Early Weaning and Reproductive Performance of Beef Cows

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Introduction

Calves reared in conventional beef production systems are weaned from their dams at 180 to 220 days of age. Early weaning is typically applied when calves are 60 to 150 days of age. The immediate result of early weaning is the premature end of milk production by the dam and reduced nutrient needs as a result of the female transitioning from lactation to a non-lactation status. The resource-sparing effects of early weaning are a result of this event: nutrient requirements of the dam decreases, intake of forage decreases, and stocking rate decreases. Cow performance can be conserved through improved body condition, reduced postpartum anestrous interval, and maintenance of a 12-month calving interval. Early-weaned calves can be managed such that their body weights at 205 days of age are similar to or greater than those of conventionally weaned calves.

In a ranch setting, a reduction in range forage production/quality has consequences. Reduced reproductive performance associated with poor body condition is a concern (Lusby et al., 1981). A greater concern is damage to range resources that can take years to repair (Heitschmidt, 2004; Smart et al., 2005). Management strategies that spare forage resources and reduce the nutrient requirements of females during the breeding season can mitigate the effects of lower range production that can occur during a drought.

The primary benefits of early weaning of beef calves as a management strategy are: 1. to reduce grazed forage demand when forage is limited; 2. enhance reproductive performance, typically when beef females are thin at calving, and; 3. to manage body condition of beef females prior to calving.

Forage Sparing Effect of Early Weaning

Early weaning provides an opportunity to reduce demand for pasture forage and other feed stocks during conditions such as drought (Hammes et al., 1970; Harvey et al., 1975; Rasby, 2007).

Heitschmidt (2004) reported that a majority of the variation in annual range forage production in the Northern Great Plains (i.e., approximately 66%) was explained by the total precipitation during the months of April and May. Smart et al. (2005) reported similar results. It was estimated that 79% of annual production by perennial grasses in the Northern Great Plains was achieved by July 1 during 2 out of every 3 years. In 19 out of 20 years, 65% of annual perennial grass production was achieved by July 1 (Heitschmidt, 2004).

Rainfall information and timely forage production measurements can be used in concert to judge whether implementation of a drought mitigation strategy is warranted. Ranchers need only to access historical precipitation information for their area and to be willing to collect annual measurements of forage productivity on or near July 1. In this model of management, July 1 becomes what is known as a trigger date for drought-related decisions (Mousel, 2007).

Mosley (2002) proposed that the following relationship could be used to estimate forage yield for a given year:

$$\frac{\text{Total precipitation in April, May, June}}{\text{Median total precipitation in April, May, and June}} = \text{Annual Forage Yield (\% of median)}$$

Annual forage yield can be measured in several ways (Mousel, 2007); ranchers should contact local conservation agents, extension agents, or beef industry consultants to determine a method that best suits their needs. Forage productivity estimates should be collected from the same general locations and range sites each year. If possible, forage condition should be further documented by taking photographs from fixed reference points each year (e.g., looking down a fence line from a specific point; Smart et al., 2005; Mousel, 2007). Forage yield estimates collected on July 1 represent conservatively about 80% of annual forage yield (Heitschmidt, 2004).

Table 1. Conception rate, postpartum interval, and calf performance at normal weaning time (October 11) for spring calving very thin first-calf Hereford heifers and their dams.

Item	*Normal Weaning 7 months of age*	*Early Weaning[a] 6 to 8 weeks of age*	*Difference*
Conception rates, %	59	97	38
Calving to conception, days	91	73	18
Cyclic at 85 days postpartum, days	34	90	56
Weight at normal weaning, lb	788	875	87
Calf weight at normal weaning, lb	373	374	1

[a]Early weaned calves managed in a drylot or on pasture (JAS 1981;53:1193-1197).

On many ranches, rapidly diminishing range forage and thin cows are the forces that drive decision making during drought. The decision to implement a drought mitigation measure, such as early weaning, should be made in advance and based on objective observations of both precipitation and forage condition. Reports addressing the effects of early weaning on range condition or range forage conservation are hard to find. In the absence of original research on these topics, the best alternative is to estimate forage conservation based on changes in dry matter intake (DMI) that accompany early weaning. As discussed above, the resource-sparing effects of early weaning result from the premature end of lactation and concomitant reduction in nutrient requirements by cows and heifers. Calf removal also has a resource-sparing effect because forage intake by suckling calves begins by as early as 30 days of age.

The National Research Council (NRC, 2000) estimated DMI by a 1200 lb beef cow (peak milk production = 20 lb) to average approximately 28 lb per day during lactation. The same animal, without producing milk, consumes an average of 24 lb DM (DM) per day during mid-gestation. Using this scenario, the savings in range forage accrued on a daily basis due to cow intake alone would average 4.0 lb per day or 120 lb per month.

Range forage consumption by beef calves has been estimated to average 4.3 lb DM per day between 30 and 150 days of age (Boggs et al., 1980). Hollingsworth-Jenkins et al. (1995) estimated that a 300 lb beef calf consumed approximately 5.3 lb DM per day, whereas Lusby et al. (1976) reported that 370 lb Hereford calves consumed 2.9 lb DM per day. If a calf consumes 1.5% of its body weight on a DM basis of an average quality forage in a grazing scenario and if the calf weighs 300 lb on average across the grazing season, then it will eat approximately 4.5 lb of forage DM per day or 135 lb per month during the pre-weaning period.

Conservatively, the combined effects of reduced nutrient requirements by the cow and removal of the calf could reduce demand for range forage by 8.5 lb DM per day or 255 lb per month. Using this logic, there would be one extra day of grazing for the dry cow in early to mid-gestation for every 2.5 days that the calf is weaned. Work by Bohert et al. (2006) indicated that cows grazing native range may distribute their grazing activities more widely following early weaning.

Effect of Early Weaning on Reproduction

Reduced reproductive performance associated with poor body condition is usually the most immediate threat (Lusby et al., 1981) when forage is limited after calving and prior to the start of the breeding season. Early weaning has been used successfully as a management strategy to spare body condition or to promote reproductive performance of heifers and cows (Laster et al., 1973; Lusby et al., 1981; Houghton et al., 1990; Purvis et al., 1996; *Table 1*). Early-weaning has been viewed historically as a last-resort measure to deal with the consequences of sub-par nutrition following parturition (Rasby, 2007).

The Decision to Wean Early — Calf Age

The beef calf is a functional monogastric for the first 2 to 3 weeks of life. The rumen of a newborn lacks the symbiotic microbial population that enables adult cattle to process forage fiber via fermentative digestion. Bacteria, protozoa, and fungi enter the rumen through the nose and mouth during the first days of life as the calf comes into contact with the saliva of other animals and environmental features such as soil, bedding, and feed (Bryant and Small, 1960). By 3 days of age, there are significant numbers of cellulolytic, amylolytic, proteolytic, and lactate-using bacteria in the rumen (Anderson et al., 1987).

Ruminal development starts when microbial action within the immature rumen liberates volatile fatty acids from food particles. These act as chemical signals that stimulate maturation of the absorptive surfaces of the rumen. Butyrate is particularly effective in stimulating the development of ruminal papillae (Tamate et al., 1962; Anderson et al., 1987). Moreover, the presence of solid feeds in the rumen enables development of the muscles and nerves controlling ruminal motility (Heinrichs and Jones, 2003).

Anderson et al. (1987) reported that dairy-type cattle weaned at 30 or 45 days of age had nearly complete ruminal function within 2 weeks of weaning. Ruminal development proceeded rapidly once solid food consumption had begun. Additionally, the calves of spring-calving beef cows grazing native range consumed significant amounts of forage at 30 days of age (Boggs et al., 1980). These data were interpreted to suggest that the rumens of 30-day-old calves were functional enough to permit weaning (i.e., removal of milk and milk replacers). Beef calves weaned at young ages can be successfully managed provided the diet is palatable and energy/protein dense. Early weaned calves have high requirements and DM/nutrient intake is critical.

Breeding Females — Expectations for Performance

Many benefits of early weaning that happen to breeding females can be attributed to increased body condition. Body condition score is linked to reproductive performance. As body condition score increased up to a moderate level (i.e., BCS 5; 1 to 9 scale), the length of the post-partum anestrous period decreased and conception rate increased (Smith and Vincent, 1972; Lusby et al., 1981; Houghton et al., 1990). Embryonic loss may also be minimized when body condition score is adequate (Geary, 2005).

The relationship between body condition score and lactation is firmly established. Ciminski et al. (2002) reported that lactating cows lost one-tenth of a body condition score (1 to 9 scale) for every 2 weeks they suckled their calves. Improved body condition score and increased body weights (Lusby et al., 1981; Purvis et al., 1996; Story et al., 2000; Ciminski et al., 2002; Bohnert et al., 2006), reduced post-partum interval (Smith and Vincent, 1972; Lusby et al., 1981; Houghton et al., 1990), and greater conception rates (Laster et al., 1973; Lusby et al., 1981) have been attributed to early weaning. Early weaning was also occasionally associated with reduced winter feed costs (Peterson et al., 1987; Purvis et al., 1996; Story et al., 2000) and greater income per cow (Peterson et al., 1987).

Reproductive Considerations When Dry Lotting Beef Cows

1. Artificial Insemination is easier to implement provided labor/time is available.
   a. Estrous Synchronization is easier to implement.
      i. With AI or natural service
      ii. Estrous Synchronization Calendar *http://www.iowabeefcenter.org/estrus_synch.html*
   b. Sexed semen
      i. AI pregnancy rates are lower for sexed semen but may be an option to increase the percentage of male calves — assumes pregnant females are purchased as replacement for a terminal system.

2. Bull to Cow ratio
   a. A function of bull age
      i. 15 month old bull will be expected to service 15 cows
         1. For young bulls, we would not change bull:cow ratio when breeding in a dry-lot setting.
      ii. Mature bull
         1. 1:30 to 1:35 (usually 1:25)
   b. Never have single sire pens (one bull per pen or pasture)
      i. If you have to have single sire pens or pastures: Check bulls frequently
         1. Rotate bulls amongst pens every 7 to 10 days

3. Transporting cows
   a. AI — Transport within 3 days post AI or need to wait until 35 days post AI
   b. Natural Service — Transport 35 days after pulling the bulls

4. Sort young cows (2's and 3's) from old cows — especially during lactation
   a. If managed together after calving, young cows in the herd will lose weight and body condition, especially when limit-fed.
      i. Young cows losing body condition after calving and before the beginning of the breeding season will have low reproductive performance.
      ii. Tools to learn condition scoring beef cows.
         1. Extension Circular *http://www.ianrpubs.unl.edu/sendIt/ec281.pdf*
         2. Mobile App *https://itunes.apple.com/us/app/nubeef-bcs/id592184721?mt=8*

5. Include an approved ionophore in the ration.
   a. Feed efficiency improved by at least 4% to 5% in high concentrate diets
   b. Reproductive component

6. Provide an area for the calf when pairs are together during the breeding season to reduce injury to the calf.

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