

Early Weaning Beef Calves

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In conventional cow–calf production systems, calves are weaned from their dams when they are between 180 and 220 days of age. Early weaning is defined as separating calves from their dams at less than 180 days of age; moreover, early weaning can be performed with calves as young as 45 days of age.

Shifting calving or weaning dates can result in improved herd performance [1–3]. Profits may increase through greater reproductive performance by cows, increased calf marketing options, and increased cull cow marketing options [2–4]. Early weaning has resulted in heavier calves at the time that normal weaning would have occurred (ie, > 180 days of age), and younger, heavier calves at slaughter. In addition, one of the most interesting aspects of early weaning is that calves' genetic potential to produce intramuscular fat may be maximized [4].

If a management technique is to be incorporated into the overall business plan of a ranch, it should offer the potential for increased profit or it should conserve a primary resource, such as grazed forage or cow body condition. Several researchers have evaluated cow and calf performance when weaning occurred at less 150 days of calf age [5–7]. Economic modeling of the cow–calf enterprise indicated weaning calves at 6 months of age resulted in the greatest current value for gross income [8]; however, published studies evaluating the productivity and economic characteristics of cow–calf enterprises that routinely use early weaning are limited in number.

Situations where beef calves are weaned early

Early weaning of beef calves is done most commonly during periods when feed is scarce or expensive. It is also used in situations where breeding females are at risk for reproductive failure because of high nutrient requirements coupled with poor diet quality. In these situations, early weaning is a tool that reduces the nutrient requirements of the lactating female and

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allows her to gain, or at least maintain, body condition and weight. Fig. 1 indicates that, for every 2 weeks that the calf suckles a spring-calving cow, she loses one tenth of a body condition score (BCS; 1 = thin, 9 = obese) [9]. BCS at calving influences the length of the postpartum interval in beef cattle. On average, cows that calve at BCS 5 have a postpartum interval that is 30 days shorter than that of cows that calve at BCS 3 (Fig. 2). The reproductive performance of cows can be enhanced, especially those that calve in poor body condition (ie, $BCS \leq 4$), if their calves are weaned before, or early in, the breeding season (Table 1) [2,10,11].

Application of early weaning during drought conditions decreases nutrient requirements of breeding females. In turn, grazing pressure on range and pasture decreases. It has been demonstrated that a calf weighing 250 to 350 pounds will consume about 5.3 pounds of forage (dry matter [DM] basis) [12]. The difference in daily DM intake between lactating and nonlactating cows is 4.6 to 5.9 pounds; moreover, a 1200-pound cow will consume 24 to 28 pounds of DM daily [13]. Therefore, for every 2.5 days that the calf is weaned, there should be 1 more day of grazing for the cow.

Weaning calves before the start of, or early in, the breeding season is not a common management strategy. Usually, at this point in the production cycle, it is considered a last-resort effort to correct a management problem most often related to inadequate nutrition before and after parturition. Reducing the nutrient requirements of the dam that are associated with lactation, and eliminating the suckling stimulus, have the potential to allow noncyclic, thin cows to resume estrous cycles and become pregnant.

Preparation for early weaning

A number of items must be considered before weaning calves early. Calves can adapt quickly to changes in environment and diet if a management plan

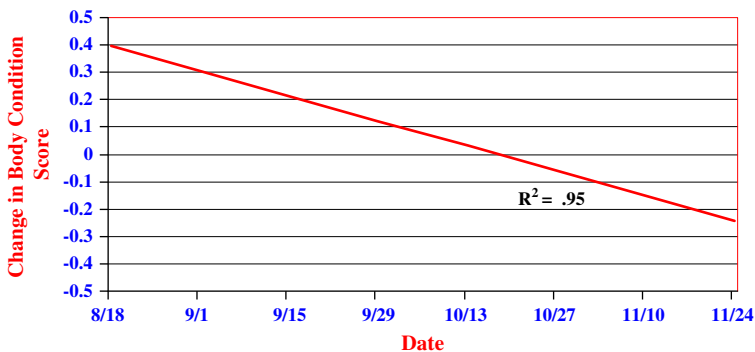


Fig. 1. Effect of weaning date on change in cow body condition score of March calving cows. (Data from Ciminski L, Adams D, Klopfenstein T, et al. Weaning date for spring calving cows grazing Sandhills Range. In: 2002 Beef Cattle Report MP 79-A. Lincoln (NE); Agricultural Research Division, University of Nebraska; 2002. p. 3–4.

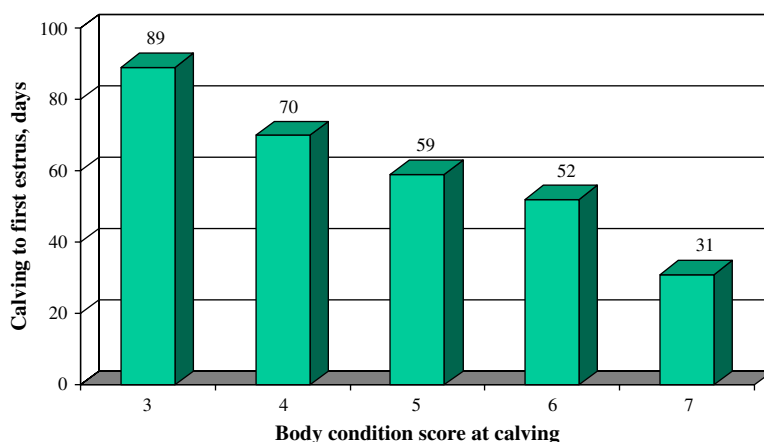


Fig. 2. Effect of body condition at calving on postpartum anestrus interval. (Data from Houghton PL, Lemenager RP, Horstman A, et al. Effects of body composition, pre- and postpartum energy level and early weaning on reproductive performance of beef cows and preweaning calf gain. *J Anim Sci* 1990;68:1438–46.)

has been developed carefully. Regardless of weaning age, calves that start eating dry feed immediately after separation from their dam have a lesser incidence of morbidity and mortality than calves that do not eat for 24 to 48 hours after separation. In addition, vaccination history, sanitation, diet type, bunk height, bunk space allowance, watering system, and environment need to be managed carefully to allow the early weaned calf to grow and be healthy.

Health program

One of the keys to a successful early weaning strategy is a well-planned herd health and vaccination program. The ideal health program differs

Table 1
Conception rate, postpartum interval, and calf weight at normal weaning time (October 11) for very thin first-calf Hereford heifers and their calves

Item	Normal weaning (7 months)	Early weaning ^a (6–8 weeks)	Difference
Conception rate (%)	59	97	38
Calving to conception (d)	91	73	18
Cycling at 85 days postpartum (%)	34	90	56
First-calf heifer weight at normal weaning time (lb)	788	875	87
Calf weight at normal weaning time (lb)	373	374	1

^a Early weaned calves were managed in a drylot or on pasture.

Data from Lusby KS, Wettemann RP, Turman EJ. Effects of early weaning calves from first-calf heifers on calf and heifer performance. *J Anim Sci* 1981;53:1193–97.

from one ranch to another; they are most successful when developed with local conditions in mind. In most cases, the rancher's veterinarian is the most valuable resource to help develop a disease-prevention program that addresses health challenges common to the area. The disease-prevention program, at a minimum, should include control measures for viral diseases (ie, the bovine respiratory disease complex), clostridial diseases, and internal and external parasites. When calves are weaned at a very young age (ie, <4 months), they still have immunity acquired passively through colostrum. Vaccinations can be rendered ineffective when passive immunity is still strong. The veterinarian should be consulted to determine the most effective strategy for immunizing very young calves.

Ideally, weaning should be scheduled so that calves can be vaccinated, dehorned, castrated, and possibly acclimated to novel feedstuffs before maternal separation actually occurs. This process is known as *preconditioning*. It begins with an initial round of viral-disease and clostridial-disease vaccination, 2 to 3 weeks before the day of maternal separation. Castration and dehorning should also be conducted at this point, if not earlier, in the calf's life. Dry feed can be introduced to calves at this time by way of a creep feeder or some other means.

On the day of maternal separation, calves are given a booster vaccination for viral diseases and are treated for internal and external parasites. Some ranchers also administer booster vaccinations for clostridial diseases at this point. If early weaning is performed during summer or early fall, it may be profitable to invest in some form of fly control.

One should follow Beef Quality Assurance methods and techniques when administering vaccinations and controlling parasites. All drugs should be handled and used according to label direction or per the instructions of your consulting veterinarian. If a feed is used as a mode of administering a drug, it should be fed according to label directions. It is a violation of federal law to use animal drugs in ways contrary to Food and Drug Administration guidelines [14].

Many believe that preconditioned cattle experience less stress, are healthier, and grow more efficiently after weaning, than nonpreconditioned counterparts. Preconditioned cattle that can be documented as such can potentially draw financial premiums at the time of sale.

Nutritional considerations

The daily gain of calves during the period that they are nursing their dams is usually 2.1 to 2.3 pounds. Calves that are weaned early should be managed to gain in this range as well. Calves are disposed to low dry matter intake (DMI) for 3 to 14 days following maternal separation and change in diet. Feed ingredients need to be considered carefully, to ensure that the initial postweaning diet (ie, the starter diet) can meet all the nutritional requirements (ie, energy, protein, minerals, and vitamins) at a DMI of 1% to 1.5% of body weight.

Starter diets are energy-dense (ie, 65% to 75% total digestible nutrients), relatively rich in crude protein (ie, 14% to 16%), and highly palatable.

Two weeks after maternal separation, calves should be able and willing to eat approximately 2.5% of their body weight on a DM basis. Usually, a diet change is warranted at this time. Many different rations are suitable for this situation, subject to local feed prices and availability (Table 2). Again, emphasis should be placed on constructing a high-quality diet that will allow cattle to achieve a targeted level of performance. For recently weaned calves, the use of low-quality forages in diets should be avoided, especially straws, corn stalks, soybean stubble, or mature hay. Grain screenings, and moldy, dusty, or damaged feeds should also be avoided.

Diets should be free of fine particles, and ingredients should aggregate properly so that calves, while eating, are unable to sort one individual diet component from others. Recently weaned calves tend to be selective eaters and, initially, may attempt to eat only the most palatable or familiar ingredients from a complete mixed diet. This kind of behavior should be discouraged if at all possible because it can lead to digestive disorders and prevent calves from consuming adequate amounts of crucial dietary nutrients. Diets should be mixed thoroughly. Aggregating agents (ie, ration conditioners), such as liquid molasses, wet corn gluten feed, corn steep liquor, wet distiller's grains, condensed distiller's solubles, or even water, can be added to the diet while mixing to make feed particles adhere to one another.

Calves will not adapt quickly to rations that are dusty. Intakes and calf performance will be less than expected. In addition, if food-borne medication is needed, dusty rations make it difficult to achieve the consumption needed for the medication to be effective. Ration conditioners are effective at controlling dust and at improving the palatability characteristics of mixed diets.

Silages, although nutritious, should be used only in limited amounts in diets for recently weaned calves. The high moisture level and

Table 2
Examples of early weaning calf rations

Ingredient	Ration		
	Starter (%)	Ration II (%)	Ration III (%)
Rolled corn	64.0	56.5	50.0
Soybean meal	20.0	17.0	12.0
Cottonseed hulls	10.0	20.0	33.0
Cane molasses	5.0	5.0	3.0
Dicalcium phosphate	—	—	0.5
Limestone	0.5	0.5	0.5
Potassium chloride	—	0.5	0.5
Salt	0.5	0.5	0.5
Vitamin A (30,000 IU/g)	1.0 lb/T	1.0 lb/T	0.5 lb/T

Data from Lalman D. Early weaning for the beef herd, Oklahoma Cooperative Extension Fact Sheet F-3264. Stillwater (OK): Oklahoma State University; 2003.

palatability characteristics of silage make it unlikely that cattle will consume silage-based diets in amounts adequate to grow at targeted levels. Silages and other fermented feeds should be introduced gradually into the diets of cattle that are inexperienced with such feeds.

Urea or other nonprotein nitrogen sources can be used in the diets of early weaned calves, but should be limited to 0.5% of the ration on a DM basis. In addition, any uneaten feed should be cleaned from feed bunks daily. This cleaning is especially critical during hot weather. Consideration should be given to feeding high-moisture rations (ie, >30% moisture) twice daily to prevent spoilage in the feed bunk and to keep the ration fresh. Conversely, dry diets can be fed once daily.

Feed intake and feeding behavior are primary indicators of calf health status. Therefore, the feeding management scheme ultimately chosen for early weaned calves should allow for tight control of feed delivery to the bunk and close monitoring of individual animal intake. Persons responsible for delivering the starter diet must make sure all calves are coming to the bunk, and make a daily record of the amount of feed offered to each pen. Bunks should be of an appropriate height to allow calves to eat easily. Early weaned calves should be provided with about 1 foot of bunk-space per animal to allow all animals within a pen to come to the bunk at the same time. It also affords managers the opportunity to watch for calves that exhibit symptoms of illness (eg, poor appetite). Bunk space allowance and daily visual appraisal by a manager are critical to achieving excellent health and performance by early weaned calves; therefore, in most circumstances, their diets should be hand-fed and not self-fed.

Recently weaned calves should be grouped or penned on the basis of body size to discourage undesirable social interaction (eg, hyperaggressiveness) within the pen and at the feed bunk. If there is significant variation in weight within a single calf crop (ie, >150 pounds), calves may need to be penned into two or more groups for feeding.

Often, inadequate DMI by recently weaned calves can be blamed on a lack of experience with feed bunks and watering devices. Calves that are inexperienced with these items tend to be reluctant to use them; however, calves can be trained to overcome their reluctance. Penning a gentle, experienced calf with early weaned calves can be an effective means of teaching early weaned calves how to eat from a bunk and how to drink from watering devices.

Starting early weaned calves on feed

It is absolutely critical to get calves to eat as soon after maternal separation as possible. The calf's first diet following maternal separation is referred to usually as a starter diet. Depending on the weight of the calf, the starter ration should be fed until the calf is consuming 4 to 5 pounds per animal per day (ie, 1.0% to 1.5% of body weight), which usually takes from 10 to 14 days. Nutritional characteristics of starter diets were discussed earlier.

Commercial starter diets offer several advantages to ranchers who attempt to wean calves at a relatively young age. Most of these products are nutritionally complete and come in the form of a pellet or cube. As such, they offer uniform particle size, and largely eliminate problems with fines. Ranchers who have limited feed-mixing capability may find commercial starter diets convenient to use. Commercial starter diets are also an easy way to incorporate medications or ionophores into the management program. These diets are typically expensive, relative to those that can be developed and blended from commodity feed ingredients. In most cases, it is more economic to switch calves from a commercial starter diet to a mixed diet 2 to 3 weeks after weaning.

Ranchers may wish to consider creep feeding calves beginning 3 to 4 weeks before weaning. This use of creep feeding is intended to train calves to eat concentrate-based feed from a bunk, rather than to increase weaning weight. Many believe that calves provided with creep feed make a smoother transition to the postweaning diet and environment.

Early weaned calves that have not been acclimated previously to concentrate-based feeds can be fed hay for the first 2 to 3 days after maternal separation. The hay can subsequently be top-dressed with concentrate-based feeds, gradually increasing the amount until a targeted level of intake is reached. Most cattle managers prefer to use grass hay instead of alfalfa as the initial postweaning feed. In many cases, grass hay has species composition, flavor, and texture similar to the forage calves grazed before weaning. These factors may influence hay intake positively. After calves have been adapted to the mixed ration, nongrass forages can be introduced.

Water

Water is an often overlooked nutrient. Clean, fresh water should be available to calves at all times. Newly weaned calves often walk the fence line of a pen or small pasture. To assist them in locating the water source, water fountains or tanks should be positioned in the fence line or at right angles to it. Calves will collide naturally with the tank or fountain as they walk. The watering device should be of an appropriate height to allow calves to obtain a drink easily.

Weaning techniques

A number of weaning techniques have been used to achieve a successful transition between suckling and eating concentrate-based feeds. The goal of each technique is to minimize the stress experienced by the calf. Heat stress can be problematic for calves weaned in the summer or early fall. It may not be necessary to provide shade, but providing an ample supply of clean, fresh water is essential. If calves are weaned into a dirt-surfaced pen, dust can

contribute to respiratory disease and pink eye outbreaks. Dirt-surfaced pens should be sprinkled with water to reduce airborne dust.

The most common weaning system in the United States is to move calves from pasture to a feeding pen that is beyond the reach of sight, smell, and hearing of their dams. The converse of this situation is also practiced, in which calves are allowed to remain on pasture while dams are maintained in a feeding pen for 3 to 5 days. After that time, the locations of the cows and calves are reversed. Proponents of this method argue that allowing calves to remain in a familiar environment following maternal separation reduces the stress that calves experience.

A third weaning method that has received recent attention from researchers is known as fence-line weaning [15]. Fence-line weaning is accomplished by separating calves and dams into adjacent pastures. Electric fencing seems to be essential for keeping calves and dams separated during the weaning period. Therefore, it is helpful when calves can be exposed to electric fencing before weaning, and so learn to respect it. Straight fence line (ie, no corners) should be sufficient between pastures to allow all dams and calves nose-to-nose contact across it (Fig. 3). Advocates of fence-line weaning believe that it minimizes the stress experienced by calves; calf and dam are allowed to socialize while nursing is prevented.

If calves are to remain on pasture and be supplemented after weaning, it is helpful to begin supplementation 2 weeks before weaning. Dams effectively teach the calves to eat the supplement off the ground. Alternatively, calves could be offered creep feed for the 2- to 3-week period before weaning. At the time of weaning, cows are moved to an adjacent pasture and



Fig. 3. Fence-lined calves 3 days after weaning. Cows on the left and calves on the right of the electric fence. (Courtesy of Jim Gosey, PhD, Lincoln, NE.)

calves are allowed to remain with the creep feeders. When using the fence-line weaning technique, consideration should be given to placing a docile, unrelated cow in the pasture with the weaned calves. This animal acts as a companion and teacher, reminding calves of the locations of water and feed, and demonstrating how to use these resources.

Economic considerations

Most studies of early weaning have concluded that ownership of early weaned calves needs to be retained for some period of time after weaning, to generate enough revenue to increase the profit potential, compared with weaning at a more conventional age (Table 3). Early weaned calves weigh less at weaning, compared with calves weaned at conventional ages, and usually, positive price slides are insufficient to offset the lesser body weight [16]. Another reason not to sell the early weaned calf directly after weaning is that young calves are more efficient than older calves at converting feed to gain. Managers need to consider taking advantage of this attribute of the early weaned calf.

Many ranchers share the belief that early weaned calves will not gain as well as calves that remain with their dams until they reach a conventional weaning age; however, this belief is erroneous. If diets are well-designed, using the concepts outlined above, early weaned calves will achieve a daily gain equal to, or greater than, calves that remain with their dams (Fig. 4) [17–19].

A marketing plan is an essential element of an early weaning program. If calves are to be marketed after a backgrounding period of predetermined length, calves likely will be targeted for a moderate rate of gain during the weaning period. An aggressive postweaning rate of gain is more cost-effective if the calves are to be retained through finishing. Regardless of the retained ownership scenario, managers should attempt to target an economically favorable marketing date by programming the rate of gain.

Table 3
Breakeven values for calves weaned at 150, 210, or 270 days of age

Item	Age at weaning (days)			Standard error
	150	210	270	
Calf value at weaning (\$/head)	\$325.33	\$393.75	\$430.19	—
Cow cost (\$/head)	(\$410.16)	(\$421.21)	(\$443.32)	—
Breakeven for weaned calf (\$/cwt)	\$113.18 ^a	\$86.81 ^b	\$82.76 ^b	2.06

^{a,b} Numbers within a row with differing superscripts are statistically different ($P = .001$).

Data from Story CE, Rasby RJ, Clark RT et al. Age of calf at weaning of spring-calving beef cows and the effect on cow and calf performance and production economics. *J Anim Sci* 2000;78:1403–13.



Fig. 4. Difference in calf weights on the normal weaning date (7 months of age) for calves weaned at 3 and 5 months of age and placed in a feedlot versus calves weaned at 7 months of age. (Data from Myers SE, Faulkner DB, Ireland FA, et al. Comparison of three weaning ages on cow/calf performance and steer carcass traits. *J Anim Sci* 1999;77:323–9.)

Some researchers have concluded that early weaned calves have a greater opportunity to achieve a United States Department of Agriculture (USDA) Quality Grade \geq Low Choice than calves weaned at conventional ages (Table 4) [4]. If the marketing plan involves retaining ownership through finishing, managers should consider seeking a market outlet that rewards desirable USDA Quality Grades.

Ranchers new to early weaning should evaluate its economic ramifications carefully on all aspects of cow–calf production. Improved calf–crop revenue does not necessarily mean that overall profitability increases. For example, early weaning reduces cow maintenance costs; however, those savings may be lost to greater heifer development costs. Early weaned heifer development costs are greater than development costs of heifers weaned at conventional ages because they are younger and smaller when they enter the development enterprise.

It has been estimated that 15% to 20% of the revenue generated by a cow–calf enterprise comes from the sale of cull cows and bulls [20], referred to commonly as noncalf revenue. Cull cow prices tend to be at their lowest annual value in November and December [21]. Marketing cull cows before the November–December time frame can have a positive impact on the revenue of the cow–calf enterprise.

When early weaning is practiced as a matter of routine, there will be a net reduction in the amount of range, pasture, and harvested forages consumed by cows. In nondrought years, the abundant forage supply could allow cows to become overconditioned. Therefore, ranchers who practice early weaning may wish to add more cows to the herd to use the surplus forage, increase productivity per unit of land, increase productivity per dollar of fixed cost,

Table 4

Carcass characteristics of early weaned steers, conventionally weaned steers fed a starch-based creep, conventionally weaned steers fed a fiber-based creep, and conventionally weaned steers offered no creep feed

Item	1 ^a	2 ^b	3 ^c	4 ^d	1 versus 2, 3	2 versus 3	1, 2, 3 versus 4
HCW (lb)	757	774	757	724	0.53	0.23	<0.01
BF (in)	0.50	0.44	0.47	0.47	0.09	0.40	0.77
YG	2.98	2.90	2.77	2.92	0.17	0.28	0.74
Marbling ^e	663	588	608	615	<0.01	0.43	0.79
% ≥CH ^{-f}	90	79	80	73	0.15	0.91	0.14
% ≥CH ^o g	73	33	44	46	<0.001	0.33	0.68

The last three columns give comparisons that show statistical difference.

Abbreviations: BF, backfat measured between 12th and 13th rib; HCW, hot carcass weight; YG, USDA yield grade.

^a Weaned at 63 days of age (doa).

^b 25% corn creep, weaned at 189 doa.

^c Fiber creep, weaned at 189 doa.

^d Weaned at 189 doa.

^e Marbling score: 500 = small^o, 600 = modest^o, 700 = moderate^o.

^f CH⁻ is the common notation for USDA low choice.

^g CH^o is the common notation for USDA average choice.

Data from Shike DW, Faulkner DB, Parrett DF, et al. Influence of weaning age, creep feeding, and type of creep on steer performance and carcass traits [abstract]. American Society of Animal Science Sectional Abstracts, Midwestern Branch 2003;[abstract 80]:46–7.

and increase revenue. However, this approach may sacrifice management flexibility in the event of an extended drought.

Summary

Early weaning is a management practice that reduces grazing pressure on pastures by decreasing the nutrient requirements of cows. Calves that are weaned early are relatively efficient at converting feed to gain, and can weigh as much, or more than, calves allowed to remain with their dams until a conventional weaning age is reached. Balanced diets with excellent physical, chemical, and palatability characteristics are essential to stimulate intake and induce calves to perform at acceptable levels. Every effort should be made to minimize stress on calves during the weaning period. Early weaned calves, if exposed to high-starch diets at a young age, may be more likely to reach their genetic potential to marble than calves weaned at conventional ages.

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