 | 1.64 | 1.8 | 1.97 | 2.13 | 2.29 |
| 2 | | — | 1.47 | 1.64 | 1.80 | 1.97 | 2.13 | 2.30 | 2.46 |
| 3 | | | — | 1.80 | 1.97 | 2.13 | 2.30 | 2.46 | 2.62 |
| 4 | | | | — | 2.13 | 2.29 | 2.46 | 2.62 | 2.79 |
| 5 | | | | | — | 2.46 | 2.62 | 2.79 | 2.95 |
| 6 | | | | | | — | 2.79 | 2.95 | 3.12 |
| 7 | | | | | | | — | 3.12 | 3.28 |
| 8 | | | | | | | | — | 3.45 |
| 9 | | | | | | | | | — |

Table adapted from Buskirk et al., 1992. *Journal of Animal Science*

Practical Application of NE System

This section provides practical application of the NE system to evaluate current and develop future nutritional programs to ensure energy requirements are met.

Scenario

- Mature British cow (1170 lbs BW)
- Peak milk = 24 lbs/day
- BCS 3 at calving
- Breeding season begins in 80 days
- Desire a BCS 5 at beginning of breeding season
- After calving diet consists of: 80% high quality grass hay, 20% wheat midds

Procedure

- ❶ Determine average BW of cow over the period evaluating:

- a. Calculate total gain necessary to increase from BCS 3 to 5
 1 BCS change = 80 lbs.
 2(80 lbs) = 160 lbs.

- b. Calculate desired BW at breeding

$$\text{initial BW} + \text{total gain to increase BCS} = \text{breeding BW}$$

$$1170 \text{ lbs} + 160 \text{ lbs} = 1330 \text{ lbs}$$

- c. Calculate average BW for period

$$\frac{(\text{initial BW} + \text{end BW})}{2} = \text{average BW}$$

$$\frac{(1170 \text{ lbs} + 1330)}{2} = 1250 \text{ lbs}$$

- ❷ Calculate ADG required to achieve desired BCS.

$$\frac{\text{lbs to BCS 5} + \text{period length (days)}}{\text{ADG}} = \text{ADG}$$

$$\frac{160 \text{ lbs} + 80 \text{ days}}{2} = 2 \text{ lbs/day}$$

- ❸ Find NE_m requirement for average cow body weight (1250 lbs) from Table 1.

$$NE_m = 9.04 \text{ Mcal/day}$$

- ❹ Determine average NE_l required for lactation (based on peak milk production = 24 lbs) in Table 2.

$$\frac{(\text{initial period } NE_l + \text{final period } NE_l)}{2} = \text{average } NE_l \text{ requirement}$$

$$\frac{(5.32 \text{ Mcal/day} + 7.39 \text{ Mcal/day})}{2} = 6.36 \text{ Mcal/day}$$

- ❺ Calculate total maintenance requirements for period.

$$(NE_m + NE_l) = \text{daily } NE_m \text{ requirement}$$

$$(9.04 \text{ Mcal/day} + 6.36 \text{ Mcal/day}) = 15.4 \text{ Mcal/day}$$

- ❻ Locate NE_g to achieve desired BCS from Table 3 and determine NE required for calculated ADG for period.

$$NE_g \times \text{ADG} = \text{average } NE_g \text{ required}$$

$$1.97 \text{ Mcal/lb} \times 2.0 \text{ lbs/day} = 3.94 \text{ Mcal/day}$$

- ❼ Calculate dietary concentration of NE_m and NE_g .

| Feedstuff | | DM | CP | NE_m | NE_g |
|--------------------------|-----------|----|------|---------|---------|
| | % of diet | % | % | Mcal/lb | Mcal/lb |
| Grass Hay ^a | 80 | 90 | 10.8 | 0.52 | 0.29 |
| Wheat Midds ^b | 20 | 90 | 17.2 | 0.78 | 0.53 |

^a Values converted to as-fed basis from Stock et al., 1995. Nebraska Cooperative Extension G91-1048-A

^b Values converted to as-fed basis from Lardy and Anderson, 1999. NDSU Extension Service AS-1182

- a. Calculate diet NE_m and diet NE_g

$$\text{Feedstuff } NE_m \times \% \text{ in diet} = NE_m/\text{lb of diet}$$

$$0.52 \times 0.80 = 0.42 \text{ Mcal/lb (grass hay contribution)}$$

$$0.78 \times 0.20 = 0.16 \text{ Mcal/lb (wheat midds contribution)}$$

$$= 0.58 \text{ Total Mcal } NE_m/\text{lb of diet}$$

$$\text{Feedstuff } NE_g \times \% \text{ in diet} = NE_g/\text{lb of diet}$$

$$0.29 \times 0.80 = 0.23 \text{ Mcal/lb (grass hay contribution)}$$

$$0.53 \times 0.20 = 0.11 \text{ Mcal/lb (wheat midds contribution)}$$

$$= 0.34 \text{ Total Mcal } NE_g/\text{lb of diet}$$

- b. Pounds of ration to meet NE_m and NE_g requirement

$$\frac{\text{Daily } NE_m \text{ requirement}}{\text{dietary } NE_m \text{ concentration}} = \text{lbs of diet for maintenance}$$

$$\frac{15.4 \text{ Mcal/day}}{0.58 \text{ } NE_m \text{ Mcal/lb}} = 26.5 \text{ lbs/day for maintenance}$$

$$\frac{\text{Daily } NE_g \text{ requirement}}{\text{dietary } NE_g \text{ concentration}} = \text{lbs of diet for gain}$$

$$\frac{3.94 \text{ Mcal/day}}{0.34 \text{ } NE_g \text{ Mcal/lb}} = 11.6 \text{ lbs/day for gain}$$

$$\text{lbs for maintenance} + \text{lbs for gain} = \text{Total lbs of diet needed/day to achieve BCS 5 at breeding}$$

$$26.5 \text{ lbs} + 11.6 \text{ lbs} = 38.1 \text{ lbs of diet}$$

- c. Calculate total feedstuffs fed per day

$$\text{lbs of diet} \times \% \text{ of feedstuff in diet} = \text{lbs of feedstuff fed/day}$$

$$38.1 \text{ lbs} \times 0.80 \text{ grass hay} = 30.5 \text{ lbs grass hay}$$

$$38.1 \text{ lbs} \times 0.20 \text{ wheat midds} = 7.6 \text{ lbs wheat midds}$$

Summary

To achieve BCS 5 by the start of the breeding season in this example, a cow must consume 38.1 lbs of the previous ration per day.

Considerations

Under certain circumstances the required ADG and ration calculated with the NE system to alter body condition may not work in a production setting. An animal may be unable to achieve desired gains or consume enough of the calculated ration in a given time period, so reformulation with more energy dense feedstuffs may be necessary. However, also consider that daily gains above 2.5 lbs are difficult to achieve in a practical setting. In such cases where reformulation is not the

solution, more time is necessary for the desired condition change to occur. This further reemphasizes the importance of evaluating cow body condition throughout the year so timely changes can be made.

A variety of regional co-product feedstuffs (Table 4) are available as energy and protein supplements to offset energy deficiencies in cow diets. Many of these feedstuffs may prove to be less expensive than common or commercial energy supplements at certain times during the year.

Conclusion

The NE system can be a viable option for producers to evaluate and adjust cow energy reserves throughout the year. Net energy values for feedstuffs are estimates. Responses such as cow body condition provide a clearer picture of actual energy concentration in the current nutrition program and its effects on energy status under certain production and environmental conditions. When energy supplementation is necessary, less expensive co-product feedstuffs may prove economically beneficial in certain regions.

Table 4. Feedstuffs to use as energy supplements in cow diets.

| Feedstuff ¹ | DM | TDN | CP | NE _m | NE _g |
|-----------------------------------|----|-------|------|-----------------|-----------------|
| | % | % | % | Mcal/lb | Mcal/lb |
| Beet pulp, dried sugar | 90 | 65.0 | 8.2 | 0.69 | 0.44 |
| Beet pulp, wet sugar | 25 | 20.0 | 2.3 | 0.19 | 0.12 |
| Canola seeds ² | 92 | 105.9 | 19.3 | 1.23 | 0.89 |
| Canola meal, expeller | 90 | 68.4 | 36.9 | 0.72 | 0.47 |
| Canola meal, solvent | 90 | 62.1 | 39.2 | 0.66 | 0.41 |
| Concentrated separator byproduct | 66 | 44.2 | 13.2 | 0.50 | 0.28 |
| Corn gluten feed, wet | 43 | 37.8 | 9.2 | 0.43 | 0.29 |
| Corn gluten feed, dry | 90 | 74.7 | 19.4 | 0.83 | 0.56 |
| Field peas, grain | 88 | 79.2 | 20.8 | 0.90 | 0.62 |
| Safflower seeds ² | 93 | 84.8 | 16.3 | 0.93 | 0.60 |
| Safflower meal, solv. | 92 | 52.4 | 23.4 | 0.51 | 0.27 |
| Sunflower meal | 90 | 57.6 | 35.0 | 0.59 | 0.32 |
| Sunflower seeds, oil ² | 95 | 115.0 | 17.0 | 1.35 | 0.98 |
| Wheat middlings | 90 | 74.7 | 17.2 | 0.78 | 0.53 |

¹ Values expressed on as-fed basis.

² Whole seeds should be limited to 15 percent of ration.

Table adapted from Lardy and Anderson, 1999. North Dakota Cooperative Extension AS-1182

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