Chapter 3
Time of Weaning: The Economic Implications

Introduction:

Economic pressures to improve production efficiencies in the beef industry have prompted many researchers to evaluate various production systems (Peterson et al. 1987; Adams et al. 1994; Faulkner et al. 1994). These researchers realize that the profitability of the beef cattle industry will depend in part on its ability to compete with other meat industries like pork and poultry. To compete effectively, the beef industry must continue to strive for low costs of production while providing a product that will meet the customer demand for consistency, quality and safety.

Energy is the feed component required in the greatest quantity by beef cattle, estimates are that about 70% of the energy consumed by a cow goes to maintenance (Jenkins and Ferrell, 1983). The beef industry has been able to compete with pork and poultry by utilizing pasture and forages for a great proportion of those energy needs. However, maintaining pasture productivity and calf gain during droughts and even during normal cyclical changes in forage quality and quantity throughout the year can be difficult and as a consequence supplemental feed costs can account for 54 to 75% of the annual cost of keeping a cow (Taylor, 1984). There are numerous management practices that can alter the amount of supplemental feed that needs to be fed. These management practices may include changing the season of calving, altering the grazing system or simply changing the genetics in the herd. Another management procedure that can have a profound effect on the cow calf production efficiency is altering the time of weaning. Peterson et al. (1987) reported that early-weaned cow-calf pairs were 43% more efficient in converting total digestible nutrients into calf gain than were normal weaned cow-calf

pairs. Weaning can manipulate cow body condition and average daily gain; where by resulting in an increase in reproductive rates and reduction in cow winter-feed costs (Lusby et al. 1981; Richards et al. 1986). If forage quantity and quality become limited the longer or shorter a cow nurses will correspond to a decrease or increase in body condition. Many researchers have found that early weaning, improves cow body condition, pregnancy rates, increases pasture carrying capacity and improves the overall profitability of the cow calf enterprise (Myers et al. 1999a; Story et al. 2000; Pordomingo 2002). However the benefits of early weaning that occur to the cow have to be balanced with the costs that occur to the calf, especially if calves are sold at weaning. Weaned calf sales contribute a great percentage of gross income to a cow / calf operation; before changing the age of weaning, careful evaluation of the costs and benefits associated with an early weaning system will need to be done.

This chapter will first discuss key production and economic variables that can be affected by weaning and how they can have an impact on cow/calf profitability. Later the impact of theses variables will be applied in a partial budget analysis using the numbers and data presented from the previous chapter.

Traditional weaning:

In a recent beef cow audit by Alberta Agriculture (1999), average calving date in the province was 21st of March, average weaning date was the 20th of October and average age at weaning was 7 months or 205 days. Why 205 days? The purebred industry adjusts weaning weights to 205 dates 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 one would probably just select older calves as replacement and bulls. The

practices of adjusting weights to a constant age has led many in the commercial cattle industry 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 to commercial producers and there are many other factors that should dictate weaning age besides an arbitrary number adopted primarily due to its repetition rather than relevance in commercial cow herd (Lusby, 1996). Analysis of the data from Kinsella showed that growth rates for the steer and heifers weaned at 132 d and 192 were identical and once backgrounded or finished they were no significant differences in weight the following spring.

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 cows lactation curve has declined substantially by this time, 3) it gives the cow time to prepare for her next calf, and 4) a cheap and abundant forage supply that costs less than the yardage and management needed to achieve similar gains through a confined feeding system.

Cow body condition and herd productivity:

The body condition of beef cows at calving is highly associated with length of the postpartum interval, lactation performance, health and vigor of the newborn calf and in the incidence of dystocia (Lusby et al. 1981; Richards et al. 1986). The condition of cows at breeding affects their reproductive performance in terms of service per conception, calving interval and the percentage of open cows (Herds and Sprott, 1987).

Bench marks and production efficiency parameters are often used as a method of identifying weaknesses which limit profit potential. Researchers working for Alberta

Agriculture (1999) have identified such a set of parameters and they are referred to as the "GOLD" indicators. GOLD stands for; Growth, 45% weaning weight of dams mature weight by 205 days; Opens, less than 4% open for mature cows; Length of calving season, 63 days or less; Death loss, calf death loss less than 4%. In the 1999 Alberta Agriculture beef cow calf audit, average weaning weight for calves was 38% of the mature cows weight, open rates were 3.8%, length of calving season was 95 days and calf death losses were under 3.5%. The improved profit opportunity for improvements in growth, open cows, length of calving season, and death loss of calves was estimated at $58 per cow when $1.15 per lb was the assumed price for weaned calves. Reducing the length of the calving season to 63 days had the best profit opportunity at $23 per cow in the breeding herd. In the 1999 audit average conception with in the first 21 days of the breeding season was less than 50%. To achieve a 96% pregnancy rate in a 63-day breeding season, average conception per 21-day cycle will need to be 70% of cows exposed (Alberta Agriculture, 1999).

Time of weaning and cow reproductive rates:

Whittier (1995a) reported that cows that were classified as thin (BCS 3-4; scale 1 to 9 where 1 is emaciated and 9 severely obese) at calving were 30% less likely to show estrus at 60 and 90 d post partum than cows that were classified as optimum (BCS 5-6; Table 4.1). Maintaining a 365-day calving interval requires a cow to rebreed within 90 days of calving. To optimize rebreeding general management recommendations are for post partum cows to have at least one estrus cycle prior to the breeding season. If one third of cows have not had an estrus cycle within the 90 day postpartum period there may

exist a major potential for low pregnancy rates if the breeding season is confined to a short time period.

Table 4.1 The effect of body condition score at calving and interval to first estrus.;

	Days after calving	
BCS at calving [a]	60 d	90 d
Thin (3-4)	46%	66%
Optimum (5-6)	61%	92%

[a] 1 to 9 scale; where 1 is emaciated and 9 severely obese
Whittier, (1995a)

Anoestrous (absence of estrous or heat) is a condition that exists in most mammals after they give birth. It is contended that it is a self defense mechanism to allow the dam to recuperate after pregnancy (Short et al. 1990). Postpartum anoestrus in cows is often a problem in younger and or growing animals. The combined effects of suckling stimulus, behavioral responses and nutritional demands of milk production are all causes of anoestrous (Short et al. 1990).

In the context of weaning as a management tool, 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 suckling occurs. This is especially true in young and thin cows.
2) The long-term effect of lactation may have an indirect effect on reproduction by reducing cow body condition score so that pregnancy is delayed or reduced in the following year after the current lactation. This is especially true if a cow does not regain enough condition following lactation and her body condition

slips on a continual basis. This is frequently seen in young cows that may breed adequately as two-year olds, but continue to loose condition as three-year-olds.

Oklahoma researchers have reported (Lusby et al. 1981) a 37% advantage (97% vs. 59%) in conception in 1st calf heifers that began calving in February when calves were weaned at 6-8 weeks post partum compared to heifers whose calves were weaned at 7 months. Additionally, the average interval from calving to conception was reduced by 18 days (91 vs. 73 days). Body conditions of the heifers in this study were not reported, however authors stated that the heifers in this study were nutritionally stressed prior to calving and weighed 5% less after calving in the spring than they did in the previous fall. Lusby and company (1981) concluded that the positive response to weaning in this study was due to the fact that the heifers were in marginal condition at calving; heifers in good to moderate condition would have had a less dramatic response to early weaning.

Asides from cow winter feed costs and wintering overhead, animal depreciation is another one of the most significant costs that face the cow calf industry. Depreciation as defined in the Webster's Dictionary is the lowering worth of an asset. In the context of a beef cow it is commonly defined as the difference in worth between a bred and open animal. Cow depreciation often does not get enough attention since winter-feed and feeding cost can be so significant to the cow calf operation. Using cow depreciation in the context of the research from Lusby et al. (1981) the cost between a 96% and 56% conception rate are significant.

Assume:

100-cow herd that buys all bred replacements

Replacement value of Bred Heifer - $1350 / hd

Cull value of open cow - $800 / hd

Animal Depreciation - $550 / hd

* converted costs on a per head basis

Cost of Animal Depreciation **97% conception (3% replacement rate)- $16.50 / hd**

Cost of Animal Depreciation **57% conception (43% replacement rate) - $ 236.50 / hd**

Work conducted by Laster et al. (1973) showed that when calves were weaned 8 days before the start of a 42-day breeding season, the percentage of cows exhibiting estrus from calving through breeding increased by 29% for 1st calvers, 27% for 2nd calvers, and 16% for mature cows. Pregnancy rates were likewise increased by 26% in 1st calvers, 16% in 2nd calvers and 28% in mature cows.

Early weaning for the purpose of improving fertility of first calf heifers can be done when the calves are 35 to 60 days of age. Neville and McCormick, (1981) reported that 81 percent of the 1st calf heifers whose calves were weaned at 56 days of age calved within the first 30 days of the subsequent calving season. In contrast, only 46 percent of the control females calved within the same period.

Whittier and company (1995b) studied the long term effects of early (90 days) versus normal (205 days) weaning of 1st calve angus sired heifers for three years. There were no statistical differences in pregnancy rates at any one year, however the normal weaned heifers had numerically lower pregnancy rates each year following the weaning management treatment than in the 1st year.

Dalsted and Gutierrez (1989) analyzed the numbers of years required for breakeven on replacement females at various replacement heifer values, cow salvage values, and net return per cow. They determined that if the replacement heifer value was $750, the salvage value was $600 and the net return per year is $75, it would requires 4

years of production for a replacement heifer to reach breakeven (Table 4.2). If young cows leave the herd before this there is a net loss. In the case of the study by Whittier and company (1995), 13% more cows reached breakeven due to early weaning management during their first lactation.

Table 4.2 Break-Even Ownership period of a cow (years)[a]

Replacement Heifer Value	Salvage Value	Net Return/Cow $75	$150	$225
$750	$600	4	2	1
	$700	2	1	1
	$800	1	1	1
$900	$600	8	3	2
	$700	6	2	2
	$800	5	2	1
$1050	$600	14	5	3
	$700	12	4	3
	$800	10	3	2

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

Longevity and improved conception rates of beef cows are key economic parameters that will affect overall profitability. In the from of a partial budget the economic value will depend upon the age of the breeding females and whether or not lactational stress will reduce BCS enough to reduce conception rates.

Time of weaning and cow feed costs:

In Alberta winter-feeding is one of the most significant costs in cow-calf production, averaging 30-35% of total production costs (Alberta Agriculture, 1999). Fat cows usually need only small quantities of supplements, while thin cows need large quantities of supplements high in energy and protein. 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. More recently research at the University of Alberta by Koberstein and coworkers (2001) concluded that thin cows required $0.31 / 1000 kg more feed input over cows in moderate to fat condition scores. Therefore a costs savings could result from having cows enter the winter in good body condition.

There has been a great deal of research done on early weaning and its effect of forage intake and supplemental feed costs (Lusby et al. 1981; Peterson et al. 1987; Myers et al. 1999a). The results are highly dependant on the quality and quantity of forage and body condition of the cows. As discussed in chapter 1, early weaning during times of drought is an accepted practice for stretching a limited forage supply. During drought the availability and cost of forage can be even more critical especially when a significant proportion of the winter feed must be purchased.

Peterson et al. (1987) conducted research on early (110 vs. 220 days of age) vs. normal weaned fall calving cows; they estimated the hay consumption by the early weaned dams was 45.3% less than normal weaned cows. 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. Work in Oklahoma by, Purvis and company (1995) found similar findings in that early weaned cows consume approximately 1% less of their body weight in forage than normal weaned cows. Both trials found no difference in pregnancy rates and concluded that the advantage of early weaning mature cows was through stretching the forage supply and reducing winter-feed costs.

Not only will early weaning mature cows help stretch the forage supply, but it will also affect the amount of supplemental feed fed during the wintering months. Typically drought conditions not only decrease available forage supply but they also increase the cost of harvested forages. Thompson et al., (1983) studied the effects of varying levels of winter-feeding and body condition on Hereford x Angus cows. Cows in body condition of 3.5 (scale 1 – 5) required 20% less feed than cows in a condition score 2.5. Similarly, Wright (1988) estimated that allowing a cow to change condition score from a 3 to 2.5 from October to March reduced the winter feed costs and improved economic returns by 17%. In another study by the Kentucky State Extension Service (1988) comparisons of the effects of early weaning to the effects of maintaining low body conditioned cows were studied. In this study they found that early weaning returned $20.57 USD / head more than maintaining thin cows and trying to recondition them before calving. Finally the work at University of Alberta by Koberstein et al. (2001), concluded that cows in good to excellent body condition would require $50 / head less than cows classified as thin during a normal winter feed year. As discussed in chapter 1, drought as a factor could more than double the savings in winter feed costs reported by Koberstein et al. (2001) due to market pressures of supply and demand that increase winter feed costs.

Cow body condition and calf vigor:

Intake and absorption of antibodies from the dam's colostrums are vital for calf survival and health. In a University of Georgia study, researchers (Vann and Baker 2001) looked at the effect of immunoglobulin G (Ig G) concentrations in the serum of calves at

24 hrs of age on their monthly weights up to the time of weaning. They found that pre calving cow body condition had major effects on the serum levels of immunoglobulin M & G present in colostrum (Table 4.4). In the Georgia study serum Ig G levels were classified as superior, average or inferior. Calves in the superior and average groups were significantly heavier at all weigh periods than those of the inferior group. At weaning the superior group was 31 pounds heavier than the average group and 64 pounds heavier than the inferior group. The results of this study verify the importance of pre calving body condition and its effect on colostrum quality. Assuming $1.15 per pound of calf at weaning, the economic difference would be $36 less per head for the group classified as average and $74 less per head for the group classified as inferior.

Table 4.4. The effect of cow body condition score on serum levels of immunoglobulin M & G immediately post parturition

	Cow body condition score			
Item	3	4	5	6
IgM* (mg/dl)	146	157	193	304
IgG** (mg/dl)	1998	2179	2310	2349

Vann and Baker, 2001
*immunoglobulin M
**immunoglobulin G

Time of weaning and calf performance:

Although the benefits of early weaning on improving cow body condition and subsequently improving reproduction and reducing feed inputs been recognized for many years (Peterson et al. 1987; Adams et al. 1994; Faulkner et al. 1994), the factor limiting practical application of early weaning has been management of the early-weaned calf (Lusby et al 1996). Considerations for early weaning must take into account the total

losses and gains to the cow calf enterprise. Early weaning reduces the number of days a calf nurses. If calves are sold at the point of weaning will the reduction in annual cow costs be greater than the reduction in sale value? King (1995) found that direct marketing calves at the point of early weaning would require a $5.24 to $18.24 USD / cwt premium for calves marketed 30 to 90 lbs (13.6 to 40.9 kg) below normal weaning weight to offset income losses due to reduced marketable product.

The potential exists to offset losses in decreased marketable product through retained ownership until traditional weaning time, or up to 45 days after weaning. Marketing weaned and pre immunized calves has been shown to return a significantly higher premium compared with nonweaned, non-immunized calves (King, 1995).

Calf growth rates will depend on many factors. These factors include: pasture forage quality/ quantity, calf age, sex & genetics, and the ability of the dam to sustain lactation. Gifford (1949) found the correlations between dam's daily milk production and calf weight to be .60, .71, .52, and .35 for the first, second, third and fourth months of lactation, respectively. Correlations between the same traits for the following four months were smaller and nonsignificant. He concluded that growth potential may not be maximized by continuing to nurse the dam beyond 4 months of age. Most researchers (Lusby et al. 1981; Myers et al. 1999a; Short et al. 2000) have concluded that weaning calves at or beyond 120 days of age will have little negative impact on the rates of gain as compared to normal weaned calves. Weaning calves earlier than 120 days of age requires more nutritional management, and although rates of gain can be kept similar to the normal weaned calves, more often than not they are depressed by (20-25%) till the calves reach 120 days of age. These variables need to be taken in account when determining

when to wean and which background system optimizes the return on investment for the manager. Although early weaned calves can be backgrounded on pasture; feedlot / dry lot programs to date, have proven to be the most effective in promoting near "normal" rates of gain (Lusby, 1996). Young calves can be very efficient on high-concentrate rations and dry matter conversions of 4:1 are possible up to weights of about 500 lbs. However, feeding in a feedlot environment comes with a cost of not only the feed but the cost of yardage.

Time of weaning and yardage:

Yardage is defined as the costs associated with the upkeep, feed delivery, manure removal, labor, interest costs and facility depreciation of a feeding and confinement facility. A recent study by Alberta Agriculture (2000) surveyed 38 cow/calf producers that wintered an average of 158 cows, it found that the average yardage cost on a per cow basis at $0.67/ head/day (Table 4.5). Although the yardage was based on wintering mature beef cows, calf yardage costs can still be significant. In Alberta, feedlot yardage costs for calves will range from $0.30 to $0.45/ hd / day (Alberta Feedlot Manual, 1996). If animals are gaining at levels of 1 to 2 lbs/day this may add significantly to the cost of gain of that animal. Feeding programs for young (2- month old) calves need to be "growing programs" that hold daily gains to levels similar to those achieved on the cow. These rates of gain will generally range in the 2.0 to 2.5 lb/day range depending on frame size and growth potential of the calves. At a 2.0 lb rate of gain and yardage at $0.40 / hd/day, there would be a $22 / head expense for calves weaned at 150 days and backgrounded to the normal weaning age of 205 days. In other words yardage would cost

$0.20 / lb of gain. There is potential to reduce the cost of yardage on a per pound basis simply by increasing the average daily gain of the calves. This however must be done in balance with the breed type and frame score of the calves; otherwise, full-fed early weaned calves may get fat too early and may not finish at acceptable slaughter weights.

Table 4.5 2000 Cow-Calf Enterprise Yardage Costs

	$/Cow Wintered	$/Head/Day
(A) Variable Costs:		
1. Fuel	13.67	0.07
2. Repairs - Machinery	12.46	0.06
3. Repairs - Buildings	10.24	0.05
4. Utilities (natural gas & electricity)	6.84	0.03
5. Custom Work	5.57	0.03
6. Operating Interest	8.13	0.04
7. Paid Labour & Benefits	2.16	0.01
8. Unpaid Labour	34.65	0.17
Total Variable Costs	**93.72**	**0.47**
(B) Capital Costs:		
1. Equip. & Bldg. a) Depreciation	33.08	0.17
b) Lease Payments	0.74	0.00
2. Capital Interest Paid	5.73	0.03
Total Capital Costs	**39.54**	**0.20**
(C) Total Cash Costs (A+B-A8-B1a)	**65.54**	**0.33**
(D) Total Production Costs (A+B)	**133.27**	**0.67**

Alberta Agriculture, 2000

More economical than feedlot back grounding would be a feeding program on a pasture situation, in which manure removal and facility depreciation would be minimal. The difficulty with pasture back grounding programs is that for very young calves (≥ 80 days of age) gains may be insufficient due to the high roughage composition and physical limitations within the calf to deal with them. In a recent Argentine study by Pordomingo (2002), he found that provided pasture resources were not limited in quality and quantity they could maintain similar weight gains to those achieved in a dry lot situation, where calves were fed a complete mixed ration. The early weaned calves on pasture were still

however supplemented with a high energy concentrate that was fed at 1% of body weight.

Researchers at Oklahoma have also researched forage systems that may provide an answer for back grounding early weaned calves, namely wheat pasture. In an experiment conducted by Lusby (1996), 55 calves born in September and October were weaned at 90 days, held in dry lot for two weeks on prairie hay and 2 lbs of protein pellets, and then moved to wheat pasture. Calves gained about 2 lbs/day on wheat throughout the grazing period without supplementation of concentrates. Virtually all cows rebred with minimal supplement on native range. Research results from this system offered the potential to reduce the winter feed costs for the cows, increasing stocking rates on the native pasture and while minimizing labor and facility overhead.

Drought and feed shortages will always be major factors that initiate early weaning. As much as pasture back grounding could hold the answer to reducing yardage and the cost of rearing early weaned calves, more often than not the dry lot feeding program will be the method chosen by producers to background calves during these periods. Likewise, dryloting early weaned calves that are under 90 days of age, will allow for better health and feed consumption monitoring (Lusby, 1996; Myers et al. 1999a; Short et al. 2000).

Calves that are destined for slaughter, will need to be moved to progressively higher energy diets over time. Moving calves from a high rate of gain in a dry lot situation back to a pasture, will result in poor gains. Therefore, calves raised in dry lot to normal weaning age on mixed rations need to be moved to nutritional programs with good gain potential for finishing. Although weaning and dryloting the calves to finish is generally the norm, there are circumstances in which calves may be moved back to pasture.

Time of weaning and the value of calf health:

Although health is often difficult to quantify, many researchers (Fluharty et al. 1996; Myers et al. 1999a) have shown early weaning has had an important role and factor in the health of calves during the back grounding and through to the finishing period. After slaughter the impact of weaning can still be quantified in terms of differences in carcass qualities and feedlot feed efficiency (Grimes et al., 1991; Myers et al. 1999a;). Myers et al. (1999a) studied the health of steers that were either 1) early weaned (EW; 165 d), 2) normal weaned creep (NWC; 215 d) animals had access to creep feed for 50 days prior to weaning or 3) normal weaned (NM; 215 d) with out creep feed. In this study they found that EW steers had 84% less respiratory morbidity when compared with average of NWC and NW steers. Another study by Meyers and coworkers (1999b) looked at the effects of weaning on the health of 90d, 152d, and 215d weaned steers. In it they observed a quadratic response for the percentage of steers treated for respiratory morbidity and for digestive morbidity. In both experiments the authors concluded that the high percentage of respiratory morbidity in the normal weaned treatments may have been attributed to effects of weather.

From 1991 to 1996 animal health and feedlot performance data was collected from the Texas A&M “Ranch to Rail program; this was an extension program started for cow/calf producers to better understand the feedlot potential for their 210 day old weaned calves. Calves were received and fed at a number of feedlot throughout Texas and classified as either sick or healthy at induction; these animals were then followed through to slaughter and evaluated for feedlot and carcass performance as well as for economic returns (Table 3.6). The average net return for the steers across the program was $37.45,

however once the steers were classified as sick or healthy the numbers dramatically changed (Henderson, 1997).

Table 3.6 The Impact of Health on Performance, Profits and Carcass Quality [a]

	Sick	Healthy
Head	3202	9393
Death Loss	3.40%	0.50%
Average Daily Gain	2.78	2.96
Total cost / lb gain	$65.96	$56.68
Medicine cost per head	$31.33	$0.00
Net return per head	($31.97)	61.23
Quality Grade		
Choice	29%	39%
Select	63%	56%
Standard	8%	5%

Data from Texas A & M Ranch to Rail Program 1991 - 1996
Drovers Journal; August,1997
[a] Costs and returns quoted in USD

All totaled 25% of calves that entered the program were classified as sick. The average death loss, treatment costs and costs of gain were all significantly higher for the sick calves as compared to the calves classified as healthy upon induction. Net returns for the calves classified as sick were -$31.37 per head as compared to a $61.23 USD for healthy calves. Not factored into the returns were the differences in bonuses or discounts for the various carcass qualities. If carcass quality had been factored into the equation the range for returns would have been from a positive $307 /head to a negative $310 per head (Henderson, 1997). Performance factors for average daily gain and feed efficiency were important at influencing the impact on the feed cost of gain, however the impact on health and the ability of the steers to express their genetic potential, beyond just the cost of medicine was even more important.

Carcass qualities:

In today's competitive value-based marketing system, raising cattle that produce high quality, uniform beef, could enhance the competitive ability of the beef industry. There will be an increase focus on finished animals to have a greater lean to fat ratio or carcass yield, while at the same time increasing the amount of intramuscular fat or marbling. The age at which weaning occurs can have a profound effect on carcass qualities. Myers and company (1999a) studied the effect of three weaning management systems and three breed types on steer and carcass performance for two years. The three weaning treatments were 1) early weaned (EW; 165 d), 2) normal weaned creep (NWC; 215 d) animals had access to creep feed for 50 days prior to weaning or 3) normal weaned (NM; 215 d) with out creep feed and the three breed types were 1) Angus x Hereford (Bri); 2) Angus x Simmental (CON); and 3) Angus x Wagyu (WAG). After the two years of study they not only found that the EW calves gain faster that the average of NWC and NW steers, but that the EW steers also had lower intakes and better feed conversions than the average of NWC and NW steers. Marbling scores were also improved for EW steers when compared with the average of NWC and NW steers. Evaluation of the breed types found that CON steers were heavier at slaughter than BRI steers and BRI steers were heavier than WAG steers. They also found that early weaning improved the percentage of steers grading Average Choice or higher by 40%.

Table 4.7 Effects of three weaning management systems on steer performance and carcass qualities.

Item	Weaning Treatment			SEM
	early weaned	normal weaned creep	normal weaned	
No of steers	48	55	64	
Initial weight	149	140	144	5
Slaughter Weight	493	478	470	7
Days in Feedlot	164	213	213	2
ADG, kg				
177-231 d	1.44	.82	.62	.05
231-443 d	1.28	1.38	1.38	.02
Overall	1.31	1.27	1.22	.02
DMI, kg/d	7.70	8.20	8.12	.11
Gain/Feed	.170	.155	.151	.003
Rib eye area cm^2	75.4	74.5	75.0	1.0
Yield Grade 1, %	12	5	16	5
Yield Grade 2, %	49	66	57	7
Yield Grade 3, %	39	29	27	5
Marbling score	1,168	1,124	1,122	13
≥Choice, %	95	87	91	4
≥Avg. Choice, %	81	58	58	6
≥Prime, %	15	10	2	4

Myers et al., 1999a

Further to the work from Myers and company, Wertz et al. (2002) found that feeding 142 day old weaned Angus and Angus x Wagyu calves a 80% concentrate ration resulted in animals that had greater marbling scores and better feed conversions than genetically similar heifers that were finished at two years of age. The authors concluded that placing early weaned heifer calves sooner onto a high concentrate ration increased their intramuscular fat or marbling relative to subcutaneous fat, so that the calves were likely to reach quality grades that were eligible for grid premiums before they attained a yield discount. The authors also concluded that breed type is also an important factor to take into account and that breeds like Wagyu may increase marbling scores but may also compromise feed efficiency.

In another study by Story et al. (2000) they also found that early weaned (150 d) steer calves had better greater daily gains, feed conversion, marbling scores and carcass yields than normal weaned (210 d) and late weaned (270 d) steers. These differences resulted in a net income per steers at slaughter for the feedlot phase of $75.36 for early weaned, $62.16 for normal weaned and $10.09 for the late weaned treatments. The authors however concluded that even though the early-weaned steers had generated the most revenue for the feedlot phase, as a system it was not sufficient enough to offset the loss of revenue that occurred at weaning. They concluded that the majority of the cow cost are incurred by the time the calf is 150 d of age. The early weaned calf does not weigh as much at weaning as the normal weaned and or late weaned and so there is not as much money generated to offset the cow costs. They concluded that for to maximize the benefits of early weaning the calf should be retained after weaning to increase profit potential for this management system.

A very important factor that will influence any cost and benefit analysis of weaning strategies will be the discounts and differentials for carcass qualities like, marbling scores, yield grades and the weight ranges for carcass discounts. Depending upon the time of the year there may be greater premiums for certain carcass grades while at other times of the year heavy discounts for over and under weight carcasses. Evaluating and knowing when weaned calves will finish and how they will grade will be a very important step in determining the costs and benefit of a weaning system for calves. An example grid and differences in returns is shown in Table 4.7.

Table 4.7 Carcass grid and pricing scenarios*:

# Animals	*100*
Carcass Weight - *lbs:*	*750*
Rail Price - *$$ / cwt.*	*$ 150.00*

Premiums & Discounts

Example Grid:

	YG1	YG2	YG3
AAA	$11.00	$8.00	$3.00
AA	$3.00	-	$(10.00)
A	$(1.00)	$(4.00)	$(14.00)

For every carcass that grades AAA & YG1, the carcass is given an $11/cwt premium above market value.

Average Report on January Carcass's:

January 15th, 2002 Canfax Market Summary

	YG1	YG2	YG3
AAA	20.0%	18.8%	6.1%
AA	34.7%	13.3%	2.2%
A	3.5%	0.3%	0.0%

$ 24,150.00	$ 22,278.00	$ 6,999.75
$ 39,818.25	$ 14,962.50	$ 2,310.00
$ 3,911.25	$ 328.50	$ -

Value of 100 animals: Total: **$114,758.25**

Example of a scenario (A) with-
***Below Average Carcasses*:**

	YG1	YG2	YG3
AAA	10.0%	5.0%	3.0%
AA	25.0%	30.0%	7.0%
A	10.0%	10.0%	0.0%

$ 12,075.00	$ 5,925.00	$ 3,442.50
$ 28,687.50	$ 33,750.00	$ 7,350.00
$ 11,175.00	$ 10,950.00	$ -

Value of 100 animals: **$113,355.00**

Example of a scenario (B) with-
Above Average Carcasses:

	YG1	YG2	YG3
AAA	40.0%	30.0%	2.0%
AA	25.0%	9.0%	1.0%
A	2.0%	1.0%	0.0%

$ 45,060.00	$ 33,792.30	$ 2,250.92
$ 28,190.06	$ 10,133.98	$ 1,125.17
$ 2,250.53	$ 1,125.02	$ -

Value of 100 animals: **$123,927.97**

The difference between a below average and above average carcass qualities on a 100 head was - $10,573.00 or $105.71/ head. Although this is just an example, the merits of producing high quality carcasses can show a considerable economic return. Many times early weaned calves are sold after they are backgrounded, however if the calves are to be fed to slaughter, carcass qualities are another factor that should be taken into account within the cost benefit analysis of early weaning.

Literature Cited

Alberta Agriculture, 1996. The Alberta Feedlot Manual. Section 4; p 1–20.

Alberta Agriculture, 1999. The Alberta Provincial Beef Cow Audit. In Press

Alberta Agriculture, 2000. Yardage costs for Alberta cow calf producers; Production economics branch AAFRD; www.agric.gov.ab.ca

Adams, D. C., R. T. Clark, S. A. Coady, J. B. Lamb, and M. K. Nielsen.1994. Extended grazing systems for improving economic returns from Nebraska sandhills cow/calf operations. J. Range Manage.47:258–263.

Butler, L.D. 1996. Understanding internal rate of return and net present value. USDA, Natural Resource Conservation Service.

Dalsted, N. and P. Gutierrez. 1989. Selection and development of replacement asset: The replacement heifer. Proc. West. Ag. Econ. Assn. Coeur D'Alene. ID. July 1989. p. 550

Faulkner, D.B, D.F. Hummel, D.D. Buskirk, L.L. Berger, D.F. Parrett and G.F. Cmarik. 1994. Performance and nutrient metabolism by nursing calves supplemented with limited or unlimited corn or soyhulls. J Anim. Sci. 72:470

Fluharty, F. L., T. B. Turner, S. J. Moeller, and G. D. Love. 1997.Effects of age at weaning and diet on growth of calves. In: Ohio State University Research and Reviews. Research Bull. 156.Columbus, OH.

Gambill. M.D., E.E. Parker, L. Tibbs, M.K. Peterson, G.B. Donart, and J.D. Wallace. 1995. Progress Report: Influence of early weaning fall supplementation and winter/spring supplementation as singular or combined treatments on the productivity of range cows. Year 2. WRCC – 104. Annual Meeting Report.

Gifford, G. 1949. The influence of cow lactation on the growth potential of beef calves. J. Anim. Sci. XXXXXX – to be added

Grimes, J. F., and T. B. Turner. 1991. Early weaning of fall-born beef calves: I. Pre-weaning calf and cow performance. J. Prod. Agric.4:464–468.

Henderson. G. 1997. Producing Quality Calves. Drovers Journal, Volume 8, p 20-21.

Herd. D.B. and L.R. Sprott. 1987. Body condition. Nutrition and Reproduction of Beef cows. Texas Agricultural Extension Service. Circular B01526

Jenkins, T.G., and C.L. Ferrell. 1983. Nutrient requirements to maintain weight of mature, nonlactating, non pregnant cows of four diverse breed groups. J. Anim. Sci. 56:761-770.

Jobes. R. 1990. Budgets their use in farm management; OSU Extension Facts. Oklahoma Cooperative Extension Service

Joerger, P. 2000. Kentucky Cooperative Extension: Economics of Beef Production. Sec 11, p 1-5.

Kentucky Cooperative Extension Service. 1988: Management of early weaned calves. Kentucky herd health memo 1:9-16.

King, M.E. 1995. The effect of value added health programs on the price of beef calvessold through five video auctions in 1994. Colorado State University Beef Program rep. 13:7-13.

Knabel, K. M., T. B. Turner, and M. A. Watson. 1989. Effects of early weaning on growth rate of spring-born calves and an economic comparison with those weaned at normal ages. Appl. Agric. Res.4:73–75.

Koberstein B., R.M. Carlyon, B. Fournier, L Giebelhaus, W. Grabousky, J. Johnson, G.W. Mathison, J. Van Kuelen, and T. Yurchack. 2001. The effect of fall body condition on winter feed requirements of wintering beef cows. In Press.

Laster, D. B., H. A. Glimp, and K. E. Gregory. 1973. Effects of early weaning on postpartum reproduction of cows. J. Anim. Sci.36:734–740.

Lusby, K. S., R. P. Wettemann, and E. J. Turman. 1981. Effects of early weaning calves from first-calf heifers on calf and heifer performance. J. Anim. Sci. 53:1193–1197.

Lusby, K.S. 1996. The use of early weaning in practical cattle management. Oklahoma Cooperative Extension Service. CR-3278-0395

Myers, S. E., D. B. Faulkner, F. A. Ireland, L. L. Berger, and D. F. Parrett. 1999a. Production systems comparing early weaning to normal weaning with or without creep feeding for beef steers. J. Anim. Sci. 77:300–310.

Myers, S. E., D. B. Faulkner, F. A. Ireland, and D. F. Parrett. 1999b.Comparison of three weaning ages on cow-calf performance and steer carcass traits. J. Anim. Sci. 77:323–329.

National Animal Health Monitoring System, 1998. Part IV: Changes in U.S. Beef Cow-Calf Industry, 1993 – 1997. At: http://www.aphis.usda.gov/vs/ceah/cahm/BEEF__Cow-Calf/bd97IV.pdf

Neville, W. E., and W. C. McCormick. 1981. Performance of early-and normal-weaned beef calves and their dams. J. Anim. Sci.52:715–724.

Penn State, 1999. Partial budgeting for agricultural businesses. College of Agricultural Sciences. Agricultural Research and Cooperative Extension, Pennsylvania State University.

Peterson, G. A., T. B. Turner, K. M. Irvin, M. E. Davis, H. W. Newland, and W. R. Harvey. 1987. Cow and calf performance and economic considerations of early weaning of fall-born beef calves. J. Anim. Sci. 64:15–22.

Pordomingo, A.J. 2002. Early weaning and length of supplementation effects on beef calves. J. Range Manage. 55, 327 – 335.

Richards, M. W., J. C. Spitzer, and M. B. Warner. 1986. Effect of varying levels of postpartum nutrition and body condition at calving on subsequent reproductive performance in beef cattle. J. Anim. Sci. 62:300–306.

Short, R.E. R.A. Bellows, R.B. Staigmiller, J.G. Berardinelli, and E.E. Custer. 1990 Physiological mechanisms controlling anoestrus and infertility in postpartum beef cattle. J. Anim. Sci. 68:799

Story, C.E., R.J. Rasby, R.T. Clark, and C.T. Milton. 2000. 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.

Taylor, R.E. Beef production and the beef industry: a beef producer's perspective. P 127. Burgess International Group Inc., Edina, Mn.

Thompson, W.P., J.C. Meiske, R.D. Goodrich, J.R. Rust and F.M. Byers. 1983. Influence of body composition on energy requirements of beef cows during winter. J. Anim. Sci. 56:1241

Wertz, A.E., L.L. Berger, P.M. Walker, D.B. Faulkner. F.K. McKeith, and S.L. Rodriguez-Zas. 2002. Early weaning and postweaning nutritional management affect feedlot performance, carcass merit, and relationship of the 12^{th}-rib fat, marbling score, and feed efficiency among Angus and Wagyu heifers. . J. Anim. Sci. 80:28-37

Whittier, J. 1995a. Time of weaning and cow condition. In: Proc., The Range Beef Cow Symposium XIV, Gering, NE. pp 92–104.

Whittier, J., B.L. Weech and R. Eakins. 1995b. Effect of weaning calves from primiparous cows at the beginning of the breeding season following first calving on subsequent dam and calf productivity. J. Anim. Sci. 73 (Suppl. 1):241

Vann and Baker. 2001. The relationship between immunoglobulin concentrations and weaning weight. J. Anim. Sci. 79 [Suppl. 1]: 223