MP 373

Feeding Beef Cows Based on Body Condition Scores

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Table of Contents

Introduction 1

Practical Importance of Body Condition Scoring 1

Body Condition Scores (BCS) 1

Guidelines for BCS 4

Effect of BCS on Body Composition 4

Effect of BCS on Reproductive Performance 4

BCS at Calving 5

BCS at Breeding 5

BCS and Age Affect Pregnancy Rate 5

Grouping Cows Based on BCS 6

Nutritional Management 7

Economics 8

Management Strategies to Improve BCS 8

Summary 9

Portions of this information were assembled and adapted for Arkansas conditions by Dr. George V. Davis, Jr., former Extension livestock specialist, from *Body Condition, Nutrition and Reproduction of Beef Cows* by Dennis B. Herd and L. R. Sprott, beef cattle specialists, Texas A&M University; and *Effects of Body Condition on Productivity in Beef Cattle* by William Kunkle, Robert Sand and D. Owen Rae, University of Florida.

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Feeding Beef Cows Based on Body Condition Scores

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Introduction

The amount and type of supplementation required for satisfactory performance in beef herds is greatly influenced by the body condition or body reserves, both protein and fat, of the cattle.

To optimize performance, body condition scores of cows should fall within a range of 5 to 7 (optimum condition) at the initiation of the calving season and remain in this range throughout the breeding season. To achieve this goal, cows should be condition scored when calves are weaned. Feeding programs should be planned for cows of varying condition so they will reach optimum body condition by the start of the calving season.

Drastic changes in body condition should be avoided so that supplementation of the herd may be minimized. To achieve this, cattle should be matched to the forage supply and management available, and body condition evaluations should be made at various times throughout the year. For spring calving herds, the logical times are:

- Midsummer
- Weaning, in the fall
- 60 days before calving
- Calving
- The beginning of breeding in the spring

Changes in management and the use of supplemental feed may be warranted, even during the summer, to prevent drastic body weight changes. There are few economical ways to increase body condition once winter has arrived.

Practical Importance of Body Condition Scoring

Variation in the condition of beef cows has a number of practical implications. The condition of cows at calving is associated with length of postpartum interval, subsequent lactation performance, health and vigor of the newborn calf and the incidence of calving difficulties in extremely fat heifers. Condition is often overrated as a cause of dystocia in older cows. **The condition of cows at breeding affects their reproductive performance in terms of services per conception, calving interval and the percentage of open cows.**

Body condition affects the amount and type of winter feed supplements that will be needed. Fat, gestating cows may need only mineral and vitamin supplementation. Thin cows usually need very good quality forage or large amounts of supplements high in energy (+70 percent TDN), medium in protein (15 to 30 percent), plus mineral and vitamin supplementation.

Body condition or changes in body condition, rather than live weight or shifts in weight, are a more reliable guide for evaluating the nutritional status of a cow. Live weight is sometimes mistakenly used as an indication of body condition and fat reserves, but gut fill and the products of pregnancy prevent weight from being an accurate indicator of condition. Live weight does not accurately reflect changes in nutritional status. In winter feeding studies where live weight and body condition scores have been measured, body condition commonly decreases proportionally more than live weight, implying a greater loss of energy relative to weight.

Two animals can have markedly different live weights and have similar body condition scores. Conversely, animals of similar live weight may differ in condition score. As an example, an 1,100 pound cow may be a 1,000 pound animal carrying an extra 100 pounds of body reserves, or a 1,200 pound cow which has lost 100 pounds of body reserves. These two animals would differ markedly in both biological and economical response to the same feeding and management regime with possible serious consequences.

In commercial practice, body condition scoring can be carried out regularly and satisfactorily in circumstances where weighing may be impractical. The technique is easy to learn and useful when practiced by the same person in the same herd over several years.

Body Condition Scores (BCS)

BCS are numbers used to suggest the relative fatness or body composition of the cow. Most published reports are using a range of 1 to 9, with a score of 1 representing very thin body condition and 9 extreme fatness (Table 1). Scoring done by different people will not agree exactly; however, scoring is not likely to vary by more than one score between trained evaluators, if a 1 to 9 system is used.

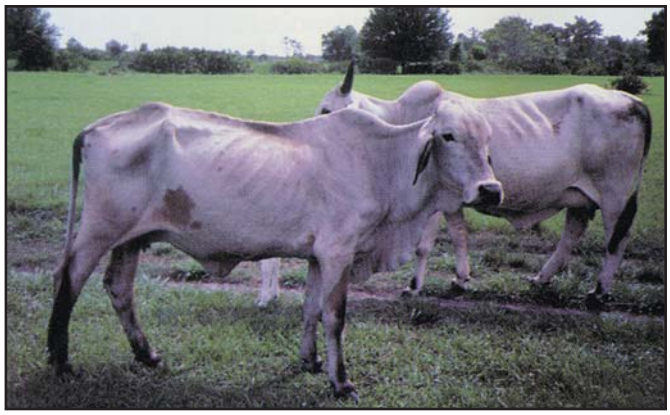
For BCS to be most helpful, producers need to calibrate the 1 to 9 BCS system under their own conditions.

Table 1. Cow Body Condition Score (BCS).

Condition Score	Appearance of Cow[a]
1	Emaciated – Bone structure of shoulder, ribs, back, hooks and pins sharp to touch and easily visible. Little evidence of fat deposits or muscling.
2	Very thin – Little evidence of fat deposits but some muscling in hindquarters. The spinous processes feel sharp to the touch and are easily seen, with space between them.
3	Thin – Beginning of fat cover over the loin, back and foreribs. Backbone still highly visible. Processes of the spine can be identified individually by touch and may still be visible. Spaces between the processes are less pronounced.
4	Borderline – Foreribs not noticeable; 12th and 13th ribs still noticeable to the eye, particularly in cattle with a big spring of rib and ribs wide apart. Full but straightness of muscling in the hindquarters. The transverse spinous processes can be identified only by palpation (with slight pressure) to feel rounded rather than sharp.
5	Moderate – 12th and 13th ribs not visible to the eye unless animal has been shrunk. Areas on each side of the tail head are fairly well filled but not mounded. The transverse spinous processes can only be felt with firm pressure to feel rounded – not noticeable to the eye. Spaces between processes not visible and only distinguishable with firm pressure.
6	Good – Ribs fully covered, not noticeable to the eye. Hindquarters plump and full. Noticeable sponginess to covering of foreribs and on each side of the tail head. Firm pressure now required to feel transverse process.
7	Very good – Abundant fat cover on either side of tail head with some patchiness evident. Ends of the spinous processes can only be felt with very firm pressure. Spaces between processes can barely be distinguished at all.
8	Fat – Animal taking on a smooth, blocky appearance; bone structure disappearing from sight. Fat cover thick and spongy with patchiness likely.
9	Very fat – Bone structure not seen or easily felt. Tail head buried in fat. Animal's mobility may actually be impaired by excess amount of fat.

[a] Adapted from Herd and Sprott, 1986.

BCS 1



BCS 4

BCS 7

BCS 2

BCS 3

BCS 5

BCS 6

BCS 8

BCS 9

Guidelines for BCS

Keep the program simple. A thin cow looks very sharp, angular and skinny, while a fat one looks smooth and boxy with bone structure hidden from sight or feel. All others fall somewhere in between.

Fat deposits are visible over the back, tail head, pins, hooks, ribs and brisket of cattle (Figure 1). A BCS of 5 should look average – neither thin nor fat. Once you have established what a BCS 5 looks like, it is much easier to determine variations from this. For cattle with long hair, handling the cattle over the back and ribs and feeling the flesh over the transverse processes can be helpful. Keep in mind that shrink can alter the look and feel of the cattle as much as one score. Animals in late pregnancy also tend to look fuller and a bit fatter.

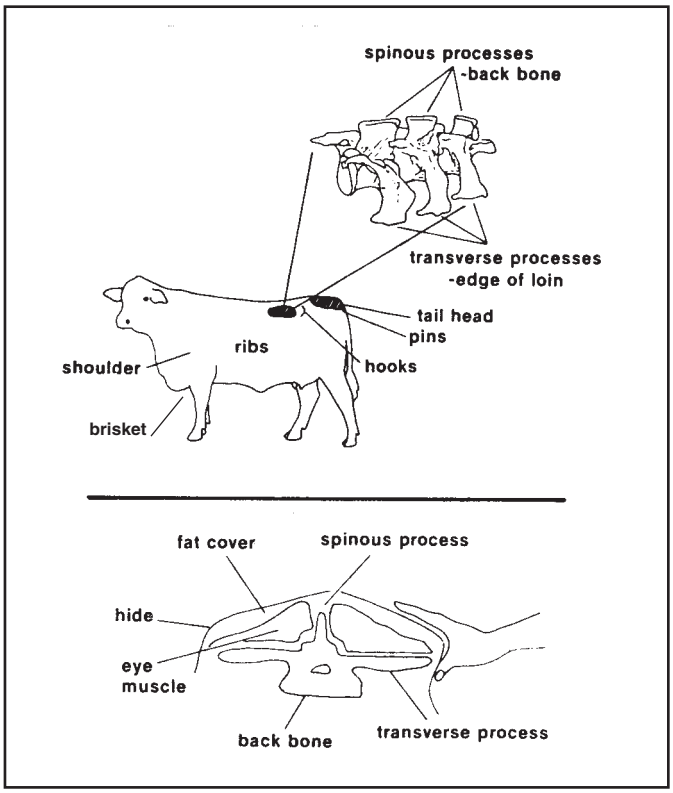


Figure 1. Anatomic areas that are used for scoring body condition in beef cows.

Effect of BCS on Body Composition

The body weight change in protein and fat for different body condition scores is illustrated in Figure 2. Gain or loss in body condition (energy reserves) primarily involves fat. When body condition score falls below 5, cows will lose muscle tone because less fat is available to supply energy to sustain vital bodily functions and the cow begins to mobilize muscle. Since many factors affect a cow's weight (stage of pregnancy, frame size) in addition to body condition, body condition scoring is a more reliable measure of nutritive reserves than weight alone.

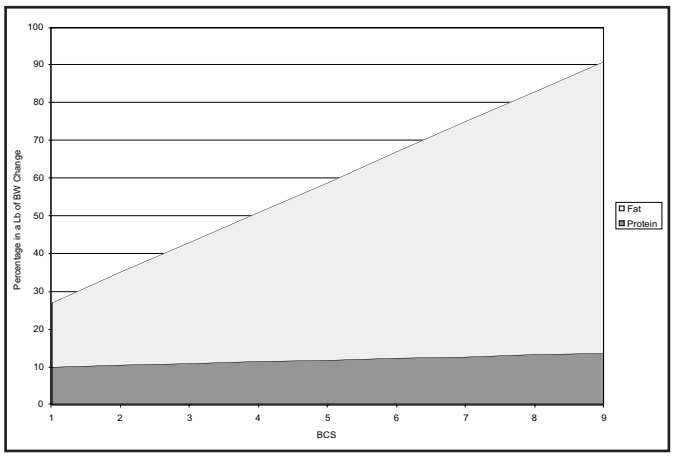


Figure 2. Percentage protein and fat in body weight change for each body condition score.

Effect of BCS on Reproductive Performance

Calving Interval and Profitability

Calving interval is defined as the period from the birth of one calf to the next. To have a 12-month calving interval, a cow must rebreed within 80 days after the birth of her calf. Cows that do, produce a pound of weaned calf cheaper than cows that take longer than 80 days to rebreed.

Trials have shown that thin cows may take up to 200 days to rebreed. Cows requiring that long to rebreed will not have a 12-month calving interval, which subsequently reduces total herd production and profitability.

Calving intervals in excess of 12 months are often caused by nutritional stress on the cow at some point, either before the calving season or during the subsequent breeding season. This results in thin body condition and poor reproductive performance. The relationship of body condition to calving interval is shown in Figure 3. The thinnest cows have the longest calving intervals, while fatter cows have shorter calving intervals. Producers should evaluate cows for condition and apply appropriate supplemental feeding practices to correct nutritional deficiencies which are indicated when cows become thin. These deficiencies must be corrected or reproductive efficiency will remain low for cows in thin body condition.

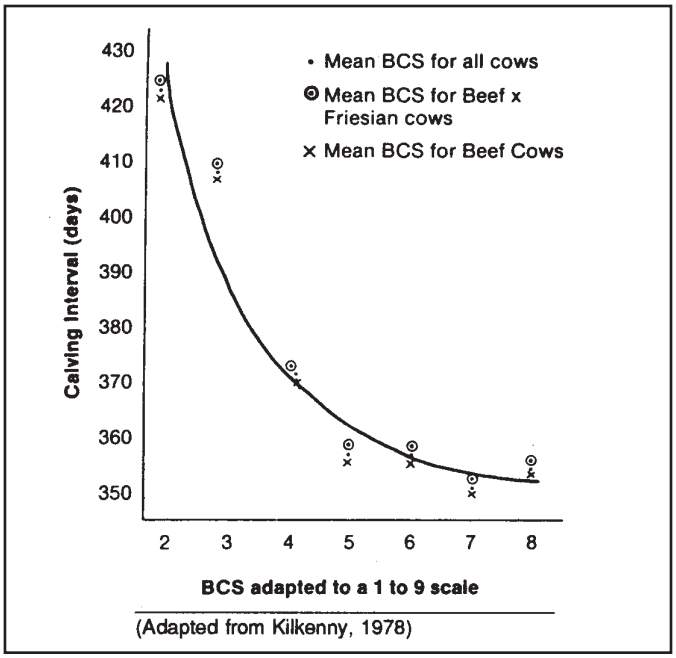


Figure 3. Relationship between cow body condition score at mating and subsequent calving interval.

BCS at Calving

The effect of body condition at calving on subsequent reproductive performance is shown in Table 2. The percentage of cows that had been in heat within 60 or 90 days after calving was lower for cows with a body condition of 4 or less than for cows scoring more than 5. Low body condition leads to low pregnancy rates. Cows scoring less than 5 at calving time had the lowest pregnancy rates, indicating that thin condition at calving time is undesirable. The acceptable body condition score prior to calving is 5 to 7. These should be the target condition scores at calving for all cows in the herd. Anything higher than 6 may or may not be helpful. Scores at calving of less than 5 will impede reproduction. Developing cows on a higher plane of nutrition to achieve the desired (5 to 7) body condition at calving will not result in calving difficulties from increased fetal size.

Table 2. Effect of body condition at calving on subsequent reproductive performance.

	Body Condition at Calving		
	4 or less	5 or 6	7 or more
Number of cows	272	364	50
Percent in heat within			
60 days after calving	46	61	91
90 days after calving	66	92	100

Adapted from Whitman, 1975.

BCS at Breeding

Cows should be in optimum condition at calving and should maintain that body condition during the breeding period. Table 3 shows results of a trial involving more than 1,000 cows where the effect of body condition during the breeding season on pregnancy rates was studied. That trial supports the fact that condition scores of less than 5 during breeding will result in extremely low pregnancy rates. Proper nutrition during the breeding season is necessary for acceptable reproduction. Cattle in excessive body condition have been shown to have a higher percentage cycling early in the breeding season; however, overall pregnancy rates were lower for these cattle, suggesting excess body condition may be detrimental to overall herd reproductive performance.

Table 3. Effect of body condition during the breeding season on pregnancy.

	Body Condition During Breeding		
	4 or less	5	6 or more
Number of cows	122	300	619
Percent pregnant	58	85	95

Sprott, 1985.

BCS and Age Affect Pregnancy Rate

Young cows (first three calves) that are thin have shown lower pregnancy rates than mature cows (Table 4). This emphasizes the importance of maintaining a BCS of 5 or higher in young cows. First-calf heifers should have a BCS of at least 6 at calving time.

Table 4. Pregnancy rate (%) related to age and body condition score of beef cows[a].

Calving Opportunity[b]	Body Condition Score[c]			Weighted Average
	≥3	4	≥5	
1	20	53	90	84
2	28	50	84	71
3	23	60	90	85
4-7	48	72	92	87
8	37	67	89	74
Weighted Average	31	60	89	82

[a] Rae et al., 1993, *Theriogenology* 39:1143; Body condition scored at pregnancy testing.
[b] Number of calving opportunities, present age minus age at first calving (years).
[c] Body condition scored at pregnancy testing from 1 to 9, 3 = thin, 4 = borderline, 5 = moderate.

Grouping Cows Based on BCS

At calf weaning time, a typical Arkansas herd would usually have cows with BCS of 4, 5, 6 and 7 with possibly a few 3's and 8's. The cows should be assigned to groups for feeding to encourage the weight changes needed (Table 5) to have all cows with BCS of 5 to 7 by calving time.

Table 5. Weight changes needed by calving time and general feed recommendations for beef cows.

BCS	Recommendations
1	Needs to gain 350 lb (cull)
2	Needs to gain 300-350 lb (cull)
3	Needs to gain 200-300 lb, improved ration, grain needed
4	Needs to gain 150-200 lb, improved ration, excellent forage
5	Needs to gain weight of fetus (100 lb), good forage
6	Needs to gain weight of fetus (100 lb), good forage
7	No weight gain needed, fair forage
8	Needs to lose 50-100 lb, limit ration, too fat to calve
9	Needs to lose 100-200 lb, may need to be culled, usually low in fertility.

Ideally, with unlimited resources, cows representing each BCS in the herd would be assigned to a separate group for feeding. However, this is usually impractical in Arkansas herds due to small herd size, inadequate facilities, etc. Often a more practical method would be to separate cows into two or three groups. If only a few cows have BCS of 3 and/or 8, cows could be assigned to two groups: one group consisting of BCS 3, 4 and 5, and another group with BCS 6, 7 and 8. When several cows have BCS of 3 and/or 8, if feasible, the herd should be divided into three groups as follows: 3's and 4's, 5's and 6's, and 7's and 8's.

Supplemental Feeding Based on BCS

Regular use of BCS will help evaluate the body composition or fatness of cattle in a fairly accurate and rather easy manner. Cows that score 5 or greater and still have reproductive problems likely have a mineral or vitamin deficiency, disease or genetic problem, or the problem may exist with the bull. Cows scoring less than 5 may not be receiving adequate levels of energy (total digestible nutrients, TDN) and protein, although other factors such as phosphorus and internal parasites may be involved. A combination of these nutritional problems is frequently observed.

In a commercial cow-calf program, the energy requirement of the cow and calf should come from forage produced on the operator's farm or ranch. Purchasing large amounts of energy supplements on a regular basis is not economically feasible. A cow's energy deficit periods must be satisfied from body stores established during periods of surplus forage. Protein, mineral and vitamin supplements facilitate this process efficiently from both a biological and economical basis.

Body condition significantly alters the requirement for TDN and slightly alters the need for protein, but it is not a determining factor of mineral or vitamin supplementation (Table 6). Mineral supplementation with emphasis on salt, calcium, phosphorus, magnesium and microminerals is advisable in all situations. Vitamin A supplementation may not be needed with excellent forage, unless it is hay stored for a lengthy period. Vitamin A should be supplemented, especially for lactating cows, with lower quality forages regardless of body condition.

Table 6. Forage (ration) crude protein and total digestible nutrient level required by dry, pregnant, mature cows of varying body condition to reach or maintain optimum body condition by calving in 90 or 120 days. (For cows that should weigh 1,100 lb at body condition score of 5.)

	Body Condition				
Nutrient[a] and Days to Calving	3	4	5	6	7
Crude protein, %[b]					
90 days	9	8.5	8	7.5	7.5
120 days	9	8.5	7.5	7.5	7.5
Total digestible nutrients, %[b]					
90 days	64	59	53	51	48
120 days	61	57	52	50	48

[a] Nutrient requirements based on 1996 National Research Council recommendations
[b] Dry-matter basis

All cattle, fat or thin, need protein supplementation to consume and utilize low quality forage with any degree of effectiveness. Protein supplementation is recommended with low quality forage regardless of the BCS or lactation status of the cow. The efficiency of response to protein supplementation is normally greater than that to energy.

Numerous supplemental feeds are available in a variety of different forms. None of the supplements are best suited for all situations. The body condition of the cow, lactation status and quality of

Table 7. Pounds of feed needed daily for 90 days by a mature, 1,100 pound cow (last 1/3 of gestation) of varying body condition, when fed forage of varying quality, to reach optimum body condition of 5 to 7 by the start of the calving season.

Item	Hay or Pasture Quality, Percent Composition on Dry-Matter Basis											
	Very Good 13% Crude Protein 57% TDN				Good 10% Crude Protein 53% TDN				Poor 7% Crude Protein 47% TDN			
Condition score of cows	3	4	5 or 6	7	3	4	5 or 6	7	3	4	5 or 6	7
Cow weight, lb	954	1022	1100 or 1191	1300	954	1022	1100 or 1191	1300	954	1022	1100 or 1191	1300
Daily weight gain, lb[1]	2.5	1.7	0.9	0	2.5	1.7	0.9	0	2.5	1.7	0.9	0
Required by cow[2]												
Crude protein, lb	2.0	1.9	1.8	1.7	2.0	1.9	1.8	1.7	2.0	1.9	1.8	1.7
TDN, lb	14.5	13.2	12	11	14.5	13.2	12	11	14.5	13.2	12	11
Daily ration, lb[3] per head												
Hay or pasture, lb	21	25	25	23	18	22	26	24	16	19	22	26
Cottonseed meal, lb	---	---	---	---	---	---	---	---	1	0.5	0.5	0.5
Corn, lb	5.5	1.5	---	---	8	4	---	---	9.5	7	3.5	---

[1] Weight gain includes 0.9 pound daily fetal growth.
[2] Based on 1996 National Research Council recommendations.
[3] Eighty-seven percent dry-matter basis. Rations were formulated based on an average daily dry matter intake (DMI) of 22.5 pounds.

forage are major factors to consider in choosing a supplement. The influence these factors have on supplementation requirements is illustrated in Table 7 for a cow that weighs 1,100 pounds at BCS 5. Producers should remember that other factors also influence nutritional requirements, such as weight, mature size, breed type, milk production level and environmental stresses.

Nutritional Management

Many cows in Arkansas need a higher level of condition at calving and breeding to improve reproductive performance and income. Grain feeding can be used to maintain or increase body condition, but this approach has economic limitations.

In spring calving herds, fall-seeded small grain pasture is often used as an economical source of feed nutrients to improve body condition of cows prior to calving. Other feed sources such as chicken litter and corn, crop by-products, feed grains and supplemental protein sources may also be used when forage supplies are inadequate.

To optimize herd performance, producers should choose a calving season that complements their forage program, use a good mineral and consider protein supplementation whenever forage protein is less than 7 percent on a dry-matter basis (e.g., summer drought pasture, etc.). Since protein supplementation stimulates the intake and digestion of low protein forage (<7 percent), body condition can be improved on droughty summer pasture and condition losses can be decreased. This approach minimizes the amount and expense of energy supplementation but may not eliminate it completely. Where minerals, vitamins and protein are furnished in adequate amounts but body condition continues to decline, large amounts of energy supplementation will be required to stop further decline or to produce an improvement. Because combinations of low quality forage and high starch grain (supplement < 0.5% body weight) are used so inefficiently, it would be more economical to produce or buy a higher quality forage when high levels of animal performance are desired.

If the requirement for energy supplementation is a yearly necessity, a change in management is necessary. The supply of nutrients from forage must be increased, both in quality and quantity, or the nutritional requirements of the cattle must be reduced (cattle with less milk potential and probably smaller in size). The stocking rate of many herds needs to be reduced to allow a greater volume of forage for each animal, thus reducing the need for excess supplement.

Economics

Cows with a BCS less than 5 bring in significantly lower income from calves produced. Body condition score is related to pregnancy rate (Table 3), calving interval (Figure 3), calf daily gain and calf age at weaning. Kunkle et al summarized data from several research trials to determine yearly income per cow as influenced by BCS (Table 8). Estimated TDN requirements were determined for cows with BCS 3 and 4 to reach BCS 5 by calving. Also, the amount of TDN saved by a decrease in BCS from 6 to 5 was determined. Estimated feed costs were used to determine the increased income per cow due to feeding cows with BCS of 3, 4 and 6 to reach BCS 5 by calving (Table 8).

Yearly income for BCS 3 and BCS 4 cows increased by $161 and $93, respectively, when they were fed to reach BCS 5 by calving. Allowing BCS 6 cows to lose weight to reach BCS 5 by calving decreased income per cow by $14. Due to reduced performance of thin cows, providing adequate nutrition for cows with BCS of 3 and 4 usually pays significant dividends. However, increases in income from improving BCS will vary in different situations. Therefore, additional supplement cost required to change body condition needs to be critically evaluated to make sure that more than $1 of income will be returned for each $1 in additional expenses.

Management Strategies to Improve BCS

Proper management of cattle and feed resources is the key to successful cattle production and profit. Several management strategies that may help maximize profit include:

- Target a calving season that fits the forage, supplements, marketing plan and management.
- Adjust stocking rate to ensure adequate forage during the stocking rate limiting months.
- Provide a good mineral free-choice all year.
- Control parasites and diseases.
- Cull open and poor producing cows.
- Group cattle by age and nutritional needs. May need to separate the following groups for part or all of the year.
  - Weaned heifers
  - Yearling heifers
  - First-calf heifers
  - Young cows
  - Mature cows
- Test forage, especially hay, for nutritive value. Provide highest quality forage to animals with the greatest nutrient needs. Supplemental protein and energy may also be needed.
- Develop replacement heifers to BCS of 6 by calving time. Provide adequate protein and energy (TDN) to young cows to improve breeding rate. This may require managing first and second calf cows in separate herds during the winter.

Table 8. Relationship of body condition score to beef cow performance and income.

Body Condition Score	Pregnancy Rate, %[a]	Yearly Income Per Cow[a]	Yearly Income Per Cow, Gain (+) or Loss (-) vs. BCS 5	Lb TDN Required to Reach BCS 5[b]	Feed Cost Per Cow to Reach BCS 5[c]	Increased Yearly Income Per Cow by Reaching BCS 5
3	43	$142	-$187	348	$26	$161
4	61	$222	-$107	186	$14	$93
5	86	$329	$0	–	–	–
6	93	$356	$+27	-175	-$13	-$14

[a] Kunkle et al.
[b] Based on 1996 National Research Council feed requirements
[c] Feed cost based on TDN at $7.50 per cwt.

- Evaluate body condition of the herd at various times throughout the year, and make needed nutritional management changes. Special consideration should be given to evaluating body condition at the following times:
  - One month prior to weaning calves. If cows are thin, consider weaning the calves earlier than normal.
  - At calf weaning time, cows with a BCS less than 5 should be assigned to one or more groups based on BCS. Provide high quality forage or supplemental energy and protein as needed to reach BCS 5 by calving. Cows with a BCS greater than 7 should be fed to lose condition to BCS 7 by calving time (refer to Table 5).
  - 60 days prior to calving. Fine-tune the feeding program for cows to reach BCS 5 or greater by calving. Maintain BCS 5 or above through the breeding season.

Summary

A BCS of 5 to 7 at calving and through breeding is required for good reproductive performance. Overstocking pastures is a common cause of poor body condition and reproductive failure. Proper stocking, year-round mineral supplementation and timely use of protein supplements offer the greatest potential for economically improving body condition scores and rebreeding performance of beef cows in Arkansas. Sorting cows by condition 90 to 120 days ahead of calving and providing adequate nutrients so that all cows will calve in BCS 5 to 7 will maintain high reproductive performance and increase income. Nutritional and reproductive decisions, so important to profitability, are made with more precision and accuracy when a body condition scoring system is routinely used.