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Increase Profit: Feeding Cows by Body Condition and Production Potential

Ivan G. Rush
University of Nebraska - Lincoln, irush1@unl.edu

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Ivan G. Rush
Extension Beef Specialist
University of Nebraska, Scottsbluff

INTRODUCTION

For the last several years cattlemen have stressed high production, especially weaning weight in their cow calf operations. It was felt, m order to be profitable output from the cow herd must be maximized. As a result, of selection for both growth and milking ability of the cow has markedly increased weaning weights and in most herds mature cow size has also increased. Compared to 10-12 years ago, today we are producing 90-95% of the beef with 2/3 of the cows.

As we expect more from the cow, nutrient intake must also increase. In many cases producers have been able to increase both cow size and weaning weights while still utilizing the available resources on the ranch and have not had adverse affects on reproductive performance. However, in many situations we have not been able to meet the cows nutrient needs from the ranch resources and one of two things have occurred. The rancher has either had to supplement at much higher levels or the cows became thin and reproduction suffered. In both cases, this costs money and usually lowers profitability.

The challenge today is to bring our production, weaning weights, yearling weights, etc., up to the point that profitability is near maximum. Cattlemen have found that the point at which reproduction starts to fail is where we should stop trying to increase output. It has been said that reproduction is 5 times more important than growth and 10 times more important than quality, as far as their effect on profitability. Ever since ranchers had cows, it has been known that to assure a high pregnancy rate cows had to be in good body condition. Therefore cows are often fed more than necessary because many ranchers do not want to take a chance of a low pregnancy rate. In other words, it is easy to assure a high pregnancy rate -- just over feed the cow.

With today's cost conscious ranchers, the real challenge is to feed just enough to assure optimum production and profitability, which may well mean something less than maximum production.

Feed costs account for the major portion of annual cow cost. In states where cost of production has been accurately determined it has been interesting to note the tremendous difference in how much it costs to produce a pound of weaned calf from one ranch to another. In herds in Iowa and in Nebraska Integrated Resource Management (IRM) cooperator herds, it was found that cost of reproducing a weaned calf varied $.20/lb ($.72 to $.92/lb). Although no one single factor accounted for all of the differences in cost of production, the major factor was often the cost of feed.

With a better understanding of cow body condition and the level of actual body fat that is

required for good reproductive performance, we are approaching a time where we can use tools to fine tune our feeding program.

What is Cow Body Condition and Scores?

Body condition scoring is simply giving a numerical score which is an estimate of the amount of body fat of the cow. Several different scoring systems can be found, however the one that is probably most common is the numerical ranking from 1-9, one being the thinnest. The following is a brief description of the visual appearance of the cows in the various numerical scores.

Score

1 Bone structure of shoulder, ribs, back, hooks and pins is sharp to the touch and easily visible. Little evidence of fat deposits or muscling. Similar to condition score 1^- in the 5-point system.

2 Little evidence of fat deposition but some muscling in the hindquarters. The spinous processes feel sharp to the touch and are easily seen with space between them. Similar to 1^o and 1^+ in the 5-point system.

3 Beginning of fat cover over the loin, back and foreribs. The backbone is still highly visible. Processes of the sj~nne can be identified individually by touch and may still be visible. Spaces between the processes are less pronounced. Similar to 2^- and 2^o in the 5-point system.

4 Foreribs are not noticeable but the 12th and 13th ribs are still noticeable to the eye, particularly in cattle with a big spring of rib and width between ribs. The transverse spinous processes can be identified only by palpation (with slight pressure) and feel rounded rather than sharp. Full but straight muscling in the hindquarters. Similar to 2^+ and 3^- in the 5-point system.

5 The 12th and 13th ribs are not visible to the eye unless the animal has been shrunk. The transverse spinous processes can only be felt with firm pressure and feel rounded but are not noticeable to the eye. Spaces between the processes are not visible and are only distinguishable with firm pressure. Areas on each side of the tailhead are fairly well filled but not mounded. Similar to 3^o in the 5-point system.

6 Ribs are fully covered and are not noticeable to the eye. Hindquarters are plump and full. Noticeable sponginess over the foreribs and on each side of the tailhead. Firm pressure is now required to feel the transverse processes. Similar to 3^+ and 4^- in the 5-point system.

7 Ends of the spinous processes can only be felt with very firm pressure. Spaces between processes can barely be distinguished. Abundant fat cover on either side of the tailhead with evident patchiness. Similar to 4^o and 4^- in the 5-point system.

8 Animal takes on a smooth, blocky appearance. Bone structure disappears from sight. Fat cover is thick and spongy and patchiness is likely. Similar to 5^- and 5^o in the 5-point system.

9 Bone structure is not seen or easily felt. The tailhead is buried in fat. The animal's mobility may actually be impaired by excessive fat. Similar to 5^+ in the 5-point system.

Even though the factors are not as precise as would be desired and are subjective, they are functional indicators of body condition which is indicative of rebreeding performance of the cow after calving.

Is the actual numerical score really critical? No, not necessarily. It does provide uniformity in the industry in describing cow condition which can benefit accurate communication. It allows comparisons of cow condition within a herd and across herds. Plus it allows more refinement in designing a precise feeding program.

Relationship of Body Condition and Rebreeding Performance

Some of the older classical research by Wiltbank and others in the mid 1960s showed that if cows and especially first calf heifers were thin when going into the calving, rebreeding would be impaired even though the cows were fed very high levels of energy after calving. In the mid 70s Rich Whitman, while at CSU, observed tremendous differences in rebreeding performance of a large number of cows that were classified in three different body conditions (Table 1). In more recent years Houghton, while working towards a Ph.D. at Purdue with Lemenager, showed the effect of body condition score at calving and breeding on days to rebreeding and conception rate (Table 2).

Table 1. Body Condition at Calving and Heat after Calving

Body Condition at Calving	No. Cows	% in Heat - Days Post-Calving	
		60	90
Thin (1-4)	272	46	66
Moderate (5-6)	364	61	92
Good (7-9)	50	91	100

(Whitman, Colorado State University, 1975)

Table 2. Effect of Body Condition Score (BCS) at Calving on Postpartum Interval (PPI) and BCS at Breeding on Conception

Body Condition Score[a]	PPI, days	Conc. Rate, %
3	89	70
4	70	80
5	59	94
6	52	100
7	31	100

Data from many different trials has led most to conclude that a cow should have at least a 5 body condition score at time of calving and a score of 6 would be more desirable for younger higher milk producing cows. Data from South Dakota also suggests that cows that calve earlier in the calving season of a herd may be slightly thinner without having adverse effects on rebreeding, because they have more days in which to recycle and rebreed. Caution should be used with the earlier calving cows however, because they have more days of a higher energy requirement before the breeding season starts. If the cows are in a declining plane of nutrition before calving then they may become too thin. Also Houghton found that if cows are thin and decreasing in condition prior to breeding then reproduction can be impaired.

When and How to Condition Score

Cow condition needs to be assessed routinely. It is critical to evaluate cow condition well before calving. This allows time to change the cows condition if needed. This is especially true in spring calving cows and perhaps the best time to evaluate cow condition is at weaning time. Some prefer to condition score cows at calving. The reasoning is that you are more accurate, because the cow will not have high levels of fill that may affect a condition score. Although this is meaningful information that can be used in long range planning of a feeding and breeding program it may be too late to make corrections for the current year.

In my opinion, it is not necessary to evaluate each cow's condition and assign an individual score. It is more practical to visually appraise the cows to sort off the thin cows that will need some additional nutrients and feed or manage them as needed. It is also extremely important to determine the reason these cows are thin and use this information in your long range management of nutrition and breeding program. Were the cows thin because of their breeding? Are you overreaching your resources? Is your pasture or range management adequate? Did you wean early enough?

Some prefer to feel the animals over the back and ribs rather than visual observation. This can perhaps be done while the cows are in the chute for pregnancy testing. It is good to work with someone who has had considerable experience assigning scores to aid in uniformity and accuracy in scoring.

How Can I Use Condition Scores in Fine Tuning a Feeding Program?

Most producers are already using cow body condition in determining a feeding program. It is advisable to feed and manage the first calf 2 year old heifers separate from the mature cows. It may be advisable to make one additional sort or herd and that would include the thinner 3 year olds and other older and thinner cows. Some are presently running this group of cows with the two year olds, however usually the older cows will be too aggressive for the young cows. Again, when sorting out the low condition cows each producer should ask, why are they thin?; are the numbers of thin cows increasing?; how much additional feed is going to be required to increase their condition and what is it going to cost?; could supplementing the entire cow herd more avoid these thin cows?; and finally, will the additional cost be made up by additional sales?; and do I want to continue in this direction?

For fine tuning a feeding program, Wiltbank offers guidelines for gain (Table 3) for cows in various body condition at weaning. For example, if cows are in a body condition of 4 (borderline) at weaning the nutrition program should be designed to provide 180 lbs of gain or 1.5 lbs daily in a 120 day period. The 180 lbs of gain accounts for approximately 100 lbs of fetal (and fetal membranes) and 80 lbs is body gain on the cow which is the approximate amount to increase one body condition score -- in this case to increase from a score of 4 to 5. If cows are in borderline (score 4) body condition at calving and you wish to increase their body weight 80 lbs prior to breeding they must be fed to gain 1.5 lbs daily which is almost impossible to achieve with high milking cows even with high quantity of roughages.

Table 3. Needed Weight Gains in Mature Pregnant Cows in Different Body Conditions

Body Condition		Weight Gain Needed to Calving, lbs				
At Weaning	Needed at Calving	Calf Fluids and Membranes	Body Weight	Total	Days to Calving	ADG lbs.
Thin	Moderate	100	160	260	120	2.2
Borderline	Moderate	100	80	180	120	1.5
Moderate	Moderate	100	0	100	120	.8
Thin	Moderate	100	160	260	200	1.3
Thin	Moderate	100	160	260	100	2.6

The National Research Council (NRC) Beef Cattle Requirements (1984) publication lists the requirements of various weight cows in different stages of production. In the case of 2 year old heifers, different requirements for various gain are provided. The present NRC requirements utilize total digestible nutrients (TDN) as the measure of energy. TDN is still used by most nutritionists for the beef cow and usually is accurate enough to meet the energy needs of most beef cow feeding programs. In the case of the grazing beef cow, an “educated guess" is needed to determine diet quality and level of intake. Past experience and recent research can be valuable in deciding on the level of supplementation of grazed forage. When grazing is combined with feeding harvested forages, quantity of hay fed can be measured but still a large portion of the ration may be unknown. It is important to evaluate waste when estimating actual intake of forages fed to cows. Nutrient analysis (quality) of the feeds fed can be determined through the use of forage analysis which is very easy and inexpensive. Forages analysis accuracy depends largely on how well the sample represents the feed supply. Most of the time it is difficult to accurately determine the quantity and quality of the major portion of the beef cow’s ration. This raises two points. One, it is of questionable value to seek precise measurements of ration calculations when we may not have the ability to carry out the exact feeding program. Yet it is important to make every effort to determine the nutrient content and quality of the ration. Second, because of the many unknowns that we commonly deal with in beef cow feeding programs, it is very critical that we constantly monitor cow condition and make the needed feeding correction before we allow a problem to develop.

A New System to Balance Beef Rations

Recent research conducted at Purdue allows a more precise method of calculating the cow's energy requirements. In this system, cow size, pregnancy, level of milk production and change in body condition are taken into account. This is similar to systems that are commonly used for growing and finishing cattle or the dairy cow where net energy for maintenance and energy for production (gain or milk) is utilized. The energy required is expressed in megacals (Mcal) rather than TDN.

Data from their study determined the quantity of energy required to increase body weight (Table 4) at various condition scores. They found that the level of energy required was not constant to increase condition on thin cows verses increasing condition on fleshy cows. For example, to increase a cow from a body condition score of 3 to 4 requires L73 Mcal of energy per pound of gain while it requires 2.87 Mcal (65% more) to increase a 6 score cow to a 7. The reason for this considerable difference is because the gain on a thin cow is principally protein and water which is efficiently gained. The gain of the fleshy cow is primarily fat which is inefficient to put on.

Table 4. Net Energy for Gain (Neg) in Cows of Varying Body Condition

Body Condition Score[a]	Mcal/lb of Weight Gain (NEg)
2	1.17
3-4	1.73
5	2.30
6-7	2.87
8	3.44

[a]Body condition scores have been converted from a 5 point system to a 9 point system.
(Lemenager et al., Purdue University, 1990)

Table 5 summarizes the energy required for the cow based on the Purdue study. It sets the requirements for various initial weights of cows and takes into account energy needed for fetal growth, level of milk production and amount of gain desired on the cow.

Larry Corah of Kansas State University and others offer a step by step procedure for calculating the energy required for a cow and to improve her condition.

Situation:

- A two-year-old cow now weighs 1,000 pounds but needs to weigh 1,150 pounds at calving.
- Time to calving = 100 days.
- Body condition score = 4 (moderately thin).
- Desired body condition score = 6 (moderate).
- Weight difference between two body condition scores = 150 pounds.

Step-by-Step Procedure:

1. Determine the average weight of the cow for the 100-day period. Start with the 1,000-pound cow with a body condition score of 4. Add 150 pounds to improve two full condition scores to a 6 (live weight = 1,150 pounds). The average is (1,000 + 1,150 divided by 2) 1,075 pounds.
2. Calculate the average daily gain needed to change two full condition scores in 100 days. (150 pounds divided by 100 days = 1.5 pounds per day).
3. Determine the net energy for maintenance (NEm) requirement for a 1,075-pound cow from Table 5. This is the simple average between the 1,050 and the 1,100 pound columns (7.86 + 8.13 divided by 2 = 8.00 Mcal/day).
4. Locate, in Table 5, the net energy requirement for fetal growth (NEc; 2.15 Mcal/day).
5. Add the net energy for maintenance (NEm) and net energy for fetal growth (Nec) together. The net energy requirement of 8.00 from Step 3 and the fetal growth requirement of 2.15 from Step 4 equals 10.15 Mcal/day.
6. Determine the average net energy requirement per pound of gain from Table 5 for a cow going from a body condition score of 4 to a body condition score of 6 and average these two numbers (1.73 + 2.87 divided by 2 = 2.30 Mcal/day).
7. Now calculate the net energy requirement for 1.5 pounds of gain per day. (1.5 pounds of gain per day x 2.30 McaI/lb = 3.45 Mcal/day.) This calculation factors in the length of time available to achieve the desired condition score (100 days).
8. Add the values obtained in Steps 3, 4 and 7 for the total Mcal/day requirement.

   Example:

Energy Needed	Mcal/Day
Maintenance	8.00
Fetal growth	2.15
For weight gain	3.45
TOTAL	13.60

9. Calculate the net energy for maintenance (NEm) and net energy for gain (NEg) values of the ration. These numbers are calculated by multiplying the NEm and g values (Mcal/lb) of each feed in the ration (using NRC, 1984 Feed Tables) with the corresponding amount (percent) of each feed in the ration on a dry matter basis. Sum the products of each feed in the ration and divide the resulting NEm and NEg values by 100. For example:

Cows ration	lb	%	NEm (Mcal/lb in feed		NEg (Mcal/lb) in feed	
Meadow hay	42	92.3	(.53)	.49	(.28)	.26
20% Protein Supp.	2	7.7	(.84)	.06	(.53)	.04
Total	26	100		.55		.30

10. Using the calculated numbers from Steps 5 and 7, calculate the amount of ration needed per day to obtain the desired endpoint. Divide the net energy for maintenance (NEm) requirement (10.15 Mcal/day) by the NEm value (Mcal/lb) of the ration. This will give the amount of ration needed to maintain cow weight. Next, divide the net energy for gain (NEg) requirement (3.45 Mcal/day) by the NEg value (Mcal/lb) of the ration. This is the amount (lb/day) of the ration needed to produce 1.5 pounds of gain. The sum of the amounts needed for maintenance equals the amount of ration needed by the cow to reach a body condition score of 6 by calving. For example:

    Amount needed for maintenance from above ration
        10.15 (maintenance req.)/.55 (NEm of ration) = 18.5 lb/day
    Amount of ration used for gain
        26 (total ration) - 18.5 (used for gain) = 7.5 lb
    Energy for gain
        7.5 lb x .30 (NEg of ration) = 2.26 Mcal

    Note: This ration would not supply the 3.45 Mcal required for the increase of 2 condition scores. To achieve this goal either more hay and/or supplement would need to be fed.

Table 5. Net Energy Requirements of Mature Beef Cows

Cow Weight, lbs.	1000	1050	1100	1150	1200	1250	1300	1350	1400
NE_m, Mcal/d[a]	7.57	7.86	8.13	8.41	8.68	9.22	9.22	9.48	9.75
NE_c, Mcal/d for fetal growth[b]	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
NE_1, Mcal/d (average milk)[c]	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
NE_1, Mcal/d (superior milk)[c]	6.80	3.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80
Body condition scored	Net Energy (NE) Required for 1 lb. of Weight Change, Mcal/lb								
2	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
3-4	1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.73
5	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
6-7	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87
8	3.44	3.44	3.44	3.44	3.44	3.44	3.44	3.44	3.44

[a]NE_m is calculated to be 0.777 Mcal/kg $W^{.75}$ which comes from .072 + allowance for activity.
[b]Energy required for the conceptus (products of conception) during the last trimester of gestation with a weight gain of .9 lb/day. This is added to NE_m during the last trimester of gestation.
[c]Energy required to support lactation. Average milk is 10 lbs of milk production/day; superior milk is 20 lbs/day. Calculated as lbs of milk x .34 Mcal/lb. This is added to NE_m during lactation.
[d]Body condition scores have been converted from a 5 point system; approximately 60-80 lbs difference between condition scores.

Is It Economical to Feed for Proper Body Condition?

Let's assume that mature cows were in body condition 4 at weaning and we felt that because of the high cost of feed it was of questionable economical value to increase their condition the 120 days before calving. Utilizing the net energy system to calculate feed needed, it would require an additional 800 lbs good quality forage to gain the additional 80 lbs of body weight. At a feed cost of $50/ton that would increase our feed cost $30.00. However, if the thin cow lowered pregnancy rate 10% (from 95% to 85%) and delayed average calving date 10 days, then the loss of income would be approximately $40 (assuming an open cow costs $250 and the lost of weaning weight at $80 cwt).

In contrast, let's assume that cows are in an average body condition (score of 5) and to assure a good reproductive rate we want to increase their condition one score (5 to 6) or approximately 80 lbs. Let's further assume the average condition cow will have a pregnancy rate of 92%. It would require an additional 1550 lbs of average quality forage to gain the added 80 lbs and at $50/ton it would add $39 to our feed cost. If we increased pregnancy rate 5% (92% to 97%) it would only contribute approximately $12.50 added revenue. Looking at it another way we would need to increase pregnancy rate by approximately 15% to economically justify the fleshy cows.

Some producers prefer to have their cows in thin to moderate condition at calving and then have them in a gaining or increasing plane of nutrition at time of breeding. Some feel that the moderate condition cows will calve with less calving difficulty. Research data does not support this commonly held belief. The advisability of this practice will be dependent upon the cost of energy (feed) before and after calving. In most spring calving programs, producers rely on grazing after weaning and up to 30-45 days before calving and then utilize harvest roughages shortly before and after calving. In this case the cost of energy from the harvested feeds is often double that of energy from grazed forage. Also there is considerable risk in going into the winter with thin cows. Data from Adams, while at Miles City, Montana, indicates that the maintenance requirement for thin cows is much higher than for fleshy cows in cold temperatures. This may be a practice that is economical in areas where concentrated energy sources are relatively cheap compared to roughages.

A good time to increase cow condition in a spring calving herd is in the fall while the quantity and quality of grass is still good and cold stress is not a problem. This may be accomplished by weaning the calves at an earlier age to decrease the nutrient demand on the cow or provide some protein supplementation to allow maximum utilization of energy from the grass. The same may be accomplished by moving cows to high quality pasture such as meadow regrowth, small grain pasture, alfalfa aftermath, etc. In some cases it may be advisable to wean the calves and provide some supplementation. This is especially true with first calf two year old heifers.

Data collected by Don Adams and Bob Short on mature cows grazing native range in the fall showed the impact of time of weaning and supplementation on cow weight change and calf gain during the fall (Table 6).

Table 6. The Effect of Weaning Date and Protein Supplementation in the Fall on Cow and Calf Performance. (Adams and Short)

	September 19		December 11	
Weaning Date Protein Supplement	No	Yes	No	Yes
Cow & Calf Performance, lb				
Cow weight change, Sept-Dec	-23	80	-130	-25
Cow condition change	0.13	+1.3	-1.4	-0.6
Milk production	6.0	6.2	3.0	4.8
weaning weight	445	445	507	5.36

As can be seen from the table when the calves were left on the cows and the cows were not fed supplement, for each 1 lb the calf gained the cow lost 2 lb. When the cows were supplemented, for each pound the calf gained the cow lost 0.3 lb. Cows that had calves weaned in September and were supplemented gained 80 lb from September to December, while those that were not supplemented (calves weaned) lost 23 lb. There was a difference of 210 lb in cow weight in these 4 different management and supplementing systems in this trial. There is considerable opportunity of managing cows in early fall to improve or maintain cow condition.

SUMMARY

In summary, as is often stated, usually production should be based on the most economical resources in your area. Many want exact numbers (optimum weaning weight, reproduction rate, etc.), however the most economical return can only be determined with each individual rancher after reviewing his input cost and potential production. Usually, if the rancher is maximizing the use of his resources and if there is a decrease in performance then perhaps his expected production is too high. This may be offset if other nutrient sources, especially energy, can be purchased at an economical figure (at or below his production cost). Thus is not to imply that proper protein supplementation should not be used. In fact, it is in contrast, because proper supplementation, especially protein, allows maximum use of available range resources. Cows should be maintained in adequate condition to assure a relatively good reproductive rate, however maintaining cows in excellent body condition to assure high production and reproduction will be of questionable economic benefit. Meeting the cow's energy requirements can usually be determined accurately enough by using TDN, however if fine tuning is desired and precise quantity and quality can be determined and fed then the net energy system offers several advantages and has the potential to allow us to cut feed cost.