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Time of Weaning and Cow Condition

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INTRODUCTION

The primary mission of a beef brood cow is to consistently produce calves. There are numerous management practices designed to assist cows in accomplishing this mission. Young cows frequently require more management attention to be reproductively successful than do older, mature cows.

In recent years attention has been focused on altering time of weaning to manipulate cow body condition as a method of maintaining high reproductive rates while also reducing winter feed requirements. If cows nurse their calves for a longer or shorter period of time than is traditional, a corresponding decrease or increase in body condition may result due to the nutrients required for maintaining lactation. Changing either the calving date, the weaning date, or both will likely have an influence on cow condition. Age of the calf at weaning is affected by both the date of birth and the date of weaning. Consequently, a change in weaning age will impact weaning weight, therefore any change in time of weaning must balance the potential positive impacts on the cows with potential negative impacts on the calves or calf market weight.

ROLE OF COW BODY CONDITION ON HERD PRODUCTIVITY

The condition of beef cows at calving is associated with length of postpartum interval, subsequent lactation performance, health and vigor of the newborn calf and in extremely fat or thin heifers an increase in the incidence of calving difficulty. The condition of cows at breeding affects their reproductive performance in terms of services per conception, calving interval and the percentage of open cows (Herd and Sprott, 1987).

Body condition in the fall affects the amount and type of winter feed supplements that will be needed, particularly in spring calving cow herds. Fat cows usually need only small quantities of supplements, while thin cows usually need large quantities of supplements high in energy. Researchers in Minnesota (Thompson et al., 1983) reported a 6-10% higher energy requirement for maintaining thin cows through the winter in a cold environment, than cows in moderate to high body condition. Therefore, a cost savings may also result from having cows enter the winter in good body condition.

MATCHING CALVING AND WEANING DATES TO THE RANCH FORAGE BASE

Beef cows are high utilizers of forage and in many production systems perform very well on exclusively forage diets. Often protein or energy supplements are fed during periods of low

forage quality and hay is fed when grazable forage is limited. In most cases, whenever high levels of supplementation or hay feeding is required, cost of production increases. Adams et al. (1994) compared the economic returns from six forage-based hay feeding and grazing systems in the Nebraska sandhills. The forage systems involved various combinations of grazing winter range, hay feeding and using subirrigated meadows for hay production or grazing. The authors concluded that forage management strategies which involved high use of grazing compared to hay feeding or heavy protein supplementation resulted in greater net return per calf and less year to year price risk. Designing forage management systems that capitalize on the cow's ability to self-harvest her diet through grazing, and managing so that the phases of the annual reproduction cycle match the forage base is an important strategy for achieving ranch profitability.

Time of Calving. The nutrient requirements of a cow increases substantially after calving. If the time of calving precedes too far the time when grazing of high quality forage is available, the cost of supplemental feed will be high. Therefore timing the start of calving to correspond with the plant growth cycle will reduce the need for high levels of supplement or hay feeding. Many producers have found that calving at a time that grass is available in adequate quantity and of sufficient quality to meet a cows peak lactation need is desirable. Peak lactation generally occurs 45 to 65 days after calving. Matching calving date to the forage base is beyond the scope of this paper, yet has direct bearing on the impact of time of weaning and cow condition. Suffice it to say that choosing a calving date should be done after serious evaluation of many considerations and not simply based on tradition or the desire to achieve heavy weaning weights by having older calves. Remember, if the added pounds on calves are more costly to put on than their value, the impact on ranch profit will be negative.

TRADITIONAL WEANING AT 7 MONTHS OF AGE

The seedstock beef industry adjusts weaning weights to 205 days to make a fair comparison of animals born on different dates. Older calves normally weigh more. If weights were not adjusted to a constant age in seedstock cattle one would probably just select older cattle. The practice of adjusting weights to a constant age has led many in the commercial cattle business to the notion that their calves should be weaned as near to 205 days of age as possible. In fact, there is little basis for this practice in commercial herds.

Why do we adjust weight to 205 days? To answer this question, we must go back to 1944. Marvin Kroger and J.H. Knox published a paper in the Journal of Animal Science (Kroger and Knox, 1944) entitled "A method for estimating weaning weights of range calves at a constant age." They had taken the weights of calves weaned at the New Mexico Experiment Station from 1936 to 1943 and developed a formula for adjusting those weights to a constant age. What was the average age at which calves were weaned in this research? You guessed it; 205 days (Source: Silcox, 1995). Today the 205-day adjustment factor is standard for the seedstock industry. However, the value of this time frame to commercial producers is limited and there are many other factors that should dictate weaning age besides an arbitrary number adopted primarily due to it's repetition rather than relevance in commercial cow herds.

More appropriate reasons for the traditional weaning age of 7 to 8 months of age include:

1) In spring calving cows the decline in forage growth and approach of harsh weather occurs about 7 to 8 months after calving, 2) a beef cow's lactation curve has declined substantially by this time, 3) it gives the cow time to prepare for her next calf, and 4) it has been done that way for many, many years. There may be just as many reasons to reevaluate time of weaning, particularly with regard to managing cow body condition. In the following sections possible reasons and strategies for altering time of weaning will be discussed.

TIME OF WEANING ALTERNATIVES TO DECREASE THE IMPACT ON REPRODUCTION OF SUCKLING AND LACTATION

Anestrus (absence of estrus or heat) is a condition that exists in most mammals after they give birth which allows time to recuperate after pregnancy. Postpartum anestrus in cows is defined as the time after calving during which estrous cycles do not occur (Short et al., 1994).

The combined effects of the suckling stimulus, behavioral responses and nutritional demands of milk production cause anestrus in beef cows. An in-depth explanation of the steps that a cow goes through in resuming normal estrous cycles can be found in a paper published by Short et al., 1990.

In context of the current topic, suckling and lactation impact reproduction in two ways:

1) The short-term effect of suckling lengthens the postpartum interval and may reduce or delay pregnancy during the breeding period in the year the suckling occurs. This is especially true in young cows and thin cows.

2) The long-term effect of lactation may have an indirect effect on reproduction by reducing cow body condition so that pregnancy is delayed or reduced in the year(s) following the lactation. This is especially true if a cow does not regain enough condition year after year and her condition at calving slips lower each year. This result is frequently seen in young cows who may breed adequately as two-year-olds, but because they continue to loose condition as three-year-olds, reproductive failure is high during that year.

Let's briefly discuss weaning options available to help manage the impact of suckling and lactation. It should be emphasized here that suckling and lactation are certainly not the only alternatives available for achieving reproductive success. Nutrition plays a vital role in this regard and the reader should refer to papers in these proceedings by Dr. Mark Petersen and Dr. Dave Sanson for more discussion of nutrition and reproduction.

Weaning Options. Many possibilities exist, from partial and temporary weaning to complete weaning. These practices are found in more detail in a report by Short et al., 1994. Complete weaning treatments can occur anytime from right after calving up to near the time of the next calving. In order for a weaning treatment to have an impact in the short term it must occur before or early in the breeding season.

Partial Weaning -- This is when calves are separated from their dams for most of the day

and then allowed one or two short periods during the day to suckle. Reducing the length of time a cow is suckled will often result in shortening the postpartum interval to estrus. However, the response to this management is variable and the practicality of such a system greatly limits its usefulness in commercial herds.

Temporary Weaning -- This is when calves are completely removed from their dams for a short period (usually 2 to 4 days). Temporary weaning has been successfully coupled with estrous synchronization programs which use progestins (Smith et al., 1979). The practical application of temporary weaning is frequently limited to use only at the beginning of the breeding season and in conjunction with estrous synchronization.

Complete Weaning -- This strategy involves permanent separation of a calf from its dam. Complete weaning can be done at any time after birth and for the purposes of this paper will be discussed in relation to five time periods:

a. early weaning before the start of the breeding season (birth to 90 days).
b. early weaning during the breeding season (90 days to 160 days, assuming a 70 day breeding season).
c. normal weaning (180 to 240 days).
d. late weaning (240 to 280 days).
e. variable weaning, or manipulating the time of weaning from year to year to match the circumstances of the production cycle. This would likely occur between 120 and 280 days of age.

Management challenges in handling the weaned calf increase as age of the calf decreases. A discussion of calf management will be presented later.

Early Weaning

Oklahoma researchers reported (Lusby et al., 1981) a 37% advantage (97% vs 59%) in conception in first-calf heifers that began calving in February when calves were weaned every two weeks at 6 to 8 weeks of age compared to heifers whose calves were weaned at 7 months. Additionally, the average interval from calving to conception was shortened by 18 days (91 vs 73 days, Table 1).

Body condition scores were not reported in the Oklahoma study. However, the authors state that the Hereford heifers used in the study were nutritionally stressed during the winter prior to calving and weighed about 5% less after calving in the spring than they did the previous fall (Table 2).

TABLE 1. CONCEPTION RATES AND POSTPARTUM INTERVALS OF HEIFERS IN OKLAHOMA WITH SUCKLED OR EARLY-WEANED CALVES (LUSBY ET AL., 1981)

	Treatment	
Item	Suckled	Early Weaned
Conception rate		
No. conceived/No. exposed	19/32	30/31
Pregnant, %	59.4[a]	96.8[b]
Interval from parturition to conception (Calving date minus 280 days), days	90.5[a]	73.0[b]
Interval to onset of ovarian activity for cows cycling by 85 days, days	83.0[a]	73.0[b]

[a,b] Means in the same row with different superscripts differ (P<.05).

TABLE 2. WEIGHT CHANGES OF HEIFERS IN OKLAHOMA WITH SUCKLED OR EARLY-WEANED CALVES (FROM LUSBY ET AL, 1981)

	Treatment	
Item	Suckled	Early Weaned
Heifer weights, lbs		
Fall before calving, Nov. 15, 1978	739	727
After calving	697	681
Weight changes, lbs		
Calving to start of breeding season	-16[a]	34[b]
During breeding season	48[a]	73[b]
Calving to weaning	90[a]	195[b]

[a,b] Means in the same row with different superscripts differ (P<.05).

The positive results seen in this study are likely due to the fact that the heifers were in thin or marginal condition at calving. While no data is cited here for first-calf heifers in moderate to good condition at calving, one would expect a less dramatic response during the short-term to early weaning management in such heifers. To evaluate the potential long-term effect of early weaning on reproduction in first-calf heifers an experiment was conducted in Missouri (Whittier et al., 1995).

The objective of the Missouri study was to determine if weaning calves from first-calf heifers at the beginning of the breeding season following their first calving would allow them to gain sufficient weight and body condition to improve rebreeding in subsequent years with minimum feed inputs to the dam. Angus-sired heifers (n=141) were assigned at breeding time to either normal weaning (NW) at 7-8 months or early weaning (EW) at the beginning of the breeding season. All heifers were synchronized for estrus using Syncro-Mate-B. At the time of implant removal all calves were temporarily weaned for 48 hours. After 48 hours the NW calves were returned to their dams while the EW calves were placed in a drylot for feeding. The data from this study are still being collected. After completion of the study a strict economic analysis will be done. The effect of weaning treatment on dam weight and body condition is shown in Figure 1.

Note that EW dams were heavier and higher in condition at their first weaning than NW dams. However, by their second weaning there was no difference. The pregnancy rates at the end of each breeding season over four breedings (breeding season 1 was as a yearling) is shown in Figure 2.

There was no statistical difference in pregnancy rate at any year, however the NW dams had numerically lower pregnancy rates each year following the weaning management treatment. Remember, the only difference in management between the two treatments occurred during their first lactation. The cumulative impact of the weaning management as two-year-olds is seen when the percentage of cows that produced three consecutive calves is compared (Figure 3).

Dalsted and Gutierrez (1989) analyzed the number of years required for breakeven on replacement females at various replacement heifer values, cow salvage values, and net return per cow (Table 3). They determined that if heifer value is $500, salvage value is $400 and net return per year is $50, it requires 4 years of production for a replacement heifer to reach breakeven. If young cows leave the herd before this there is a net loss. In the case of the Missouri study 13% more cows reached breakeven due to early weaning management during their first lactation.

Early Weaning in Mature Cows

Forage Intake. There has been a good deal of research done with early weaning programs in mature cows. The results vary depending on available quality and quantity of forage and body condition of the cows. Weaning calves during or soon after the breeding season in drought years is an accepted practice for stretching a limited forage supply.

Research with early weaning of fall-born calves in Ohio (Peterson et al., 1987) (110 vs 222 days of age) estimated the hay consumption by the dams was 45.3% less than cows with normal weaned calves. In this same study when TDN consumption for both the cow and the calf was compared, early weaned cow/calf pairs consumed 20.4% less TDN than normal weaned cow/calf pairs. Recent work in Oklahoma (Purvis, personal communication) indicates that cows consume approximately 1% of their body weight less following early weaning than if normal weaned.

TABLE 3. BREAK-EVEN OWNERSHIP PERIOD OF A COW (YEARS).[a]

Replacement Heifer Value	Salvage Value	Net Return/Cow[b]		
		$50	$100	$150
$500	$400	4	2	1
	$450	2	1	1
	$500	1	1	1
$600	$400	8	3	2
	$450	6	2	2
	$500	5	2	1
$700	$400	14	5	3
	$450	12	4	3
	$500	10	3	2

[a] Dalsted and Gutierrez 1989
[b] 90% weaning rate and 5% discount rate

Reproduction. On-going research at New Mexico State University is investigating the effects of early weaning (165 vs 225 days of age) and two different supplementation strategies on cow body condition and reproduction (Gombill et al., 1995). The overall goal of the study is to investigate management techniques that will decrease input costs while maintaining optimal cow performance. Preliminary data indicates that early weaning resulted in increased cow weight and body condition, but no difference in reproductive measurements was seen.

Oklahoma State University (Purvis et al., 1995) is currently evaluating combining early weaning (70 days postpartum) with reduced feed inputs prior to calving as a technique to reduce cow costs. The treatments being evaluated are 1) cows under normal management to attain a mean body condition score (BCS) of 5.0 at calving; 2) cows to calve at BCS 5.0 coupled with early weaning at 70 days postpartum; and 3) cows maintained to calve at BCS 3.5 coupled with early weaning at 70 days. The first year's data from this on-going five year study showed reduced calf weights in both early weaned groups and no difference in cow pregnancy rate.

The preliminary results from New Mexico and Oklahoma are generally consistent with other research reports where early weaning management with mature cows in adequate or even marginal body condition was evaluated. Unless mature cows are severely limited in nutrition and body condition become critical, any advantage from early weaning typically comes through stretching the forage supply rather than an appreciable improvement in reproduction.

Variable Weaning

The term "variable weaning" is used to describe a management system designed to manipulate the time of weaning from year to year to match the circumstances of the particular production year. Variable weaning may serve as a technique for tempering the match or mismatch of cattle to resources. For example, if a rancher determines that his cows don't match his production environment and feed resources as well as he desires, he might be able to use some type of time of weaning management to temper this mismatch until a more long-term solution made. Changing the genetic characteristics of a herd takes time unless the cow herd is sold and other cows purchased to replace them. This approach is generally infeasible.

The precipitation, market and management circumstances often change from year to year. By using some type of variable weaning system a rancher may be able to:

1) manage under drought conditions
2) manage cow condition relative to available feed supply
3) minimize the purchase of "off ranch" inputs
4) meet certain markets for the calves

There are however limitations and challenges to adopting a variable weaning approach. Since time of weaning may vary considerably from one year to the next it is important to plan well. Variable weaning management will require a high level of management and organizational expertise. Factors such as marketing at different times each year, adjusting stocking rates to utilize grazing after calves are weaned or stretching grazing if calves remain with cows beyond typical weaning time all must be addressed in a system where weaning is not done strictly based on calendar dates year after year.

Late Weaning

Data at the USDA-ARS research laboratory at Miles City, Montana (Short et al., 1995) compared cows that calved in April whose calves were weaned in either mid to late September or mid to late December approximately 90 days apart. Half of the cows in each weaning age group received .75 lb of supplemental protein per day from September to December and half received no supplement. All cows grazed on native range forage during the study. Changes in body weight and body condition were quite dramatic and varied across years (Figure 4).

The weight and condition losses induced by late weaning were almost completely prevented by protein supplementation, and supplementing the normal weaning age cows resulted in marked improvements. There were no effects the following year on weaning weights or pregnancy rates.

The authors concluded from these data that even though supplementing during the fall is unusual, it can prevent problems created by late weaning. However, if cows are going into the fall in poor condition, it would not be wise to wean late even with supplementation. If

cows are thin enough that they require an increase in body condition prior to calving, then supplemental protein along with weaning at 5 to 6 months of age can help cows recover.

If conditions exist where adequate forage quality and quantity are available, weaning calves later than the traditional 7 to 8 months of age may be feasible. Calf weights will likely be greater in late weaning systems. However, if cow condition is reduced to the point that it impact subsequent cow reproduction, or if calf weight gains during the late sucking period are reduced significantly, the risks will outweigh the advantages.

Time of Weaning Management in Fall Calving Herds

Most of the discussion in this paper focuses on spring calving cows. That is because most calving seasons in the Northern Great Plains occur in the spring. There are regions of the country, and circumstances in the Northern Great Plains where fall calving has distinct advantages and is a common practice. In fall calving systems, one disadvantage is that peak demand for nutrients to support lactation occurs out of synchrony with peak nutrient availability from grazed forages. Therefore, early weaning systems with mature cows may be more advantageous in fall calving herds than spring calving herds. Additional information on early weaning in fall herds may be obtained from other sources (See Peterson et al., 1987).

Performance of Calves in Early Weaning Systems

In 1981 Lusby et al. (1981) stated:

> "Although early weaning could have obvious economic benefits when forage for the lactating cows is lacking or when cows are in such poor condition at breeding that adequate rebreeding performance is impossible, the factor limiting wide use of early weaning has been efficient management of the early-weaned calf. The benefits of early weaning to the cow can be realized only if weaned calves can be successfully and economically raised with minimal facilities, labor and feed costs."

Management of early weaned calves will not be discussed in detail in this paper due to space. However, a few highlights will be noted. Success and performance of calves weaned from 2 to 4 months of age is greatest when high concentrate, highly palatable diets are fed. It is not necessary to use a milk substitute in calves at this age since their rumen is capable of some function by this age and will adapt rather quickly to a high concentrate diet. Calves older than 4 months will digest forages adequately, but their nutrient requirements are high and may not be met by only forage diets.

With proper management it is possible for young, early weaned calves to perform well. Oklahoma researchers (Gill et al., 1993) compared five steer management schemes which began at 3 months of age. One group of steers were weaned at 3.5 months of age and placed in a feedlot, the other groups were weaned at 8 months of age and managed on various growing and finishing programs. All steers were fed to similar fat thickness and slaughtered. The feedlot feed efficiency greatly favored the early weaned calves (5.3 pounds of feed per pound of gain) over

older cattle (feed/gain of 8.4 for those weaned at 8 months and grazed on native range the full season before entering the feedlot). There was also a significant economic advantage to the early weaned calves. The early weaned calves returned $176.62 per head while the least favorable comparative group lost $106.56.

In the study cited earlier from Missouri (Whittier et al., 1995) in which calves were weaned from first-calf heifers at the start of the breeding season there was no difference in weight of calves at normal weaning time. In this study early weaned calves were placed in a drylot at weaning and hand-fed a mixed ration (90% DM, 15% crude protein, and 68% TDN) until they were adapted. The same ration was then self-fed until calves were approximately 150 days old at which time they were turned back to pasture with access to creep feed.

Other studies have shown reduced performance in calves that were early weaned. In most of these studies calves have not been fed or managed intensively. Certainly the cost of more intensive feeding and management must be balanced against the benefits received. The potential cost savings or improved reproduction from the dam whose calf is early weaned must also be factored when evaluating calf performance.

Summary and Conclusions

1. Several options are available to cattle producers to use time of weaning as a management tool to manipulate cow body condition.

2. Results and application of early weaning are more favorable in young cows, especially first-calf heifers, than in mature cows. Early weaning needs to be done prior to, or early in, the breeding season to have an impact on pregnancy within that year. A long term benefit of having more cows stay in production through four calvings has been shown by using early weaning management when they are first-calf heifers.

3. Weaning calves from mature cows at 5 to 6 months of age will increase their body condition and reduce their forage intake demands. However, a consistent benefit to reproduction has not been shown.

4. Perhaps the most favorable months to change body condition in spring calving cows are September, October and November. Prior to then the demand for milk production is high and make it difficult to increase cow condition. After these months the impact of colder temperatures also make it difficult to add condition.

Figure 1. Weight and body condition of cows at three times whose calves were weaned at the beginning of the breeding season following first calving (Whittier, et al., 1995) (Beg. Wt (BC) = weight or body condition at beginning of breeding season; Wt (BC) at Wn 1 = weight or body condition at weaning of first calf; Wt (BC) at Wn 2 = weight or body condition at weaning of second calf).

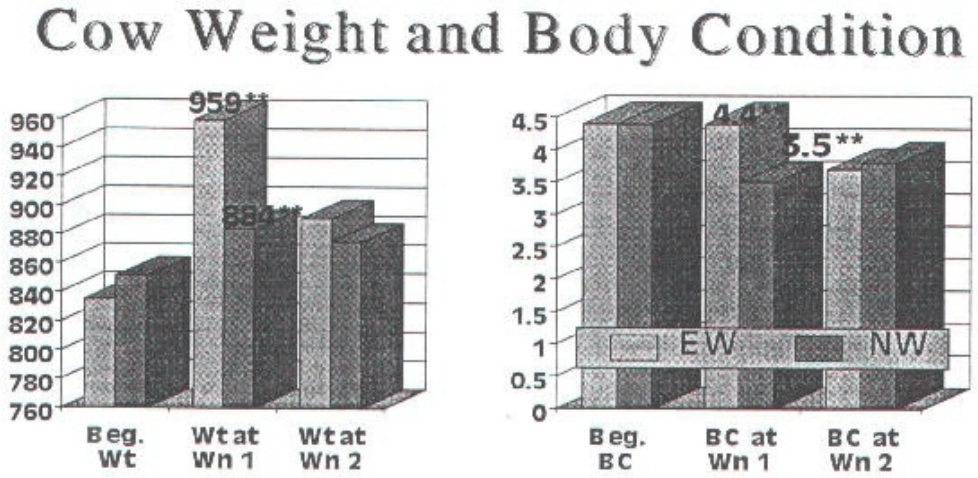


Figure 2. Pregnancy rate of cows over four years whose calves were early weaned at the start of the breeding season following their first calving (Whittier, et al., 1995) (Preg 1 = pregnancy check as yearling; Preg 2 = pregnancy check as 2-yr-old; etc.).

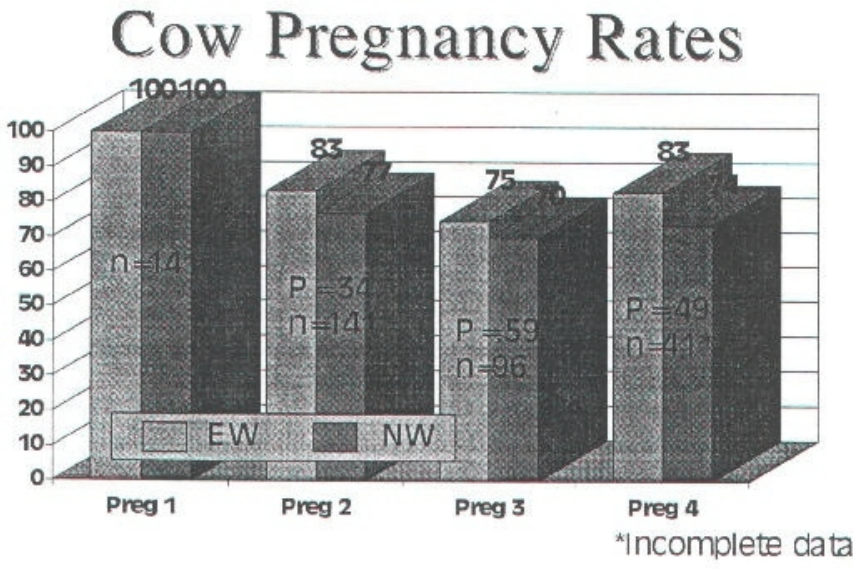


Figure 3. Percentage of cows that weaned three consecutive calves following early weaning (i.e., start of breeding season following first calving) or normal weaning (Whittier et al., 1995).

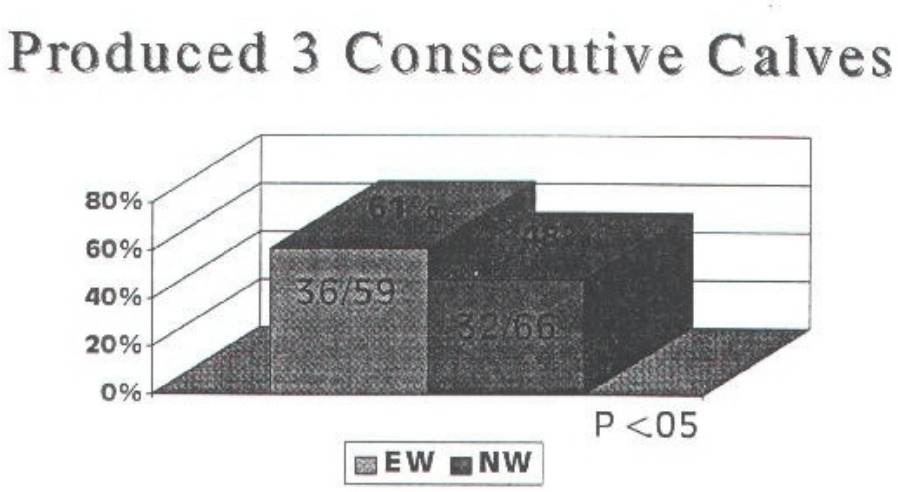
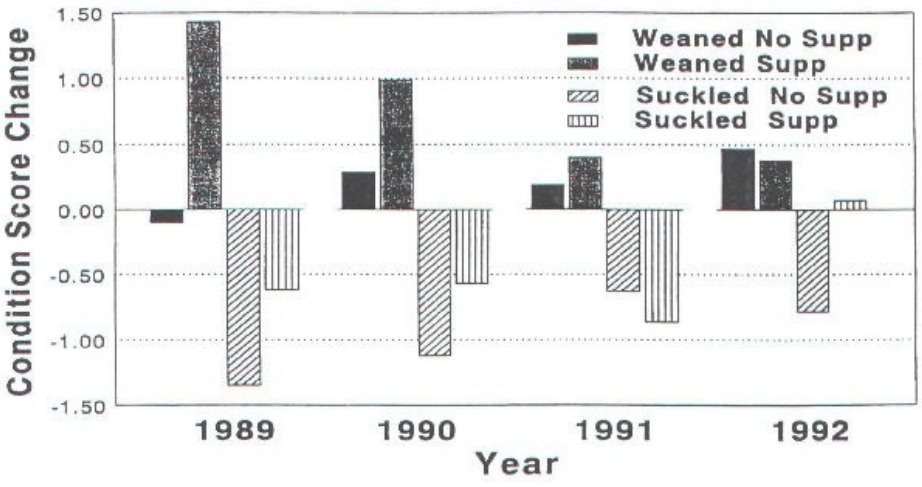


Figure 4. Change in body condition of cows that had calves weaned in either mid to late Spetember or mid to late December and were either supplemented or not supplemented during the same time period (Short et al., 1995).



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