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Production and Economic Comparisons of Two Calving Dates for Beef Cows in the Nebraska Sandhills

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ABSTRACT

Calving date for 120 cows in the Nebraska Sandhills was changed from the traditional calving season beginning March 15 (d 75) to one beginning June 15 (d 167) to match increased nutrient needs for lactating cows to immature grazed forages that are high in protein and energy. The hypotheses being tested were that 1) less hay and purchased feeds would be required, 2) production costs would be reduced, and 3) net returns would be greater for June-calving cows compared with their March-calving counterparts. All steer calves from 75 March-calving cows were moved to a feedlot within 60 d of weaning (March calf-feds). Half the steer calves from the 120 June-calving herd were moved within 60 d of weaning to a feedlot to be finished (June calf-feds) and the other half were moved to a feedlot in September after summer grazing of Sandhills rangeland (June yearlings). Half of the June-calving cows were bred on subirrigated regrowth (Meadow) and half on upland range. Data on 4 consecutive calf crops were collected through harvest with an additional year collected to feedlot placement. Results showed that fed hay was reduced from 1.79 to 0.10 metric tons per cow annually for the June-calving system. Cost and return analyses were conducted by production phases on steer calves. Production costs for both June-calving groups were less and net returns higher when compared with the March-calved group. The highest net return for a calf group was for the June yearlings from cows bred on subirrigated regrowth.

Key words: beef cow, calving date, Nebraska Sandhills

INTRODUCTION

The amount of harvested and purchased feeds required to sustain a cow herd in the Nebraska Sandhills is directly related to calving date (Adams et al., 1996; Clark et al., 2004). Cows calving in February and March cause lactation to occur in early spring when the range resource is dormant and low in protein and energy. Effects of low protein and energy are generally mitigated by feeding harvested feeds. In contrast, a dry, gestating cow requires little or no supplementation during this same time period. Producers who began calving during the first half of April reported feeding 758 kg/yr of hay per cow compared with 1,486 kg/yr of hay for those who began calving during the last half of February (Clark et al., 2004).

Lower costs result from feeding less hay and protein supplement. Studies in Nebraska and other Great Plains states have demonstrated that calving late in the spring reduced the amount of hay and supplements fed and improved potential profitability (Deutscher et al., 1991; Klopfenstein, 1991; May et al., 1999; Clark et al., 2004).

Market timing is another factor that affects profitability. Calves and cull cows from June-calving herds may be sold when the market's average seasonal prices are highest. The average seasonal prices are lowest when calves and culls are normally sold from herds calved in March.

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June-born calves that graze summer range as yearlings may provide another advantage over March-born calves; they do not have to be held over most of the winter before the grazing season begins. A low-quality diet that limits gains is usually used for wintering March-born calves. Increased gains due to compensatory growth during the summer grazing season may offset some of the wintering costs; however, research has shown feedlot finishing performance was affected by previous nutrition, particularly as it related to grazing programs (Mader et al., 1989).

Our objectives were to determine if harvested or purchased feeds, or both, and labor could be reduced by matching lactation (i.e., calving date) with nutrient content of grazed forages in beef cow-calf systems, and to evaluate the economics of March vs. June calving systems. We hypothesized that a June calving season would match the increased nutrient requirements associated with lactation and late gestation with greater nutrient content of immature growing plants, extending grazing compared with the traditional March calving season and permitting a decrease in hay fed with a corresponding reduction in cost of production. We also hypothesized that costs associated with a June-calving system would be lower and net returns, revenues minus costs, would be higher than those for the March-calving system.

MATERIALS AND METHODS

Production Systems

In 1993, cows from a March-calving cow herd were bred to calve beginning either March 15, d 75 (75 cows) or June 15, d 167 (120 cows). Cows were blocked by age and randomly assigned to 1 of the 2 systems. All steer calves from March-calving cows were finished as calf-feds, and were moved shortly after weaning directly to the feedlot for finishing. One-half of the steer calves from June-calving system were finished as calf-feds and the remainder grazed Sandhills range as yearlings the summer after they were weaned before being finished. All calf-feds were placed in a feedlot 243 d after the beginning of the calving season. Steers that were summer grazed as yearlings entered the feedlot 454 d after the start of the June calving season in which they were born. Calving dates, weaning dates, and feeding periods are given in Table 1. Heifer calves were developed for replacements so no postweaning data was available for them.

The length of the breeding season was 60 d for the March-calving system and 45 d for the June-calving system. A 60-d breeding season for March-calving cows is common to western Nebraska. A 45-d breeding season was implemented for the June-calving cows because late-born calves were considered to be at risk when early winter storms occur.

June-calving cows were divided into 2 groups of 60 for the breeding season. One group was bred on subirrigated meadow regrowth, and the other group was bred on upland range.

Pregnancy and weaning rates for both systems are found in Table 2. Because of the longer length between parturition and rebreeding for cows transitioning to the June-calving system, the first year pregnancy rates (1993 to 1994) were not included in the analysis.

Animal production and resource use (i.e., grazing, feed, and labor) records were maintained on each herd from breeding to harvest for 4 production cycles (1993 to 1999). Records on the fifth cycle are abbreviated and only include breeding to feedlot placement (1997 to 1999). Table 3 contains the averages of these data.

March-calving cows were fed hay from subirrigated meadows from mid-January through April. June-calving cows were fed meadow hay for 3 d after weaning and during a winter storm in February 1996.

March-born calves were weaned after September 15 (d 259) and before October 6 (d 280), and the steers were shipped to the feedlot in mid-November and harvested at 1.27 cm of backfat. June-born calves were weaned in early January. Half of the steer calves were shipped to the feedlot in mid-February, finished as calf-feds, and harvested at 1.27 cm of backfat. The other half of the June-born steer calves grazed subirrigated meadow for approximately 90 d until they were moved to upland pasture in June. These June-born steers remained on upland pasture until mid-September when they were shipped, as yearlings, to the feedlot. They were then harvested at 1.27 cm of backfat.

All animals were weighed at birth, weaning, feedlot placement, and harvest. Yearling steers were also weighed when they were moved onto grass for summer grazing. Analyses of variance were used to compare the annual averages weights for the 3 groups of calf-feds. The means and standard deviations are summarized in Table 4. This table includes results for heifers through weaning and steers through harvest. Student *t*-tests were used to compare the annual averages between range and meadow treatments for the yearling steers. The means and standard deviations for these treatments are in Table 5. The results for the yearling steers were identical to the June-born calf-feds through weaning and so were not included in Table 5.

Costs and Returns Analyses

Cost budgets were developed for each phase of production for each system. Budgets were based on the average resources consumed during 3 phases using 1998 resource prices (USDA, 2000). All budgets included costs for harvesting hay, feed purchases, grazing (e.g., maintenance of fences and water facilities), labor, operating interest, management, overhead, and heifer replacement, but did not include charges for land, property taxes, insurance, or buildings. The ownership costs for only hay harvesting and feeding equipment were included in

Table 1. Approximate dates for key activities in the March[1] and June[2] calving systems

Activity	March Calf-feds[3]	June Calf-feds	June Yearlings[4]
Breed cows	June 5 to August 4 d 157 to 217	September 5 to October 20 d 249 to 294	September 5 to October 20 d 249 to 294
Calve cows	March 15 to May 14 d 75 to 135	June 15 to July 30 d 167 to 212	June 15 to July 30 d 167 to 212
Wean calves	September 16 to October 5 d 260 to 279	January 5 to 14 d 5 to 14	January 5 to 14 d 5 to 14
Move yearlings to grass	—	—	May 28 to June 8 d 149 to 160
Move steers to feedlot	November 9 to 17 d 314 to 322	February 10 to 16 d 41 to 47	September 8 to 16 d 252 to 260
Harvest finished animals	May 3 to June 15 d 124 to 167	August 8 to September 9 d 221 to 253	January 4 to February 4 d 4 to 35

[1]Bulls were placed with cows for 60 d so full-term calves would be born beginning March 15.

[2]Bulls were placed with cows for 45 d so full-term calves would be born beginning June 15.

[3]Calf-feds are animals that are moved into the feedlot for finishing soon after they are weaned.

[4]Yearling animals were allowed to graze rangeland for one summer after weaning prior to being moved into the feedlot for finishing.

the analysis because all other equipment was considered identical for each of the systems. Based on research at the University of Nebraska's Gudmundsen Sandhills Laboratory (**GSL**), it was determined that the same land base (about 90% upland and 10% subirrigated meadows) could support equivalent numbers of cows year-round for either the March- or June-calving system. Therefore, land charges and taxes and building requirements were considered identical for the 2 systems and so were not included in the budgets. The March-calving system used the meadows for hay production, whereas the June-calving systems used the meadows for summer, spring, and fall grazing.

The major costs for producing a weaned calf are those necessary to support the cow enterprise (Selley et al., 2001). The hay cost, $44/metric ton, was based on budget estimates for harvesting ($33/metric ton) and feeding ($11/metric ton), excluding labor. These figures included ownership costs for interest and depreciation on the equipment. Labor costs

Table 2. Pregnancy rate and weaning rate (percentage of cows exposed to the bull) of cows bred to start calving March 15 and June 15[1]

	Begin calving March 15 (d 75)		Begin calving June 15 (d 167): Range-bred cows		Begin calving June 15 (d 167): Meadow-bred cows	
Item	Avg %	SD	Avg %	SD	Avg %	SD
Pregnancy rate[2]	95.0	0.0247	92.9	0.0336	94.0	0.0526
Weaning rate[3]	88.7	0.0462	89.9	0.0654	90.7	0.0810

[1]The breeding season was 60 d for the March-calving and 45 d for the June-calving systems.

[2]Number of cows that tested pregnant divided by the number of cows exposed to bulls during the breeding season as per Standardized Performance Analysis guidelines (McGrann, 2000). Differences between groups are not significant using ANOVA ($P = 0.81$).

[3]Number of cows that weaned a calf divided by the number of cows exposed to bulls during the breeding season as per Standardized Performance Analysis guidelines (McGrann, 2000). Differences between groups are not significant using ANOVA ($P = 0.93$).

Table 3. Average resource use per head for March-born[1] and June-born[2] calf-fed[3] and yearling[4] steers

	March	June			
		Calf-feds		Yearlings	
Resource use	Calf-feds	Range-bred cows	Meadow-bred cows	Range-bred cows	Meadow-bred cows
Cows					
Hay (metric tons)	1.79	0.10	0.10	0.10	0.10
Protein supplement (kg)	44	70	70	70	70
Range-grazed (d)	233	207	162	207	162
Meadow-grazed (d)	—	150	195	150	195
Feeding labor (h)	0.66	0.18	0.18	0.18	0.18
Calving labor (h)	0.57	0.3	0.3	0.3	0.3
Steers (from weaning until moved to summer grazing or the feedlot)					
Hay (metric tons)	—	0.20	0.20	0.72	0.72
Protein supplement (kg)	—	48	48	170	170
Range-grazed (d)	49	—	—	31	31
Feeding labor (h)	—	0.15	0.15	0.53	0.53
Yearlings (from the beginning of summer grazing until moved to the feedlot)					
Range-grazed (d)	—	—	—	102	102
Feedlot (d)	191	189	189	134	134

[1]Bulls were placed with cows for 60 d so full-term calves would be born beginning March 15.

[2]Bulls were placed with cows for 45 d so full-term calves would be born beginning June 15.

[3]Calf-feds are animals that are moved into the feedlot for finishing soon after they are weaned.

[4]Yearling steers were allowed to graze rangeland for one summer after weaning prior to being moved into the feedlot for finishing.

included in the budgets were based on actual labor for feeding and calving as recorded by the University staff at GSL. Feeding methods, distances to livestock from feed sources, and herd size at GSL are such that we believe labor to be representative of cow-calf producers in the Nebraska Sandhills. Labor was charged at the rate of $7.50/h except calving labor, which was charged $11.25/h because calving requires more skill than other activities and often occurs at night. No other labor was included in cow budgets because it was assumed that all other labor would be similar between the systems. Purchased feeds (i.e., protein supplement, salt, and minerals) were charged on actual usage, again based on 1998 prices. Interest on the value of cows and bulls was charged at the rate of 7.5%.

Following Standardized Performance Analysis guidelines (McGrann, 2000), replacement heifer costs were estimated from the net cost to produce a weaned calf. The initial selection rate was 20% of the heifer calves with 16% of these heifers ending up in the cow herd. No other heifer development costs were included. Creighton (2004) showed that these costs vary considerably based on development strategies and the quality of available forage. We assumed these costs would be similar between the systems.

Each cow-cost budget was credited with income for sale of cull cows, bulls, and cull replacement heifers, minus death loss. Both March and June cull cows were assigned a cull weight of 500 kg. The prices used for calculating cull values were different for the March and June cows based on seasonal average cull cow prices (Feuz and Burgener, 2005) and the time culling took place.

Grazing costs, not including land cost, were estimated at $4/mo per cow when grazing upland range and $6/mo per cow while grazing meadow. These are financial costs only and cover such items as repair and upkeep on fences and watering facilities and operating costs associated with checking cattle. To properly graze meadows, more fencing and water facilities were required than with upland range. The costs do not include the value of the forage. Animal health costs were similar between the 2 systems and $15/cow was included in both budgets.

Costs beyond weaning were based on the actual amounts of feed fed and the associated labor. The grazing fee used for the June-born steers (yearlings) grazing rangeland during the summer was $0.50/d per head. This cost covered renting additional grass where the landowner provided labor and pasture management.

Table 4. Averages and SD of weights and ADG for March-born[1] and June-born[2] steers and heifers where steers were moved to the feedlot at weaning

	March				June							
					Range-bred cows				Meadow-bred cows			
	Steers		Heifers		Steers		Heifers		Steers		Heifers	
Item	Avg	SD	Avg	SD	Avg	SD	Avg	SD	Avg	SD	Avg	SD
Birth wt[3]	43	2.1	40	1.5	43	3.1	40	2.8	44	3.0	39	2.4
Weaning wt[4]	220	11.4	211	13.1	189	11.2	183	11.7	199	17.0	191	10.1
Beginning feedlot wt[5]	235	9.5	—	—	198	13.0	—	—	209	16.0	—	—
Feedlot ADG[6]	1.58	0.14	—	—	1.68	0.16	—	—	1.61	0.13	—	—
Harvest live wt[7]	534	16.9	—	—	510	30.1	—	—	509	18.6	—	—

[1]Bulls were placed with cows for 60 d so full-term calves would be born beginning March 15.

[2]Bulls were placed with cows for 45 d so full-term calves would be born beginning June 15.

[3]Differences between steers groups ($P = 0.84$) and heifers groups ($P = 0.69$) are not significant.

[4]The ANOVA indicates that significant differences exist between the 3 groups of steers ($P = 0.01$) and the 3 groups of heifers ($P = 0.01$). Student *t*-tests show the difference between March steers and June range steers is significant ($P = 0.003$) and between March steers and June meadow steers is significant ($P = 0.06$), and the difference between the June range and June meadow group is not significant ($P = 0.30$). Differences between the March heifers and June range heifers is significant ($P = 0.009$) and between March heifers and June meadow heifers is significant ($P = 0.03$). The difference between the June range and June meadow heifers was not significant ($P = 0.29$).

[5]The ANOVA indicates that significant differences exist between the 3 groups of steers ($P = 0.01$). Student *t*-tests show that differences between March steers and June range steers is significant ($P = 0.01$) and between March steers and June meadow steers is significant ($P = 0.05$). The difference between June range and June meadow steers is not significant ($P = 0.31$).

[6]The ANOVA indicates that differences between the ADG is not significant ($P = 0.64$).

[7]The ANOVA indicates that differences between the ADG is not significant ($P = 0.26$).

Table 5. Averages and standard deviations for BW and ADG of June-born[1] steers that were grazed the summer following weaning before being moved into the feedlot

	Range-bred cows		Meadow-bred cows	
Production phase	Avg (kg)	SD	Avg (kg)	SD
Weaning wt (same as Table 4)	189	11.2	199	17.0
ADG weaning to summer grazing[2]	0.46	0.18	0.51	0.21
Wt beginning summer grazing[3]	262	28.3	281	37.2
ADG while summer grazing[4]	0.73	0.10	0.60	0.17
Wt beginning feedlot[5]	335	21.7	341	19.1
ADG in feedlot[6]	1.82	0.21	1.84	0.21
Harvest live wt[7]	574	23.7	584	21.8

[1]Bulls were placed with cows for 45 d so full term calves would be born beginning June 15.

[2]ANOVA indicates that differences between the ADG is not significant ($P = 0.74$).

[3]ANOVA indicates that differences between the ADG is not significant ($P = 0.44$).

[4]ANOVA indicates that differences between the ADG is not significant ($P = 0.25$).

[5]ANOVA indicates that differences between the ADG is not significant ($P = 0.66$).

[6]ANOVA indicates that differences between the ADG is not significant ($P = 0.88$).

[7]ANOVA indicates that differences between the ADG is not significant ($P = 0.56$).

Feedlot costs used actual amounts of feed fed at the University of Nebraska feedlot near Mead, Nebraska. Diets were identical for all groups. Ingredient costs were based on 1998 prices plus a \$0.022/kg trucking charge to and from the feedlot. Feedlot costs also include a \$0.30/d per head yardage charge.

The costs beyond weaning for calf-fed and yearling steers were calculated in 2 ways. One method simply carried costs forward as they were incurred through the 3 phases of production. This method is representative of a producer retaining ownership of the cattle from birth to harvest. The second method is representative of cattle moving through the market where the production phases, weaning (phase 1), postweaning prefeedlot (phase 2), and feedlot (phase 3) are separate enterprises. This second method of cost used the average market value of the calf at the end of the previous phase plus the cost of the current phase as the total cost for that phase.

Table 6 shows the average net returns associated with each of the above mentioned cost methods. The first method is net returns (**RO**), where RO implies retained ownership; the second method is net returns (**To Phase**), where To Phase indicates the market valuation method. Gross revenues were calculated by multiplying the average steer weight at the end of each production phase by the average of the 1992 through 1999 market prices, adjusted to 1998 dollars, using the consumer price index published by the US Bureau of Labor Statistics (2007); original prices were taken from Feuz and Burgener (2005). The 2 net returns for each of the systems, found in Table 6, for each of the 3 production phases were calculated as the difference between the gross revenue per calf and the cost of growing the calf during that particular phase.

RESULTS AND DISCUSSION

Matching cow nutrient requirements by manipulating calving date to match nutrients available from range and meadow grazing permitted the amount of hay fed (Table 3) to be substantially reduced without significant impacts on pregnancy and weaning rates (Table 2). March-calving cows had a pregnancy rate of 95.0% and a weaning rate of 88.7%, whereas the June-calving cows on range had a pregnancy rate of 92.9% and a weaning rate of 89.9%, and those on meadow had a 94.0% pregnancy rate and a 90.7% weaning rate. Analysis of variance and student *t*-tests showed that calf-feds from the March system had a greater ($P = 0.01$) weaning weight (220 kg) and feedlot entry weight (235 kg) than June system calf-feds, which had weaning weights of 189 and 199 kg and feedlot entry weights of 198 and 209 kg for range- and meadow-bred cows, respectively (Table 4). The lighter weight of the June-born calves compared with March-born calves is best explained by smaller, late season calf gains produced on forages lower in digestibility and protein content typical of Sandhills range during November through January (Lardy et al. 1997).

The annual average amount of hay fed to March-calving cows in the 5 yr from 1993 to 1999 was approximately 1.8 metric tons/yr per cow compared with 0.1 metric tons/yr per cow for June-calving cows. However, the June-calving cows received about 26 kg/yr more protein supplement per cow than March-calving cows. Labor for feeding and calving to produce a weaned calf in the June system was 61% less than the March system (Table 3). A building commonly used for calving in the traditional March system was not needed in the June system. The cost savings associated with not having this building were not included in the analysis but certainly could be considered when making a decision in which season to calve.

Post-weaning (phase 2) feed inputs for calf-fed steers were higher in the June system than the March system, which is a result of both their smaller size and the season when they were weaned. March-born steers grazed subirrigated meadow pasture between weaning and feedlot placement whereas June-born steers were fed hay and protein supplement.

June-born steers held over as yearlings to graze the summer following being weaned required more supplement, harvested forage, and grazing than either the June- or March-born calf-fed steers but required about 8 wk less time in the feedlot. The analysis of variance showed no differences ($P = 0.10$) for ADG in the feedlot and harvest weights for either the calf-feds as a group or the yearlings as a group. The calf-fed group averaged from 1.58 kg/steer per day and a harvest weight of 534 kg for the March-born steers, to 1.68 and 1.61 kg/steer per day and harvest weights of 510 and 509 kg for the June-born steers, range and meadow treatment respectively. The feedlot performance of the yearling group of June-born steers averaged 1.82 kg/steer per day with a harvest weight of 574 kg for the range treatment and 1.84 kg/steer per day and a harvest weight of 584 kg for the meadow treatment. A greater percentage of the carcasses from the March-born calf-feds graded choice (53%) than those of the June-born calf-feds (33%). The June-born yearling steers had the largest percentage of carcasses (66%) that graded choice (Table 7). Carcass yield grades were 3 or less for steers in all systems.

The initial motivation for changing the calving season was based on the idea that the June calving season provided a better match for the cyclical nutrient requirements of the cow with seasonally available nutrients from grazed forages in the Nebraska Sandhills. However, as the

Table 6. Financial analysis of March-born[1] and June-born[2] steers by feeding program, breeding treatment, and production phase

Calving season and feeding program[3]	Breeding treatment	Financial parameter	Production phase: To weaning[4] ($)	Weaning to feedlot ($)	Feedlot to harvest ($)
March					
Calf-fed		Ending calf value[5]	443.88	456.39	844.69
		Cost for this phase	252.00	42.00	286.00
		Cost to phase end	252.00	294.00	580.00
		Net return (To Phase)[6]	—	–29.49	102.30
		Net return (RO)[7]	191.88	162.39	264.69
June					
Calf-fed	Range-bred cows	Ending calf value	426.08	454.62	783.64
		Cost for this phase	173.00	46.00	286.00
		Cost to phase end	173.00	219.00	505.00
		Net return (To Phase)	—	–17.46	43.02
		Net return (RO)	253.08	235.62	278.64
	Meadow-bred cows	Ending calf value	443.01	470.61	782.10
		Cost for this phase	178.00	47.00	286.00
		Cost to phase end	178.00	225.00	511.00
		Net return (To Phase)	—	–19.40	25.50
		Net return (RO)	265.01	245.61	271.10
Yearling-fed	Range-bred cows	Ending calf value	426.08	609.00	933.31
		Cost for this phase	173.00	209.00	254.00
		Cost to phase end	173.00	382.00	636.00
		Net return (To Phase)	—	–26.08	70.32
		Net return (RO)	253.08	227.00	297.31
	Meadow-bred cows	Ending calf value	443.01	612.66	949.57
		Cost for this phase	178.00	211.00	254.00
		Cost to phase end	178.00	389.00	643.00
		Net return (To Phase)	—	–41.35	82.91
		Net return (RO)	265.01	223.66	306.57

[1]Bulls were placed with cows for 60 d so full-term calves would be born beginning March 15.

[2]Bulls were placed with cows for 45 d so full-term calves would be born beginning June 15.

[3]Calf-fed steers were moved to the feedlot within 60 d of weaning and yearlings were grazed on rangeland the summer following weaning before being moved to the feedlot.

[4]Land costs are not included in this analysis.

[5]Calf value was calculated by multiplying the average steer weight and the monthly average steer price for comparable weight steers over an 8-yr period.

[6]To Phase refers to a method to determine costs beyond weaning for calf-fed and yearling steers that uses the average market value of the calf at the end of the previous phase plus the cost of the current phase as the total cost for that phase

[7]RO stands for retained ownership, one method to determine costs beyond weaning for calf-fed and yearling steers, is the return for the phase in question in excess of the accumulated costs for all phases up to and including the one being analyzed.

comparison between calving periods was made, it became clear that the interaction of factors both biological and economic were the real driving forces in the calving season decision.

To illustrate this point, the March-born calves weaned at an average heavier weight, about 24 kg/steer, but because of the larger calf size and seasonal market differences, an 11% higher per kilogram price was received for the June-born calves. The seasonal premium at weaning accounted for approximately 63% of the higher price, and the price slide associated with size difference accounted for the remaining 37% of the premium gained by the June-born steer calves. These premiums helped mitigate the gap in calf weaning weight and calf value between the June- and March-born calves, resulting in the June-born range-treated steers being valued at $17.80 less per animal, and the June-born meadow-treated steers being valued at $0.87 less per animal. Given similar valuation at weaning of the seasonally separated steers implied that any difference in cost between the systems would be the primary factor that would determine differences in net returns. In this case, the June-born steers had lower cost: $79/steer for the range treatment and $74/steer for the meadow treatment. The June-born range treatment had a $5/steer lower cost than the June-born meadow treatment, but on average produced lighter weight weaned calves resulting in a $16.93 difference. The overall outcome of these interactions gave the June-born range and meadow treatments a $61.20 and $73.13/steer respectively net return (RO) advantage over the March-born calving system to the end of phase 1. These results demonstrate the interaction of cost, seasonal price differences, and overall resource allocation on net returns (RO) when considering alternative calving systems. In this case the disadvantage of selling lighter weight calves was partially offset because of the seasonally higher market price and price slide. If the additional benefits of reduced costs are included, higher net returns (RO) result for the June-born calving system. The associated cost and net returns are summarized in Table 6.

The additional financial costs associated with growing a steer calf past weaning were nearly the same for both the June- and March-born calf-fed systems; therefore, the financial cost advantage remained with the June system through the feedlot phase for the net returns (RO) for all treatments and production phases (Table 6). Interestingly the advantage in net returns that the meadow treatment had over the range treatment for the June-born calf-feds disappeared in phase 3. This advantage appears to be the result of compensatory gains made by the range treatment steers in the feedlot. The yearling results, however, are quite different and show that the June-born meadow-treated steers finished 10 kg/head heavier than the range-treated contemporaries.

As the calf-fed steers progressed through each phase of production, the net returns (RO) steadily decreased. By the time the steers reach market size, the seasonal price and size differences narrowed the net returns (RO) to $13.95 and $6.41/head between the March-born steers and the June-born range-treated and meadow-treated calf-fed steers, respectively. It should be remembered that the net returns from the weaning phase do not include the costs of property taxes, buildings, insurance, and land cost. Although these costs are the same for each of the systems and their exclusion has no effect on the net return rankings of the systems, their inclusion would have reduced the magnitude of the weaning phase net returns, making them comparable between phases. The large net returns (RO) in phase 1 makes this phase appear more attractive compared with the other 2 phases. However, without including the omitted costs, no comparisons between phases can or should be made.

As steers move through the phases of production from weaning to feedlot, all June-born calving systems and treatments had higher net return (RO) when compared with the March-born system (Table 6). However this was not true of the net return (To Phase). Phase 2 had mixed results, with all systems and treatments having a negative net return (To Phase). The June-born calf-feds were less negative than the March-born calf-feds, but the June-born yearlings had a larger negative net return (To Phase). The negative net return (To Phase) for phase 2 indicates that buying and holding steers was unprofitable for all systems and treatments. Given the cost and production assumptions made here, the least unprofitable system was the June-born calf-fed range-treated steers. Again, this effect is the result of the interaction of season, cost, and calf weight. In the final phase of production, the March-born steer's net return (To Phase) exceeded all of the June-born systems and treatments. This result is due to the seasonal price, cost, and steer weight differences only, because harvest weight animals were not considered to have a price slide. These results are based on market quoted prices for slaughter cattle and do not include quality grade and yield premiums and discounts. If these premiums and discounts were included in the analysis, the June-born yearlings would have had an advantage, having the largest percent choice, possibly altering the results. The June-born calf-feds had the least number of animals that would have qualified for the choice premium, insuring that they probably would have maintained their status as the lowest net return (To Phase) systems. The net return (To Phase) for phase 3, given the cost and production assumptions, indicate that a feedlot's operators who buy cattle would have done better with March-born steers then with steers from any of the other systems.

IMPLICATIONS

Changing the beginning of the calving season from March 15, d 75, to June 15, d 167, to match cyclical nutrient requirements of cows to seasonal nutrient availability from available forages dramatically reduced the quantity of hay fed without impacting subsequent pregnancy rates and calf numbers. Some additional purchased feeds were required in the June-born calving systems. Cost and return analysis showed production costs for steers from the June-born calf-fed systems were lower and net returns (RO) for all June-born systems and treatments were higher than for the March-born system. Not all systems were equal in net returns (To Phase) and those buying cattle for resale, the holding phase, should consider carefully size, season, and length of holding cattle. Retained ownership through harvest was not investigated, but the information collected here indicates it could alter the net return (RO) rankings for that phase of production. The results here also indicate that the real advantage to changing calving season accrues to producers who sell weaned calves. If weaned steers are held and sold later, the cost difference narrows and seasonal price differences erode, making it less advantageous to change calving season from March to June.

Consideration of an alternative calving season is a complex decision and includes changes in physical and economic relationships and outcomes as well as implicit differences in management and resource allocations. Although we interpreted these data to indicate that financial gains may be possible with chronologically later calving, any changes in an individual's operation need to be considered carefully and as completely as possible, remembering that the impact of this one choice of when to calve includes the consideration of many changes in management, resource usage and allocation, benchmark performances, and marketing strategies.

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