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Matching Calving Date With Forage Nutrients: Production and Economic Impacts

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Reducing costs while maintaining production is one way to improve the economic performance of a cow-calf operation. In large parts of the beef cattle production area, feed cost is a major factor in determining overall economic efficiency. Harvested forages and purchased feed make up the majority of the total feed cost. A major goal of our work has been to research cow-calf production systems that improve the economic and overall sustainability of the cow-calf operation. Given that feed costs are such an important component of most cow-calf operations we have focused our research on ways to reduce those costs without sacrificing production or by reducing costs relatively more than production .

The concept of matching nutrients available in forages with nutrient requirements of the cow has been recommended as a means to most efficiently utilize grazed forages (Adams et al. 1996, Valentine 1990, Vavra and Raleigh 1976). They identified complementary forages, calving date, and weaning date as ways to match forages with the nutrient needs of the cow. When the cow and the range forage are well matched the cow should receive most nutrients from grazed forages. Adams et al. (1996) suggested that genetic potential for milk production in the cow, and synchrony between the animal's nutrient requirement during lactation and the highest nutrient value in the forage determine how well the animal and forage resource match. We hypothesize that when nutrient requirements of the cow are matched with nutrient output in forages, purchased or harvested feed costs and labor can be reduced relatively more than production may be reduced.

Cyclical Nature of Plant Nutrients

The quality and quantity of forage produced on rangelands are highly cyclical, within and between years. Precipitation, plant species, and the proportion of cool and warm season species affect the overall forage quality of rangeland at any point in time. Seasonal changes in nutrient density of rangeland forages are primarily associated with plant maturity. Plants contain their greatest nutrient value before maturity. In general, diets from dormant range contain between 4 and 7% crude protein with higher concentrations occurring in late summer and early fall and lower concentrations occurring during late fall and winter. Plants in a vegetative state generally contain over 10% crude protein (Lardy et al. 1997, Adams and Short 1988).

Nutrient Requirements of the Cow

Cow size, milk production, pregnancy, and activity are the primary influences on nutrient needs in cattle. The larger the cow, the more energy and protein required for maintenance. Crude protein and energy requirements during the last third of pregnancy are about 20 and 14%

greater than during the middle third of pregnancy, respectively. Cow protein and energy requirements increase again during lactation and are greater then, than any other time of the cow's production cycle. As requirements for pregnancy and lactation increase, the quantity of forage needed increases and the greatest amount of forage needed is for the cow producing a high level of milk.

Plant-Animal Interactions

The fibrous, bulky nature of forage and low concentration of crude protein limit the amount of forage an animal consumes. Inability of an animal to consume enough nutrients in a forage diet is greatest when density of the nutrient is low and/or when animal requirements are high. Lactation and pregnancy are more critical in matching the cow to the forage resource than body size because of the need for greater nutrient density in the forage. Increased requirements for cow size do not require greater nutrient density because large cows have increased capacity to eat. However, both cow size and amount of milk produced affect stocking rate. Increasing either cow size or milk production increases the amount of forage needed to sustain the cow. Generally, protein will be limiting before energy in range diets (Adams and Short 1988). As a result, the key to matching forage nutrients with cow requirements is protein content of the forage. A cow consuming a forage containing 5 to 6% crude protein is not likely to consume enough forage to meet protein requirements during most of the cow's production cycle. Crude protein content of 5% is common in range forages during late fall and winter. Dormant fall-winter range will not likely support milk production and maintain cow body condition without supplementation (Lamb et al. 1997, Short et al. 1996). Cows would likely consume enough forage to meet crude protein requirements at all production phases when forages contain 10% or greater concentration of crude protein (Lamb et al. 1997, Adams et al. 1993).

Matching Calving Date with Nutrients in Forage

A mismatch between nutrient density and cow requirements occurs in cows calving in late winter or early spring before green grass when grazed forages have low concentrations of protein and energy. The problem is exacerbated by high milk production and usually mitigated by feeding hay and/or supplements. Figure 1 shows the match of protein in range forage with cow requirements (peak milk production = 23 lb./day) for metabolizable protein during the year with the calving season beginning March 1. A rather large protein deficit is expected between March and May, and during June through July an excess in protein is expected. Both the deficit and excess can be inefficient use of the protein. The protein deficit is large enough that it is generally not practical to graze and most ranches calving in the late winter or early spring feed hay (Coady and Clark 1993). The excess is inefficient in that protein exceeds what the cow can utilize. If calving were earlier than March 1, the deficiencies and excesses would be exacerbated. If calving is moved later, the deficiencies and excess would be reduced. The extent of the reduction would be dependent on the calving date selected.

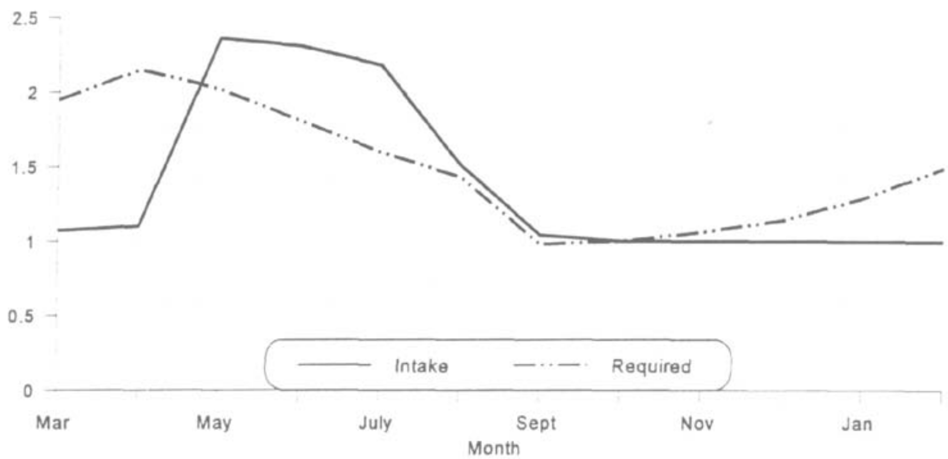

Fig. 1. Metabolizable protein (MP) requirement and availability for a 1200 pound March calving cow grazing on range with peak milk production of 23 pounds/day. (MP requirement and availability estimated from NRC 1996 computer model.)

We demonstrated that net returns per calf in a March calving system were increased by about \$50 to \$90 by extending grazing in winter and spring in lieu of feeding hay. Although we extended grazing, the March calving system using the least amount of hay still required about 2,600 lb./hay per cow during and shortly after calving (Adams et al. 1994). Coady and Clark (1993) reported that the average Sandhills ranch annually fed 3,200 pounds/head of hay to mature cows and that some ranches fed as much as 5,000 pounds of hay/head. We hypothesized that 2,600 pounds of hay or more could be replaced by grazing if the cow was synchronized with nutrients in grazed forages by moving calving to later than March. We decided to focus on calving date as the primary management tool for testing our hypothesis, i.e., costs can be reduced and profitability improved by better matching cattle to the forages. We used three criteria to determine our calving date: 1) peak nutrient requirements of the cow would occur near the time when range forages have their highest level of crude protein available in amounts adequate to meet cows needs, 2) a short period of green grass before the beginning of calving to ensure that all cows would be in moderate body condition (i.e., condition score 5 to 6 on a 9 point system), and 3) cow reproduction would be maintained near that for March calving cows. Evaluation of data from fistulated cows revealed that the peak nutrient value of Sandhills forage in amounts that would sustain a cow generally occurs in June (Figure 2). We determined that a mid-June calving date would meet our first and second criteria. We expected to have cows in moderate body condition at calving and at the beginning; of the breeding season with the mid-June calving date. We expected that the cows would likely begin to loose body condition early in the breeding season and that supplements would be needed during the breeding season and until weaning in January. The match between the cow's metabolizable protein requirements and protein content of forages for the mid-June calving date are shown in Figure 3. A deficiency of protein is evident during October through December but is less than a pound. We anticipated some loss of body condition but were not concerned if it occurred after the breeding season and could be put back on the cow before calving.

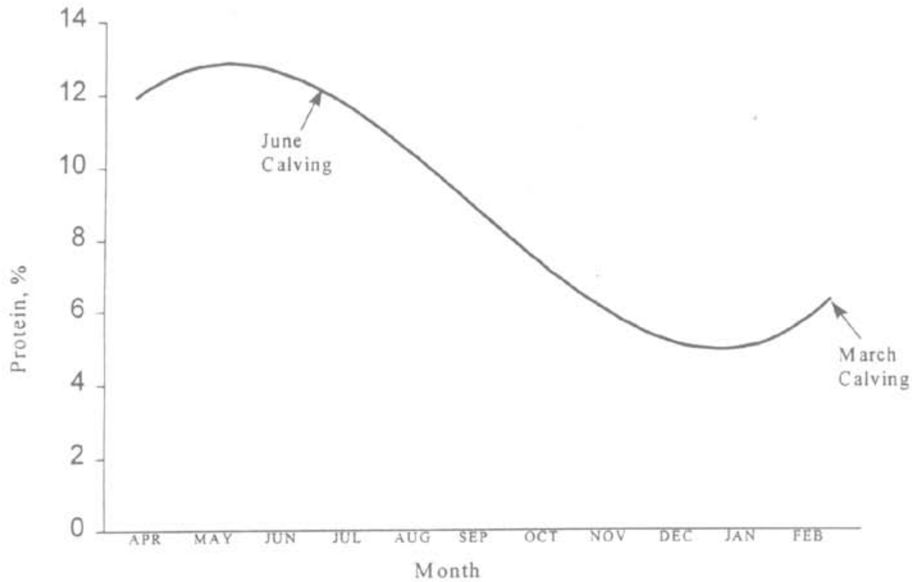

Fig. 2. Crude protein in cattle diets on Sandhills range (adapted from Lardy et al. 1997).

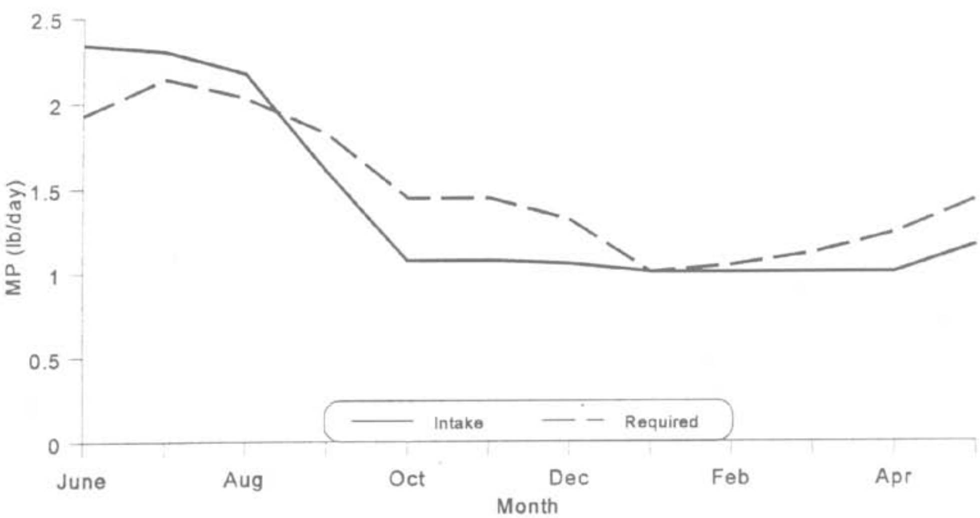

Fig. 3. Metabolizable protein (MP) requirement and estimated MP availability for a 1200 pound June calving cow grazing range with peak milk production of 23 pounds/day. (MP requirement and availability to the animal estimated from NRC 1996 computer model and feed library)

March vs. June Calving in the Nebraska Sandhills

A traditional March calving cow herd is maintained at the University of Nebraska-Lincoln Gudmundsen Sandhills Laboratory (GSL) near Whitman, Nebraska. In 1991 a subset of cows was selected from each age of March calving cows and was bred to start calving in June 1994. Production traits and economics of the June calving herd are being compared to the traditional March calving herd. A production calendar for the two calving systems is shown in Table 1.

Table 1. Production calendar for March and June calving herds

Item	March Calving	June Calving
Beginning of calving	March 18	June 18
Beginning of breeding	June 8	September 8
Weaning date	October 10	January 10
Steer calves to feedlot	November 15	1) February 14 (½ of calves) 2) September 10 (½ of calves after grazing range May 15 - September 7)
Slaughter Date for Steers	May 5	1) August 16 2) January 12

June-calving cows were fed an average of 30 pounds of hay/cow/year compared to an average of 3,182 pounds of hay/head/year for March calving cows during the first three years. Protein supplement fed to June calving cows (131 pounds/year) has been greater than that fed to March calving cows (108 pounds/year). Birth weights were higher for June born calves (96 pounds) than March born calves (90 pounds). Although birth weights were greater, we observed less dystocia with the June calving cows than March calving cows. In addition summer calving cows were checked morning and evening during calving while March calving cows were checked about every two hours during the first three weeks of calving. Calving shed, and associated pens and equipment were not needed for June calving cows. Average calving dates were March 30 and June 29 for March and June calving herds, respectively. Calf scours have not been observed in the June calving system. Pregnancy rates were similar (about 95%) for March and June calving cows. Weaning weight was about 35 pounds higher for March born steer calves (471 pounds) than June born steer calves (436 pounds).

ECONOMIC CONSIDERATIONS FOR EVALUATING SUMMER CALVING

We have not completed a thorough economic comparison of our summer calving project. We have only three complete years of cow and calf data and two complete years of yearling data. The results that we have presented and will present below are preliminary, but we believe they show the trends of the systems.

Total Feed Requirements and Availability

One of the important concepts is the differences in cow requirements by time of year due to the different calving dates. We have already shown the comparisons between metabolizable protein needs and the relative content of the forages for both March and June calving cows. Another way to examine the cow needs is to look at requirements for various times of the year by AUMs (animal unit months). Figure 4 shows AUM requirements for three time periods for spring (March), summer (June), and summer with yearlings herds. The requirements are for a 100-cow herd that has a replacement rate of 15%. We assumed 1200 pound cows with productivity similar to that which we have experienced with our research herds. The shown requirements are for the cows, first calf heifers, heifer calves and yearlings where appropriate. Bull requirements were not included since they would be similar for spring or summer calving herds.

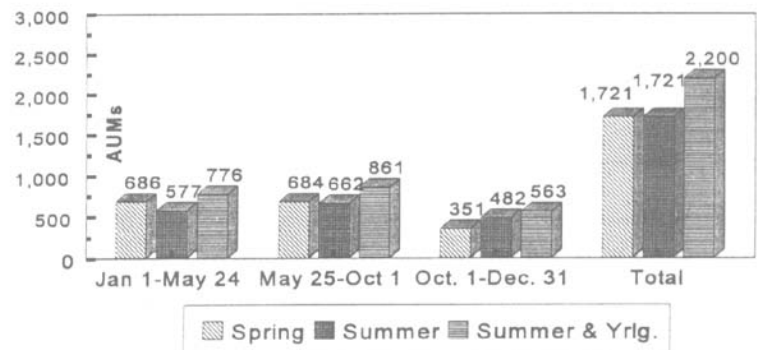

Fig. 4. AUM requirements for summer and spring calving cows and summer calving cows with yearlings summered on grass.

The first time period begins with the calendar year and ends when the warm season grasses in the Sandhills produce adequate volume for grazing. The second time period represents traditional summer/early fall grazing, while the last period is late fall, early winter. Producers often graze their cattle on regrowth on meadows and dormant upland forages during this last period. Notice that total cow herd nutrient requirements are about 18% higher during the winter/early spring period for the March calving cows. Even if one needs to feed hay to both herds during that time (e.g., during a snow storm), the summer calving cows will need less. Figures 1, 2, and 3 also demonstrate that nutrient needs will be poorly matched with nutrient availability from forages during that same time frame for the spring calving cow. On the other end of the time scale, the summer calving herd has higher requirements in the fall and early winter since the cows are lactating during that time. The total AUM requirements for the summer calving and spring calving cows are the same. The requirements just occur at different times of the year. Total AUMs for the summer calving with yearlings are 479 AUMs higher than the other two systems. We assumed that the same number of cows and replacements were maintained and all non-replacement heifers and all steer calves were run as yearlings and sold in mid-September. If the producer's resources were fully utilized with the straight cow/calf systems, then he/she would need to acquire more resources or reduce cow numbers to accommodate the yearling cattle. Each producer must look at their resource availability compared to the cow requirements to help determine which type of system fits. If an operation is short on winter feed but has adequate fall and early winter grazing, the summer system may work well for balancing resources.

Economics of Selling Weaned Calves and Calf-fed Finished Cattle

One of the keys to a successful cow-calf operation is the marketing of the cattle. Marketing includes the decision as to when and in what form to market. Changing the calving date alters the time of year when cattle are available for sale. If calves are to be sold at weaning, then the marketing date shifts from October for the spring born calves to January for the summer born calves. If calves are weaned and sent relatively quickly to the feed lot under a retained ownership scenario, then the spring born calves will finish in late April to mid-May. The summer born calves will finish in August. Price cycles are important considerations. Market highs for fed cattle historically have occurred in April and market lows have occurred in August (Figure 5). The summer born calves that are finished as calf feds would then be ready for sale during the market lows. Does that mean that they would be less profitable than their spring born counterparts that would be sold in May? Not necessarily since one would need to examine all the costs of both systems. The costs of the summer born calves, finished for the August market, would need to be reduced relatively more than the difference in the April and August fed cattle prices. Using the most recent 10 year price (August and May) for 1100-1300 pound choice slaughter steers (Wellman 1997), the summer born calf feds would gross about $828/head ($69.66 x 12) compared to $876 ($72.97 x 12) for the spring born calf feds. Costs for producing the summer born animal would need to be 6% or more lower than the costs for the spring born to make the summer born competitive.

Our research is demonstrating that we can reduce harvested forages in the system by about 1.5 tons per cow per year. If it costs $30/ton to either buy or produce the hay we have reduced costs by $45/cow just by our reduction in harvested forages. This reduction in the use of harvested forage has not resulted in reduced production when ownership is retained through the feedlot. The latter analysis is appropriate for the operator who raises his or her own calves and then retains ownership through the feedlot and who is looking at the financial rather than economic costs of the system. We conducted an economic analysis of steers where we priced the calves and the inputs at their actual or opportunity cost. Pricing the calves at weaning and ignoring the cost savings to weaning resulted in similar economic break-even costs for the spring and summer born calf feds. Both break-evens were around $60/cwt. with the spring born calf feds having slightly ($1.50/cwt.) lower costs per cwt. These costs were based on charging actual costs of the finishing ration plus $0.30/head/day yardage. In addition, interest was charged at the annual rate of 8% on the value of the animal at weaning and the other costs for the period they were incurred. With the economic analysis, the spring born calf feds would net the producer more return over the opportunity costs since they reach market when the prices have been historically higher.

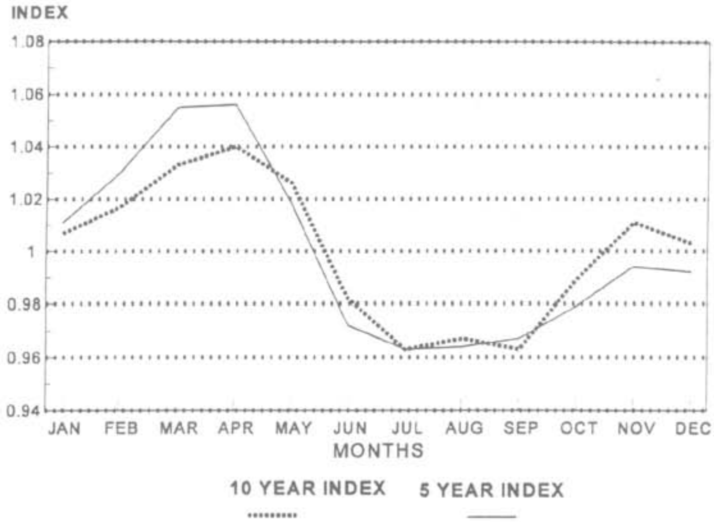

Fig. 5. Seasonal price index for choice 2-4 yield grade 1100 to 1300 pound slaughter steers (Wyoming, western Nebraska, and southwest South Dakota).

One option for both systems is to sell the calves at or near weaning. Table 2 shows the gross returns of selling both heifer and steer calves from the summer and spring herds. Prices are based on the weekly prices for January (summer born) and October (spring born) for Western Nebraska and Eastern Wyoming (Livestock Marketing Information Center 1977) 1992 through

Table 2. Gross returns from summer and spring born calves sold at weaning for Western Nebraska and Eastern Wyoming--1992-1997 prices

	Price/cwt	Gross/head	Price/cwt	
Steers	**Summer Born** (wn wt=436)		**Spring Born** (wn wt=471)	
Mean price	$93.18	$406.26	$87.03	$409.91
Mean price + Std. Deviation	$110.02	$479.69	$102.96	$484.94
Mean - Std. Deviation	$76.34	$332.84	$71.10	$334.88
Heifers	**Summer Born** (wn wt=420)		**Spring Born** (wn wt=454)	
Mean price	$76.01	$319.24	$77.12	$350.12
Mean price + Std. Deviation	$98.33	$412.99	$98.08	$445.28
Mean - Std. Deviation	$53.69	$225.50	$56.16	$254.97

January of 1997. The January 1992 prices were dropped from the average on the assumption that they may or may not have much relationship to the October 1992 prices. Those prices are reported in 50-pound increments, so the October prices represent the 450-500 pound price while January prices are for 400-450 pound calves.

The gross returns on the summer and spring born steer calves sold at weaning are very similar. Even though the spring born calves weaned heavier than their summer born counterparts, the lower price for heavier calves and for October compared to January offset the weaning weight advantage. The spring born heifer calves grossed about $30/head more than their summer born peers. Price differentials for summer born heifer calves were not as favorable as for the summer born steer calves.

We conservatively have estimated that our financial based costs have been reduced by $45/cow. That translates into a savings of $50/calf (assuming a 90% weaning rate). That $50 savings is from reduction in hay feeding and accounts for the slightly higher supplement fed to the summer cows. If we were to consider the opportunity cost of the forage, labor savings, and cost to feed the forage the savings would be even larger.

CONCLUSIONS

Our research will continue for at least two more years. At that time we will complete an economic and comparative risk analysis of the two calving systems. Our current results for the Nebraska Sandhills show that summer calving systems offer more flexibility in marketing for cattle with genetics similar to ours. In addition, synchronizing the cow to the forage resource has saved more than enough costs to offset the lower weaning weight for both steer and heifer calves. Even the system of finishing the summer calves as calf feds appears to be competitive with calf fed, spring born calves from a financial analysis perspective. From an economic analysis view, the finishing of spring born calves is more efficient than finishing the summer borns as calf feds. The latter is primarily due to the difference in prices when the two different sets of calves would be ready for market. We have not provided analysis for the summer calf/yearling system since we only have two years data; however, that system may in the end be the most efficient of all.

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