

# *Beef Cattle Management Update*

**INFLUENCE OF NUTRITION ON REPRODUCTION  
IN THE BEEF COW HERD**

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## **INTRODUCTION**

The primary goal for cow/calf producers is to obtain one live calf from each cow, every year. Unfortunately most beef cattle operations fail to achieve an annual 100% calving rate. For a producer to ensure that each cow calves on a yearly basis, cows are required to conceive within 83 days after calving. Many beef cattle have not even resumed their estrous cycles by this point. Several factors contribute to delaying the onset of estrous cycles in postpartum cows; however, nutrition and suckling are the two critical factors that tend to dictate when cows begin to cycle. Because most beef cows are suckled within the first few months after calving, nutrition becomes the major component that can be managed to enhance productivity of beef cows.

Similarly, in heifers, age and weight are the primary factors that dictate when a heifer achieves puberty. Without initiating puberty, heifers cannot become pregnant to calve during a set calving season. Heifers must reach an acceptable weight before puberty is obtained. Heifers should be fed to reach approximately 65% of their mature body weight by the beginning of the breeding season. Only a well-managed nutrition program can ensure that acceptable weights are consistently met.

The nutrition/reproduction interaction involves several intricate relationships. From a nutrition standpoint, energy, protein, minerals and vitamins all affect reproduction through various avenues. The hypothalamus, pituitary, and/or the ovaries can be affected by a nutritional deficiency. As beef producers, we must understand the nutrition/reproduction axis to fully appreciate how our cows respond to nutritional management and produce a live healthy calf on a yearly basis.

## **BODY WEIGHT AND CONDITION**

Body condition scoring (BCS) is a reliable method to assess the nutritional status of a cow herd. A visual body condition scoring system developed for beef cattle uses a scale from 1 to 9, with 1 representing emaciated and 9 obese cattle (Whitman, 1975).

A linear relationship exists between body weight change and body condition score (using a 1 to 9 scale), where approximately a 90-lb weight change is associated with each unit change in BCS.

Table 1. Body condition scores and animal appearance at each condition score.

BCS	Condition	Appearance
1	Emaciated	Shoulder, ribs and back are visible
2	Very thin	Some muscle, no fat deposits
3	Thin	Some fat deposits, ribs visible
4	Borderline	Foreribs not noticeable
5	Moderate	12 <sup>th</sup> and 13 <sup>th</sup> ribs not visible
6	Good	Ribs covered, sponginess to tailhead
7	Very good	Abundant fat on tailhead
8	Fat	Fat cover thick and spongy
9	Obese	Extremely fat throughout

Live weight at calving has no effect on reproductive performance, whereas calving condition score is a better indicator than prepartum change in either weight or condition score on the duration of postpartum anestrus (Whitman, 1975; Lalman et al., 1997). When cows are thin at calving or have BCS of 4 or less, increased postpartum level of energy increases percentages of females exhibiting estrus during the breeding season. Likewise, heifers that calve with a BCS of 4, and are fed to maintain weight after parturition, have a reduction in ovarian activity and lower pregnancy rates than to heifers that calve at a similar body condition and gain weight after parturition (Wetteman et al., 1986). Body condition score at parturition and breeding are the dominant factors influencing pregnancy success, although body weight changes during late gestation modulated this effect.

In a recent unpublished study (Figure 1), Stevenson et al. collected blood samples from suckled beef cows at the initiation of the breeding season. Of the 1702 cows in this study only 47.2% of the cows were cycling at the onset of the breeding season. However, as BCS increased the percentage of cows that were cycling also increased. It is important to note that by the initiation of the breeding season, when cows had a body condition of less than 4 only 33.9% percent of those cows had resumed their estrous cycles!

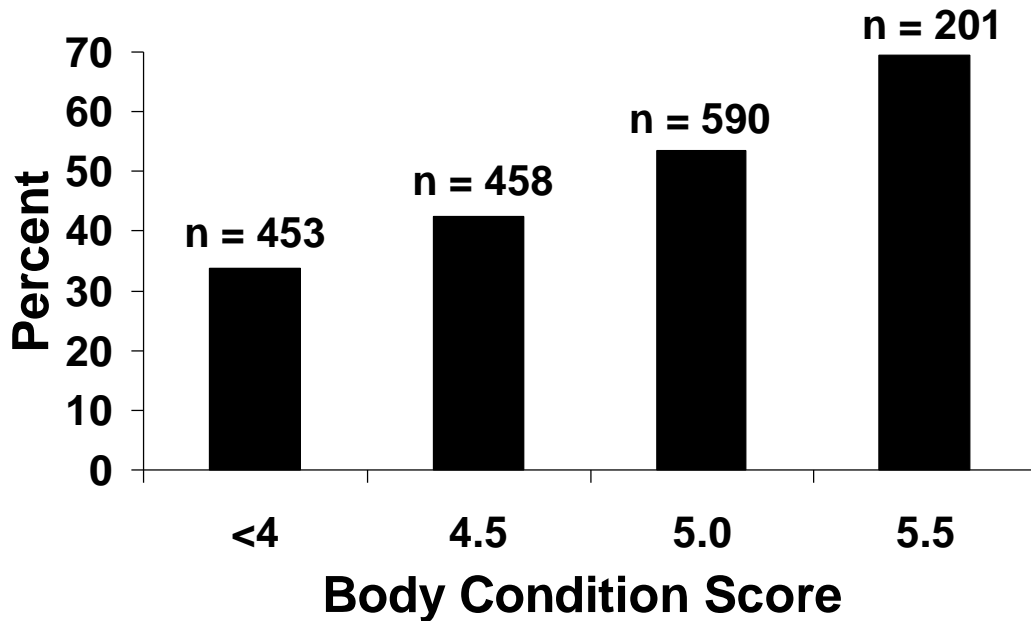


Figure 1. Percentage of cows cycling at various body condition scores (Stevenson et al., unpublished).

## PREPARTUM NUTRITION

Several studies have reported the relationship between nutritional status and reproductive performance in cattle. The general belief is that cows maintained on an increasing plane of nutrition prior to parturition usually have a shorter postpartum interval to their first ovulation than cows on a decreasing plane of nutrition. Energy restriction during the prepartum period results in thin body condition at calving, prolonged postpartum anestrus, and a decrease in the percentage of cows exhibiting estrus during the breeding season. Pregnancy rates and intervals from parturition to pregnancy also are affected by level of prepartum energy.

Some experts have suggested that when prepartum nutrient restriction is followed by increased postpartum nutrient intake, the negative effect of prepartum nutrient restriction may be overcome partially. However, the effectiveness of elevated postpartum nutrient intake may depend on the severity of prepartum nutrient restriction (Lalman et al., 1997). This conclusion concurred with that of Perry et al. (1991) in which prepartum nutrient restriction resulted in 1.8 units loss in BCS during a 90-d prepartum period. Enhanced energy in the postpartum diet reduced, but did not completely abolish, the negative effects of prepartum energy restriction on postpartum anestrus.

Table 2 demonstrates the importance of prepartum nutrition on return to estrous cycles in suckled beef cows. Cows calving in poor condition (i.e., BCS of 3 or 4) had longer intervals before resuming their estrous cycles than cows calving in good condition (i.e. BCS 5 or greater). Remember, for cows to calve on a yearly interval they are to conceive within 83 days after calving; therefore, if cows only reinitiate their estrous cycles at 70 to 90 days postcalving the possibility of a yearly calving interval is vastly reduced.

Table 2. Influence of body condition on return to estrous cycles in beef cows.

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

Houghton et al., 1990.

## POSTPARTUM NUTRITION

Numerous studies document that increasing nutritional levels following parturition increases conception and pregnancy rates in beef cows (Wiltbank et al., 1962; Whitman, 1975). Increasing the dietary energy density increases weight and condition score, in the process decreasing the postpartum interval to first estrus (Lalman et al., 1997). However, few cows fed a high energy diet resume normal estrous cycles by 90 d postpartum. Similarly, suckled beef cows gaining in excess of 1 kg/d while consuming an 85% concentrate diet do not resume cyclic ovarian activity before 70 d postpartum.

To fully appreciate the importance of a sound nutrition program before and after parturition, one must just consider that half the suckled cows in a given herd have not initiated estrous cycles at the onset of the breeding season. For example, Figure 2 represents data from 2041 suckled beef cows (Stevenson et al., unpublished data). Only 51.3% of all cows had initiated estrous cycles by the onset of the breeding season. As the postpartum interval increases, the percentage of cows resuming their estrous cycles also increases; therefore, the blame for poor conception rates during a breeding season may result more from anestrus rather than an artificial insemination technician, bull, or synchronization program. The simplest method to overcome anestrus is to ensure that cattle are maintained on a sound nutrition regimen.

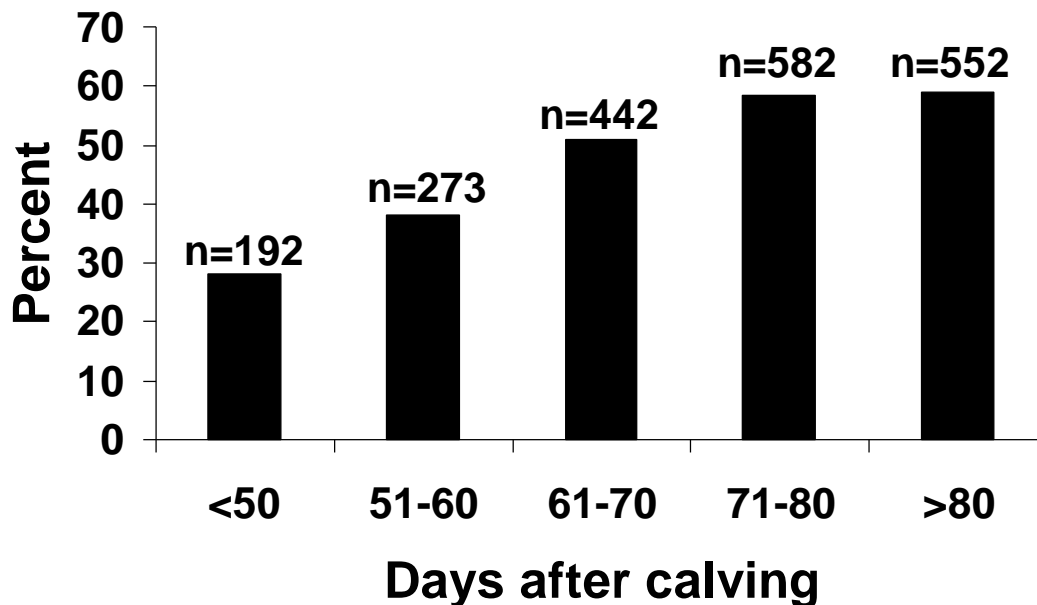


Figure 2. Percentage of cows cycling at selected intervals after parturition.

## ENERGY BALANCE

Energy balance is defined as the net energy that is consumed minus net energy required for maintenance and production. Insufficient intake of energy, protein, vitamins, and micro- and macrominerals have all been associated with suboptimal reproductive performance. Of these nutritional effects on reproduction, energy balance is probably the single most important nutritional factor related to poor reproductive function in cows during the periparturient period. During the first 4 to 10 wk postpartum, at least 92% of dairy cows experience a period of negative (Zurek et al., 1995). This nutritional state occurs because cows are unable to consume adequate dry matter to provide sufficient nutrients to support maintenance, lactation, and reproductive functions. Short and Adams (1988) prioritized the metabolic use of available energy in ruminants ranking each physiological state in order of importance, as follows: 1) basal metabolism; 2) activity; 3) growth; 4) energy reserves; 5) pregnancy; 6) lactation; 7) additional energy reserves; 8) estrous cycles and initiation of pregnancy; and 9) excess energy reserves. Based on this list of metabolic priorities for energy, reproductive function is compromised during the period of negative energy balance because available energy is directed towards meeting minimum energy reserves and milk production.

Generally, beef cows do not experience a period of negative energy balance because they fail to produce the quantity of milk that dairy cows produce; however, several studies in dairy cows have determined the effect of energy balance on reproductive parameters. Most dairy cows experience a negative energy balance that reaches a nadir within the first 2 weeks after calving (Zurek et al., 1995), with ovulation usually occurring approximately 10 to 15 days after the nadir (Zurek et al., 1995). Days to first ovulation are correlated with energy balance nadir. In addition, milk fat percentage is elevated during the first and second week after calving and declined gradually, simultaneously with decreasing negative energy balance (Zurek et al., 1995). Milk fat percentage also is correlated positively ( $r = 0.61$ ) with declining energy deficit, and may be an indicator of the degree of energy deficit (Zurek et al., 1995). Negative energy balance also has been implicated to cause amenorrhea in athletic women.

## MANAGEMENT

Figure 3 sketches the production cycle of a cow. Shortly after weaning, beef cows should be in mid gestation. This is the period at which producers can manipulate the diet to either increase or decrease a cow's condition. At this point, cows require very little in terms of nutrients to maintain their metabolism. If cows are in poor condition there is no better stage to adjust a cows feed regimen to increase her condition.

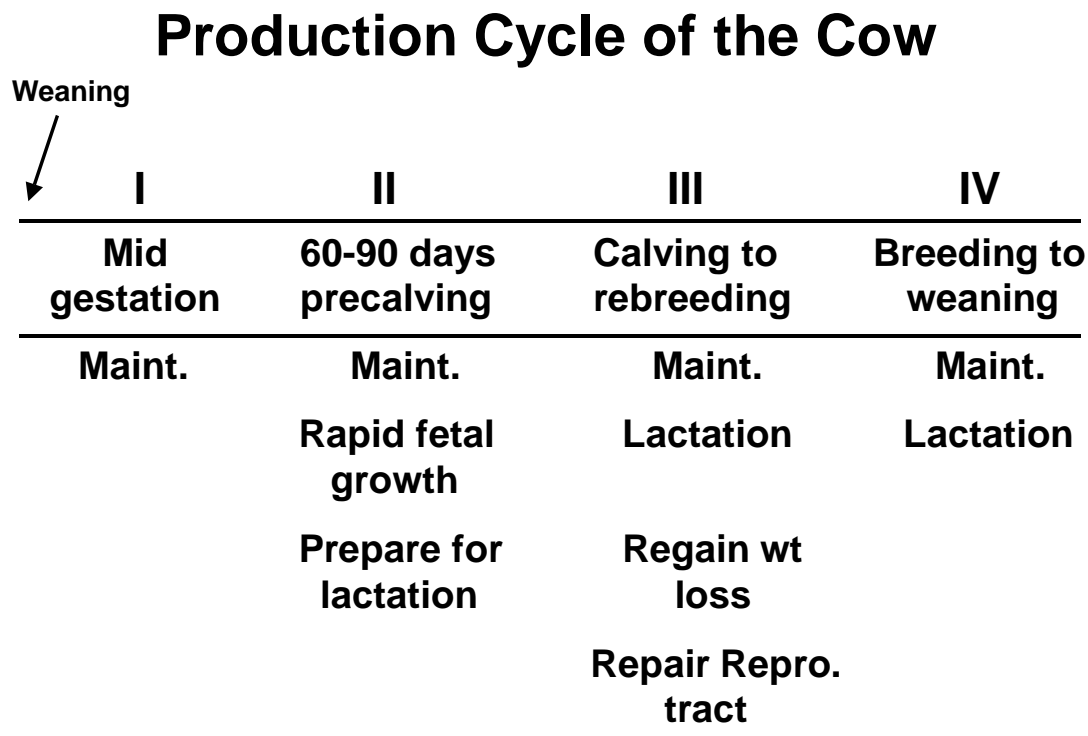


Figure 3. Production cycle of a beef cow emphasizing important nutritional and reproductive requirements.

During stage two, the fetus begins to grow rapidly (up to a pound of gain a day shortly before parturition). In addition, cows also require several other physiological mechanisms to occur to prepare a cow for lactation. Therefore, adjusting a cow's condition requires more feed and very often occurs during the worst part of winter when feed quality tends to be poorer and supplementation becomes expensive. The period of greatest nutritional need is stage three, shortly after calving. A cow is required to produce milk for a growing calf, she must regain any weight lost shortly before and after parturition and finally repair her reproductive tract in order to become pregnant within three months after birth. During this stage a cow usually is consuming as much feed as she can to support herself. Adjusting condition at this stage often is futile. Cows usually are grazing and tend to consume their full protein, vitamin and mineral requirements; however, the grass is often lush and wet which occasionally can cause a deficiency in energy.

During stage four of a cow's production cycle, lactation requires the majority of nutrients, but condition can be manipulated here with some innovative feeding practices.

## **CONCLUSION**

Our primary objective, as beef cattle producers, is to produce one live calf from every cow once a year. Many factors account for the failure of cows to maintain that yearly calving interval. The nutrition/reproduction interaction is a complex system involving many interactions between nutritional components and physiological signals, but is still the most responsible interaction for the equilibrium between feeding cows sufficiently to conceive and maintaining that pregnancy until term without utilizing excess resources that eliminate potential profits. Every producer experiences different challenges in an attempt to optimize profitability of their herds, yet without a full appreciation of the delicate balance between nutrition and reproduction many operations fail to achieve optimal production from their cows.

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