SDSU Extension

BEEF

Chapter 4

Influence of Body Condition on Reproductive Performance

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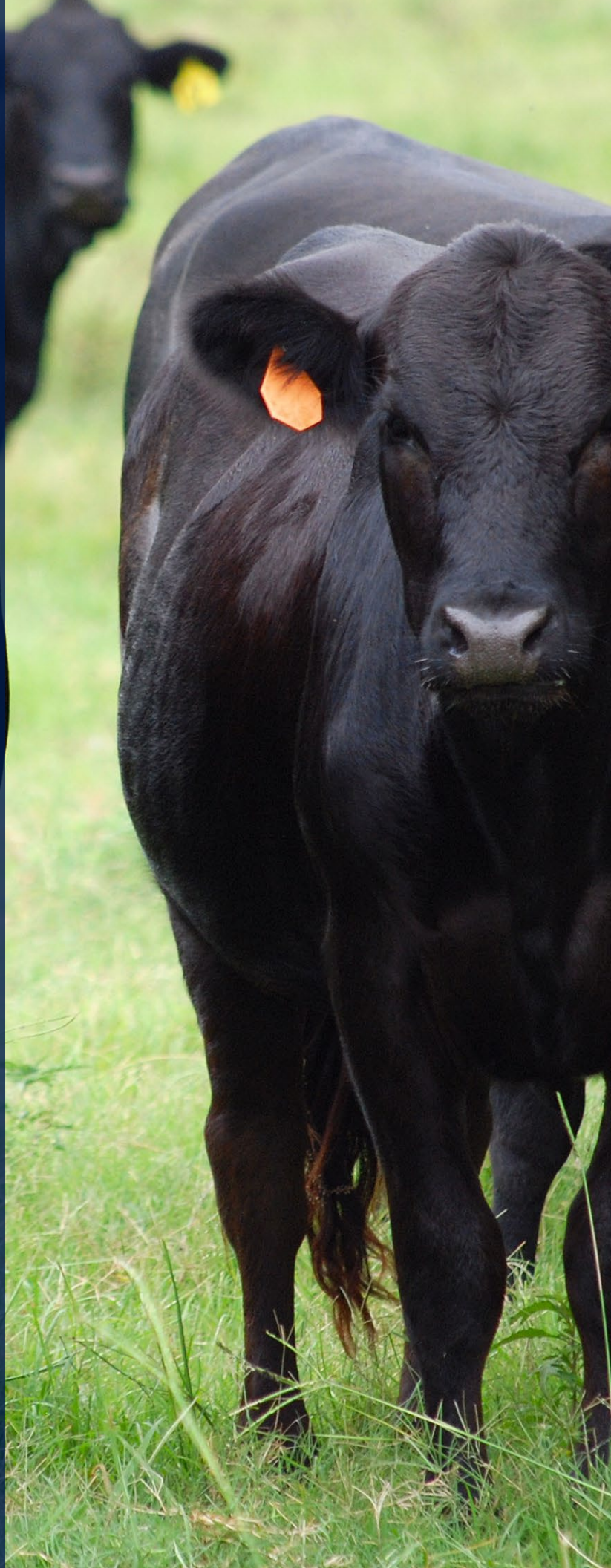

Chapter 4:

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Introduction

It has been understood for decades that reproductive performance is the most important aspect affecting production efficiency of a cow-calf enterprise. To maintain a calving interval of 365 days, a cow must re-breed in 80 to 85 days after calving. The priorities of nutrient utilization in a beef cow are: body maintenance, growth, lactation, fetal growth, breeding, and body reserve according to Short et al. (1990). The energy reserves of the beef cow at calving (body condition score) has been identified as the single most important factor affecting postpartum interval to estrus and rebreeding success in beef cows.

What Are Body Condition Scores?

Body condition scoring (BCS) is an effective management tool to estimate of the energy reserves of the cow. The most commonly used BCS system for beef cattle in the United States uses scores from 1 to 9 (Table 1), with 1 being emaciated and 9 being obese (Whitman, 1975). Examples of cows in BCS of 3, 5 and 7 are shown in Photo Sets 1 to 5. Using BCS to evaluate cattle does not require any special equipment and can be conducted anytime during the year.

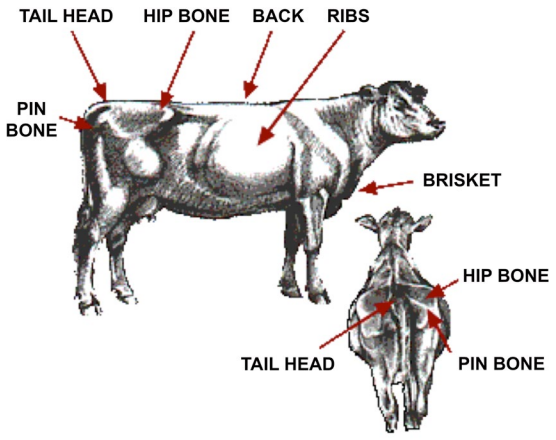

Figure 1: Key evaluation locations to assess body condition. *Adapted from Rasby, 2013*

Key Points

- Body condition scoring provides a method or index of the energy reserves of cows.
- Body condition score affects how quickly cows rebreed and consequently reflects ranch income.
- Managing body condition to avoid over- and under-feeding helps producers control costs and optimize production.

Table 1: Key points for condition scoring beef cows. *Adapted from Pruitt and Momont, 1988*

Reference Point:	Condition Score								
	1	2	3	4	5	6	7	8	9
Physically weak	Yes	No	No	No	No	No	No	No	No
Muscle atrophy[a]	Yes	Yes	Slight	No	No	No	No	No	No
Outline of spine visable	Yes	Yes	Yes	Yes	Slight	No	No	No	No
Outline of ribs visable	All	All	All	3-5	1-2	0	0	0	0
Fat in brisket and flanks	No	No	No	No	No	Some	Full	Full	Full
Outline of hip and pin bones visable	Yes	Yes	Yes	Yes	Yes	Yes	Slight	No	No
Fat in udder and patchy fat around tail head	No	No	No	No	No	No	No	Slight	Yes

[a] Muscles of loin, rump and hindquarter are concave, indicating loss of muscle tissue.

Assessment can be done using visual indicators or palpation of the key bone structures for fat cover. Ideal times to palpate cows for fat cover are when cows are going through a chute for processing. The areas to evaluate include the backbone, ribs, hips, pinbones, tailhead, and brisket (Figure 1). Palpating cows for fatness along the backbone, ribs, and tailhead is not always necessary, but will help improve visual assessment skills and provide additional information to increase accuracy of assessments. Table 1 is an excellent tool for help in assessing BCS.

Effects of BCS on Cow Productivity and Reproduction

Poor body condition is associated with reduced income per cow, increased postpartum interval, increased dystocia, and lower weaning weights. The relationship between a cow's BCS and total income of a cowherd is shown in Table 2 (Kunkle et al., 1994). As BCS decreased, both the pregnancy rates and the weaning weights declined. This combination resulted in dramatic reduction in income per cow exposed. While the calf prices and income per cow represent values from the early 1990's, the same concepts apply and have been shown to be true, regardless of actual calf price.

Morrison et al. (1999) grouped mature beef cows into three groups based on their BCS (≤ 4, 5 or 6, or ≥ 7) ninety days before calving. The groups were all managed so that each cow would calve with a BCS of 5 or 6. They found that pregnancy rates at 20, 40, or 60 days after the start of the breeding season were similar across the three groups. Calf birth weights and weaning weights were also similar. These researchers concluded that a large change in BCS pre-calving did not affect subsequent reproduction as long as the cows had a BCS of at least 5 at calving.

Cow BCS at calving also affects the length of time from calving until the return to estrus, or postpartum interval (PPI). In order to maintain a calving interval of one calf every year, cows need to maintain a PPI of 60 days or less. Houghton et al. (1990) showed that cows with a BCS less than 5 exhibited an extended PPI of over 80 days, which represented a postpartum anestrous interval 28 to 58 days longer than that exhibited by either moderately conditioned or fleshy cows (BCS > 5; Table 3). This and other research have consistently reported that cows in a BCS of at least 5 at calving will maintain a yearly calving interval.

Table 2: Relationship of body condition score (BCS) to beef cow performance and income. *Kunkle et al., 1994*

BCS	Pregancy rate, %	Calving interval,d	Calf ADG, lb.	Calf WW, lb.	Calf Price, $/100 lb.	$/Cow Exposed[a]
3	43	414	1.60	374	96	154
4	61	381	1.75	460	86	241
5	86	364	1.85	514	81	358
6	93	364	1.85	514	81	387

[a] Income per calf x pregnancy rate.

Photo 1. Body Condition Score 3

Photo 2. Body Condition Score 4

Photo 3. Body Condition Score 5

Photo 4. Body Condition Score 6

Photo 5. Body Condition Score 8
Photos courtesy Walker and Rusche, 2014

Table 3: Effect of body condition score (BCS) at parturition on postpartum interval (PPI). *Adapted from Houghton et al., 1990*

BCS	PPI, days
3	88.5
4	69.7
5	59.4
6	51.7
7	30.6

Whether a cow calves early or late in the calving season influences the effect of BCS at calving on reproductive performance. Pruitt and Momont (1988) found that early calving cows can be slightly thinner at calving than late calving cows simply because they have additional time to re-cycle and rebreed (Table 4). Early calving cows are defined as cows, which have calved in the first 21 days and late calving cows are defined as any other cows.

Table 4: Effect of body condition score (BCS) on percentage of cows cycling. *Pruitt and Momont, 1988*

BCS*	No. of Cows	% of Cycling Cows		
		May	June	July
Early Calving Cows				
≤4	45	10.0	28.2	70.5
5	84	17.8	43.5	85.6
6	43	41.9	77.5	97.5
≥7	25	45.9	76.6	94.7
Late Calving Cows				
≤4	14	0.0	0.0	44.7
5	41	0.0	26.0	74.4
6	22	0.0	35.3	98.5
≥7	6	0.0	65.8	99.1

* BCS assigned in March prior to calving.

Houghton et al. (1990) also showed that when given the opportunity to gain weight and increase condition following calving, slightly thinner cows (BCS < 5) will have pregnancy rates comparable to cows that calve in moderate condition. They also found that pregnancy rates improved for fleshy (fat) cows losing condition (Table 5). Conversely, cows that were moving away from a BCS 5, (fat cows getting fatter or thin cows getting thinner) were less likely to become pregnant.

Other than the work of Houghton et al. (1990) demonstrating the negative effects of BCS > 7 on pregnancy rates in cows, comparably little research has been done studying the effects of excess body condition on reproduction in beef cows. This likely reflects the relative rarity of fat cows in commercial setting compared to cows that are too thin. Excessively fat heifers, however, are not that unusual, especially when heifers are developed in drylot settings using harvested feeds. It has been demonstrated that heifers developed to a BCS of 7 needed to reach a higher BCS to resume cycling after anestrous compared to heifers developed to reach a BCS 5 (Cassady et al., 2009).

Table 5: Effect of postpartum condition score change on pregnancy rate. *Adapted from Houghton et al., 1990*

BCS status	Pregancy (%)
Thin (<5) & increasing BCS	100
Fleshy (>5) & increasing BCS	75
Thin (<5) & decreasing BCS	69
Fleshy (>5) & decreasing BCS	94
Moderate (4.5-5.5) & maintaining BCS	100

What is the Optimum BCS?

Lamond (1970) proposed the concept of a target BCS at calving. Numerous researchers have studied the minimum BCS for acceptable reproductive performance. Dziuk and Bellows (1983), Richards et al. (1986), Houghton et al. (1990) and Morrison et al. (1999) have all suggested that a BCS of 5 at calving is the critical level affecting subsequent reproductive performance in mature beef cows. For first-calf heifers the critical BCS at calving is generally recognized as 6, to provide an additional safety factor because of longer postpartum intervals associated with first-calf heifers (DeRouen et al., 1994).

When determining the management goals for a ranch, it is important to recognize the optimum BCS can vary from one operation to another, depending upon factors such as management systems and economic conditions. Mulliniks et al. (2012) analyzed the reproductive performance of 2- and 3-year old cows that had BCS of 4, 5, or 6 at the time of calving. The cows had all been managed and raised similarly on a New Mexico research station. These researchers found that there were no differences between the groups in postpartum interval, pregnancy percentage, or calving interval.

They concluded that this population of cows had become adapted to their environment so that they were able to reproduce successfully with a lower BCS. Researchers in Nebraska reported similar results where cows that had a BCS of 4.0 at calving had pregnancy rates similar to cows that had BCS ranging from 4.7 to 5.3 (Stalker et al., 2007). In this case prior to breeding, cows grazed very high quality subirrigated meadows with sufficient nutrient content that cows which had calved at a BCS of 4.0 gained 0.8 BCS units by the start of breeding season. This is consistent with results reported by Houghton (1990) and shown in Table 5.

There is an element of "risk vs. reward" to consider when determining a target BCS. Cows that calved in a BCS of 4.4 had 10 percent fewer live calves at birth and a 12% lower pregnancy rate compared to cows that calved at a BCS of 5.7 (Bohnert et al., 2013). There is also the potential for cumulative carryover effects of lowered BCS. Larson et al., (2009) reported that over a 3-year study in Nebraska, cows in management treatments that resulted in average BCS at calving of less than 5.0 had a later average calving date and fewer calves born in the first 21 days of the calving season, even though overall pregnancy rates were not different. Higher BCS provide a level of insurance against reproductive failure and greater assurance that a yearly calving interval will be maintained, but at a potentially higher feed cost. There is little margin for error with thinner cows, especially those with BCS below 4.5. Managers must consider the resources available and their tolerance for risk as they manage the body condition of their herd (Mathis et al., 2002.) Working with cows with lower BCS may become a cycle in which cows that are thin at calving breed later in the breeding season each year until they do not breed during the defined breeding season.

Utilizing BCS to Improve Cost Effectively Improve Reproductive Performance

The key to maintaining BCS and optimizing reproductive performance is evaluating cows early. Wiltbank (1982) illustrated the concept of weight gain necessary for cows of varying BCS prior to calving (Table 6). Evaluation of cow BCS in mid-gestation when nutrient needs for the developing fetus are low, provides adequate time for weight gain and recovery of body condition. While some increase in condition may still be possible, waiting until the last trimester of pregnancy, when nutrient demands for fetal growth are much higher, puts much more pressure on a feeding system to try to increase cow BCS.

The periodic monitoring of the BCS of a cowherd can be an especially effective tool to help cow calf producers optimize the reproductive performance of their cows while also avoiding excessive feed costs. Some suggestions for how to utilize BCS during various production periods are listed in Table 7.

One of the biggest advantages to evaluating BCS during these critical time periods is providing an early warning system to producers to help guide management decisions. For instance, if cows are unacceptably thin at weaning, that is an indication that there is an imbalance between a ranch's feed resources and the herd's nutrient requirements during lactation. Cows that are too thin at calving would indicate that the herd's feeding program during mid- to late-gestation needs to be re-evaluated.

Sorting cows into groups based on body condition is

Table 6: Necessary weight gains in pregnant cows in different body conditions. *Wiltbank, 1982.*

Body Condition		Weight Gain Needed to Calving, lb				
At Weaning	Needed @ Calving	Calf Growth*	Body Weight, lbs	Total	Days to Calving	ADG, lbs
Thin (<4)	Moderate	100	160	260	120	2.2
Borderline (4)	Moderate	100	80	180	120	1.5
Moderate (5-6)	Moderate	100	0	100	120	0.8
Thin (<4)	Moderate	100	160	260	200	1.3
Thin (<4)	Moderate	100	160	260	100	2.6

* Calf Growth includes calf, fluid and membranes.

Table 7: How to utilize body condition scores at various stages of production. *Blasi et al.*

Production Period	Management
Late Lactation (2 months prior to weaning)	Depending upon current forage availability, supplementations and/or a modified weaning stategy may be necessary. Wean thin cows, especially young and older.
Weaning	Pay particular attention to young cows weaning their first calf and cows beyond their prime age: they are most likely to be thin at this time.
100 days before calving	Last opportunity to gain body condition. Separate thin cows from cows in good condition and increase feed to thin cows.
Calving	If cows are thin, a change in the feeding program is needed. It is expensive to increase condition on thin cows after calving.
Breeding season	If cows are thin at this time, additional supplementation and/or implementation of an early weaning strategy may be necessary.

a sound practice to optimize production and costs. Cows in thin condition (BCS < 4) should be fed at a higher plane of nutrition to reach the desired target. This allows the manager to allocate feed resources to those cattle with the highest probability of a response. Increasing the energy reserves of these cows should result in improved re-breeding next year.

At the same time those cows with a BCS of 5 or greater would not require additional feed inputs to increase their body reserves. This is especially valuable when feed is either scarce or expensive. Providing more inputs into cows that are in moderate or higher condition will generally not increase production enough to justify the additional expense.

How much additional energy is required to change body condition on a cow? The data in Table 8 show the number of megacalories (Mcals) of Net Energy for Maintenance (NEm) that are required to change the body condition scores of beef cows. For example, to change the condition score of a 1200 pound cow from a BCS 3 to a BCS 5 requires a total of 368 Mcals NE over the cow's maintenance requirements (172 Mcals to move from a 3 to a 4 BCS and 196 Mcals to move from a 4 to a 5 BCS.)

The amount of energy needed to add condition is not linear across all BCS. Weight gain on a thin cow consists of a higher proportion of muscle, and muscle contains a high percentage of water, thus the efficiency of weight gain is relatively high. Weight increases in a higher conditioned cow contain a higher proportion of fat, thus requiring more energy for a similar weight gain.

For example, a 1400 pound cow in late gestation would require approximately 12 Mcal NEm to maintain her body condition. If this cow were in a body condition score 4, it would take an additional 264 Mcal to move her to a BCS 5. How much the energy density of the ration needs to increase depends on the length of time available to achieve

Table 8: Megacalories (Mcal) of net energy for maintenance (NEm). *NRC, 2000*

Body Condition Score	Cow Body Weights (Pounds)						
	900	1000	1100	1200	1300	1400	1500
2	114	126	139	151	164	177	189
3	129	143	157	172	186	200	214
4	147	163	180	196	212	229	245
5	170	188	207	226	245	264	283
6	198	220	242	264	286	308	330
7	234	260	285	311	337	363	389
8	280	311	342	373	405	436	467
9	342	380	418	456	494	532	570

Body weights for cow condition scores 1 through 9 are 76.5, 81.3, 86.7, 92.9, 100, 118.1, 129.9 and 144.3 percent of condition score 5, respectively.

the desired increase. Table 9 illustrates how much additional energy per day is required for the 1400 pound cow described above to add one BCS in either 30, 60, or 90 days. If we assume that feed intake for that cow is about 27 pounds per day, feeding her an alfalfa-grass mix hay ration should support adding one BCS if we allow 90 days for that change to occur. Shorter time frames require higher energy densities in the diet. A sixty day period would require feed with similar energy content as 100% alfalfa hay, while adding one BCS in 30 days would require a ration similar to corn silage.

Summary

Body condition scores are an excellent indicator of reproductive performance, with moderately conditioned cows having optimal performance. Evaluating cows/heifer at critical times throughout the year allows producers to make management decisions to change BCS as needed.

Table 9: Impact of feeding period length on energy requirements to change BCS 4 to 5 (for a 1400 pound cow in late gestation).

Energy Requirements	90 Days	60 Days	30 Days
Base Maintenance Requirement (Mcal NEm per Day)	12	12	12
Additional NEm Required to Change Body Condition (Mcal/day)	2.9	4.4	8.8
Diet Energy Density Required (Mcal/pound, assuming 27 pounds intake)	0.55	0.61	0.77

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