AS-1198

Body Condition Scoring II:

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

A. Manuel Encinias
Extension Associate
Co-Products Initiative

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.

NDSU EXTENSION SERVICE
North Dakota State University, Fargo, ND 58105

DECEMBER 2000

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

initial BW + total gain to increase BCS = breeding BW
1170 lbs + 160 lbs = 1330 lbs

c. Calculate average BW for period

(initial BW + end BW)/2 = average BW
(1170 lbs + 1330) /2 = 1250 lbs

❷ Calculate ADG required to achieve desired BCS.

lbs to BCS 5 + period length (days) = ADG
160 lbs + 80 days = 2 lbs/day

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

NE_m = 9.04 Mcal/day

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

(initial period NE_l + final period NE_l) ÷ 2 = average NE_l requirement
(5.32 Mcal/day + 7.39 Mcal/day) ÷ 2 = 6.36 Mcal/day

❺ Calculate total maintenance requirements for period.

(NE_m + NE_l) = daily NE_m requirement
(9.04 Mcal/day + 6.36 Mcal/day) = 15.4 Mcal/day

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

NE_g X ADG = average NE_g required
1.97 Mcal/lb X 2.0 lbs/day = 3.94 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

Feedstuff NE_m X % in diet = NE_m/lb of diet
0.52 X 0.80 = 0.42 Mcal/lb (grass hay contribution)
0.78 X 0.20 = 0.16 Mcal/lb (wheat midds contribution)
= 0.58 Total Mcal NE_m/lb of diet

Feedstuff NE_g X % in diet = NE_g/lb of diet
0.29 X 0.80 = 0.23 Mcal/lb (grass hay contribution)
0.53 X 0.20 = 0.11 Mcal/lb (wheat midds contribution)
= 0.34 Total Mcal NE_g/lb of diet

b. Pounds of ration to meet NE_m and NE_g requirement

Daily NE_m requirement ÷ dietary NE_m concentration = lbs of diet for maintenance
15.4 Mcal/day ÷ 0.58 NE_m Mcal/lb = 26.5 lbs/day for maintenance

Daily NE_g requirement ÷ dietatry NE_g concentration = lbs of diet for gain
3.94 Mcal/day ÷ 0.34 NE_g Mcal/lb = 11.6 lbs/day for gain

lbs for maintenance + lbs for gain = Total lbs of diet needed/day to achieve BCS 5 at breeding
26.5 lbs + 11.6 lbs = 38.1 lbs of diet

c. Calculate total feedstuffs fed per day

lbs of diet X % of feedstuff in diet = lbs of feedstuff fed/day
38.1 lbs X 0.80 grass hay = 30.5 lbs grass hay
38.1 lbs X 0.20 wheat midds = 7.6 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

Literature Cited

Buskirk, D.D., R.P. Lemenager, and L.A. Horstman. 1992. Estimation of net energy requirements(NE_m and NE_g) of lactating beef cows. J. Anim. Sci. 70:3867-3876.

Corah, L.R., R.P. Lemenager, P.L. Houghton, and D.A. Blasi. 1991. Feeding your cows by body condition. C-842. Kansas State University Agricultural Experiment Station and Cooperative Extension Service.

Lardy, G.P. and V. Anderson. 1999. Alternative feeds for ruminants. AS-1182. North Dakota State University.

Mathis, C.P. and J.E. Sawyer. 2000. Beef cow efficiency in the Southwest. GB-217. New Mexico State University.

National Research Council. 1996. Nutrient Requirements of Beef Cattle. National Academy Press, Washington, DC.

Stock, R., R. Grant, and T. Klopfenstein. 1995. Average composition of feeds used in Nebraska. G91-1048-A. University of Nebraska.

AS-1198

NDSU Extension Service, North Dakota State University of Agriculture and Applied Science, and U.S. Department of Agriculture cooperating. Sharon D. Anderson, Director, Fargo, North Dakota. Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. We offer our programs and facilities to all persons regardless of race, color, national origin, religion, sex, disability, age, Vietnam era veterans status, or sexual orientation; and are an equal opportunity employer.

This publication will be made available in alternative formats for people with disabilities upon request, 701/231-7881.

3M-12-00