Effects of Time of Weaning and Cow Age Class on Performance of Fall-Calving Beef Cows and Their Progeny

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Story in Brief

Predominantly Angus beef cows were used in three consecutive years to determine the effects of time of weaning and cow age class on performance of fall-calving cows and their progeny. Treatments were arranged in a 2 x 2 factorial arrangement of treatments with two weaning dates and two age classes (mature cows ≥ 4 yrs and young cows ≤ 3 yrs). Weaning treatments were: normal weaning in mid-April at 210 d of age (NW) and, late weaning in mid-July at 300 d of age (LW). Mature cows were heavier than young cows throughout the trial but BCS fluctuations were the same for both young and mature cows. Cow weight and BCS for NW and LW cows were similar at the time of normal weaning; however, at the beginning of the calving season, NW cows were heavier (585 vs 563 kg) and had greater fat reserves (BCS=6.57 vs 5.95) than LW cows. Progeny of NW cows grew faster prior to weaning, resulting in increased weights (+22 lb) at the time of normal weaning. Nevertheless, LW calves grew significantly faster during the spring and summer months, although they were not statistically heavier than NW calves in July. Pregnancy rates were greater for LW-Mature cows (98%) and NW-Young cows (97.8%) compared to LW-Young (88%) and NW-Mature (85.5%) cows. These findings indicate that producers may benefit from matching weaning date to cow age class. It appears more advantageous to delay weaning of calves born to dams 4 yr or older, while maintaining normal weaning for dams 3 yr or younger at time of calving.

Key Words: Cows, Fall-Calving, Performance, Time of Weaning

Introduction

Traditional weaning in a fall-calving system occurs in mid-April at approximately 210 d of age; however, due to the availability of high-quality forage during the spring and early summer, a growing trend is to extend lactation and the calf growing period through mid-July (approximately 300 d of age) to increase weaning weights. This practice would appear to have a positive influence on enterprise profitability due primarily to the heavier weaning weights of older calves. It is well documented that cow BCS at calving is an important factor affecting the length of the post-partum interval (PPI) and pregnancy rates (Wiltbank et al., 1964; Selk et al., 1988). The interval to first estrus is shorter for spring calving cows as BCS at parturition increases (Richards et al., 1986; Houghton et al., 1990). Therefore, extending lactation and increasing energy requirements during the summer may result in thinner cows at the beginning of the calving season, especially if forage quality or quantity is negatively impacted due to drought or other factors. Additionally, it has been demonstrated that pre-breeding weight and condition loss of fall-calving cows may depress reproductive performance, despite ample energy reserves at calving. Prior research conducted to evaluate the effect of time of weaning on fall-calving cows has evaluated early weaning at 6 to 10 wk of age, or has managed all cows to the same BCS before the onset of calving. Therefore, the objective of this study was to elucidate the effects of late weaning compared to normal weaning on performance of fall-calving beef cows and their progeny.

Materials and Methods

In accordance with an approved Oklahoma State University Animal Care and Use Committee protocol, this study was conducted at the Range Cow Research Center, North Range Unit, approximately 16 km west of Stillwater, Oklahoma. Prior to this experiment cows and calves had been managed together as one contemporary group. Treatments were arranged in a 2 x 2 factorial arrangement of treatments with two weaning dates and two age classes at time of calving (mature cows ≥ 4 yr old and young cows ≤ 3 yr old). In three successive years (Yr 1 = Apr 2004 to Apr 2005; Yr 2 = Apr 2005 to Apr 2006; Yr 3 = Apr 2006 to Apr 2007), predominantly Angus, fall-calving cows were randomly assigned to one of two weaning date treatments: 1) normal weaning in mid-April at approximately 210 d of age (Treatment = NW), and 2) late weaning in mid-July at approximately 300 d of age (Treatment = LW). Cows were retained in the herd each year (excluding open cows) and remained in the same weaning group as initially assigned. New, pregnant cows were added to the study each spring either as rollovers from a spring-calving herd or as fall-born 2-yr old replacements. The added cows were previously managed with the experimental herd for 10 mo and were equally and randomly assigned to either NW or LW prior to the April weaning date.

Management and Weighing Procedures. Throughout the experiment, cow BW and BCS measurements were recorded after a 16-hr withdrawal from feed and water. Body condition scores (1 = emaciated, 9 = obese) were determined by two trained, independent evaluators. Throughout the experiment all cows and calves were managed as contemporaries, grazing the same pastures, receiving the same rate of supplementation, and vaccinated according to the same herd health protocol. The only exception being calf management during the 84 d between weaning dates. In mid-April (d = 0) cow BW and BCS and calf BW were recorded. Normal-weaned calves were separated from their dams and weaned using a fenceline weaning system (Price et al., 2003). Calves were maintained in drylot for 10 d post-weaning and were given ad libitum access to bermudagrass hay and water and received a 20% crude protein supplement at a rate of 1 lb per hd. On d-10, calves were placed on excellent quality native grass pasture at a stocking rate of approximately three acres per calf. In mid-July (d = 84), after a 16-h shrink, cow BW and BCS and calf BW were recorded for both treatments. Late-weaned calves were separated from their dams and weaned using the fenceline weaning system and were managed the same as NW calves were post-weaning.

Cow BW and BCS was recorded prior to the beginning of the calving season (late August) and every 2 wk throughout the calving season (only those cows that had calved in the prior period) to determine post-calving BW and BCS. Birth weight of each calf was determined and bull calves were castrated within 24 h of birth. Non-shrunk calf BW was subsequently determined at approximately 70, 120, and 150 d of age. Cow BW and BCS was recorded at the beginning (late November) and end (late January) of the breeding season, and at both weaning dates.

Cows were evaluated twice daily for estrous detection for the first 7 d of the breeding season. Cows were artificially inseminated 12 h after detection of standing estrus. Cows not artificially inseminated during this time were treated with 5 mg/mL of Lutalyse (Pfizer), and twice daily estrous detection was continued for 2 wk. One week after cessation of artificial insemination, three Angus bulls were turned in with cows for 35 d to constitute a 63 d breeding season. Cows were pregnancy checked by rectal palpation approximately 80 d after bulls were removed from the breeding pastures. All open cows remained on the study until the July weaning date and were then removed from the study.

Statistical Analyses. Cow was considered the experimental unit. No interactions between year and treatments were detected; therefore, data were pooled across years and analyzed using the MIXED MODEL procedure of SAS (SAS Inst. Inc., Cary, NC). All interactions and covariates remained in the model regardless of significance. Significance was declared when the P-value for the F-statistic was $\leq .05$. The model for cow BW and BCS and reproductive performance included weaning treatment and cow age class and the interaction as fixed effects with year considered a random variable. The model for calf weaning and post-weaning performance (all calves weaned on the study) included weaning treatment, cow age class, and the interaction, breed of sire and sex as fixed effects; calf birth date and calf birth weight were included as covariates and year was treated as a random variable. For analysis of calf pre-weaning performance (only calves born to dams having weaned a calf on the study), the model included weaning treatment, cow age class, and the interaction, calf sex and breed of sire as fixed effects. Again, year was considered a random variable. Values in tables are LS means.

Results

Pre-partum Cow Weight and BCS. No weaning treatment x cow age class interactions were observed for any of the cow weight or BCS data. Therefore, main effects for each are reported. Cow BW (Table 1) and BCS (Table 2) did not differ between weaning treatments in April. However, cows assigned to a normal weaning date gained more BW and BCS during the summer months compared to late-weaned cows. During the 84 d between weaning dates, NW cows gained 72.7 lb more ($P<.0001$) BW compared to LW cows (260 vs 187 lb), and were 61.7 lb heavier and had 0.69 more units of body condition compared to LW cows in July. Normal-weaned cows maintained this advantage in BW and BCS being heavier (1288 vs 1240 lb, $P<.02$) and having 0.6 more units of body condition (6.6 vs 6.0, $P<.0001$) when measured in late August prior to the onset of the calving season.

The pattern of cow BW change was similar for mature and young cows, with differences ranging from 63.9 lb at pre-calving to 105.7 lb in April. As expected, mature cows were heavier ($P<.01$) at all points during the production cycle. Contrary to expectation, BW changes from April to July were the same for both mature and young cows (224.7 lb, $P=.96$). However, when evaluating changes in BCS for this period, more weight gain ($P<.05$) was associated with gain in adipose reserves in mature cows compared to young cows. This indicates that although young cow weight gain is similar in absolute amount during the summer months, the distribution of weight is different with more directed to skeletal and muscle growth than to body energy reserves in young cows.

Table 1. Effect of time of weaning on cow body weight.[a]

		Weaning Treatment[b]			
Item	n =	LW	NW	SEM[c]	P-value
April	305	989	982	18.9	.55
July	201	1163	1225	18.3	<.001
Pre-calving	196	1240	1289	34.8	<.02
Post-calving	110	1176	1209	21.4	.08
Pre-breeding	168	1170	1181	15.2	.56
Post-breeding	120	1121	1119	28.9	.93
Wt change, April to July	201	+ 187	+ 260	33.9	<.001
Rate of loss, Pre-calving to pre-breeding (lb/d)	168	- .84	- 1.37	.46	<.001
% Wt change, Pre-calving to pre-breeding	168	- 5.72	- 9.18	3.13	<.001

[a] Cow body weight reported in lb; data included for analysis collected from April 2004 to April 2007.

[b] Weaning treatments: 1) Normal weaning at 210 d of age in April (NW), and 2) Late weaning at 300 d of age in July (LW).

[c] Most conservative SEM.

Table 2. Effect of time of weaning on cow BCS.[a]

		Weaning Treatment[b]			
Item	n =	LW	NW	SEM[c]	P-value
April	304	4.55	4.36	.38	.41
July	201	5.36	6.05	.14	<.001
Pre-calving	196	5.95	6.57	.12	<.001
Post-calving	111	5.35	5.75	.13	.01
Pre-breeding	168	4.95	5.12	.07	.08
Post-breeding	120	5.11	5.06	.11	.61
Change, April to July	200	+ 1.23	+ 1.88	.22	<.001
% BCS change, Pre-calving to pre-breeding	168	-16.10	- 22.9	1.95	<.001

[a] Cow BCS (1 = Emaciated, 9 = Obese); data included for analysis collected from April 2004 to April 2007.

[b] Weaning treatments: 1) Normal weaning at 210 d of age in April (NW), and 2) Late weaning at 300 d of age in July (LW).

[c] Most conservative SEM.

Post-partum Cow Weight and BCS. Throughout the post-partum period, although both treatments were managed the same nutritionally, rate of BW and BCS loss differed dramatically between treatments (P<.0001). During the approximate 90 d from the onset of the calving season to the beginning of the breeding season, NW cows lost 9% of pre-calving BW and 22.9% of pre-calving body condition, compared to 5.7% BW loss and 16.1% condition loss for LW cows (Tables 1 and 2). At the beginning of the breeding season in late November, BW did not differ between treatments; however, BCS tended to be greater for NW cows (P=.07). No differences were observed for cow BW or BCS at the end of the breeding season.

Cow Reproductive Performance. A significant weaning treatment x cow age class interaction was detected for pregnancy rate (Table 3). Similarly, a tendency (P=.07) for weaning treatment and cow age class to interact was detected for interval to pregnancy. Mature-LW cows had a shorter (P<.05) interval to pregnancy compared to Young-NW and Mature-NW cows (72 vs 94 and 88 d, respectively). Mature-LW cows also tended (P=.10) to have a shorter interval to pregnancy when compared to Young-LW cows (72 vs 86 d). Neither weaning treatment or cow age class resulted in differences in calving date, days from calving to the beginning of the breeding season or first AI, date of conception, percentage serviced by AI, AI conception rate, or pregnancy rate.

Table 3. Reproductive performance for weaning date and cow age combinations.

	Treatment Combinations[ab]					
Item	LW-M	LW-Y	NW-M	NW-Y	SEM[c]	P-value
Calving date, Julian dt	262(28)	262(53)	259(34)	259(53)	3.0	.90
Pregnant, %	97.8(27)	88(51)	85.3(31)	99.8(51)	4.7	.02
Days, calving to first AI	83.3(6)	78.4(19)	90(9)	81(18)	7.0	.67
Interval to pregnancy[d]	71.7(7)	85.7(21)	93.5(11)	88.3(29)	5.9	.07
Date of conception, Julian dt	343(7)	348(23)	348(11)	343(29)	3.8	.22
Cows serviced by AI, %	67.9(28)	68.8(49)	74.2(31)	58.3(49)	7.8	.29
Calving interval, change	-4.2(16)	+1.0(10)	+6.8(30)	+24.8(13)	9.4	.46

[a] LW-M = Late-weaned, Mature; LW-Y = Late-weaned, Young; NW-M = Normal-weaned, Mature; NW-Y = Normal-weaned, Young.

[b] Numbers in parentheses indicate number of observations per cell.

[c] Pooled SEM.

[cd]Days from calving to conception.

Milk Production and Composition. Milk production did not differ between treatments in November (avg. 53 d post-partum) or in April (avg. 200 d post-partum). However, when evaluated in February (avg. 156 d post-partum), NW cows produced more milk than LW cows (8.15 vs 6.83 lb/d; P<.05).

Calf Pre-Weaning Performance. No time of weaning x cow age class interactions were observed for any calf pre-weaning measurement (P=.09 to .77). No differences in birth date or birth weight were detected for young vs mature cows. However, progeny of mature cows were heavier than progeny of young cows at the time of normal weaning (445 vs 419 lb; P<.01). Comparing the effects of time of weaning, no difference was observed for birth date; however, calves from NW dams were heavier at birth (80 vs 74.9 lb, P<.01), but with no apparent differences in dystocia (Table 5). In December (average calf age 75 d), calf BW did not differ. However, in early February (average calf age 127 d), calves from NW dams were 15.4 lb heavier than calves from LW dams (P<.05). Over the next 45 d this weight advantage increased to 30.8 lb (P<.001), and at the April weaning date calves from NW dams were 22 lb heavier (P<.05) than LW calves (443 vs 421 lb). These results indicate that time of weaning influences pre-weaning calf weight gain by its affect on cow BW and BCS at calving. It appears that greater cow BW and BCS at calving led to increased calf pre-weaning weight gain, ostensibly due to increased milk production.

Table 4. Effect of time of weaning on calf pre-weaning performance.[a]

		Weaning Treatment[b]			
Item	n =	LW	NW	SEM[c]	P-value
Birth date, Julian date	155	577	577	5.9	.90
Birth Wt	154	74.9	80	1.5	<.01
December Wt	121	238	240	6.2	.82
February Wt	157	308	324	5.9	<.05
April Wt	154	421	443	7.7	<.05

[a] Calf weights reported as lb; analysis included data from calves born to dams having previously weaned a calf on the study; collected from fall 2004 thru spring 2007.

[b] Weaning treatments: 1) Normal weaning at 210 d of age in April (NW), and 2) Late weaning at 300 d of age in July (LW).

[c] Most conservative SEM.

Table 5. Weaning/post-weaning performance of calves born to dams having previously weaned a calf on the study[a]

		Weaning Treatment[b]			
Item	n =	LW	NW	SEM[c]	P-value
April Wt (d=0)	77	385	421	12.6	<.01
July Wt (d=84)	77	601	586	37.0	.23
d-94 Wt	77	637	628	15.4	.71
Wt change, d-0 to d-84	77	+ 216	+ 163	26.0	<.0001
d-0 to d-84 ADG, lb/d	77	2.56	1.94	.31	<.0001

[a] Calf weights reported as LB; analysis includes data from calves born fall 2004 and 2005

[b] Weaning treatments: 1) Normal weaning at 210 d of age in April (NW), and 2) Late weaning at 300 d of age in July (LW).

[c] Most conservative SEM.

Calf Weaning/Post-Weaning Performance. When all calves weaned on the study are considered, cow age class influenced calf BW at weaning and throughout the 84 d following normal weaning, with progeny of mature cows being heavier than progeny of young cows throughout (data not shown).

Table 5 shows performance from April to 10 d following the July weaning date of calves born to cows having previously weaned a calf on the study. During the 84 d following normal weaning, LW calves out-gained NW calves (2.56 vs 1.94 lb/hd^{-d}; P<.0001), resulting in similar weights at the July weaning date (P=.23).

Conclusions

Cow BW and BCS are negatively affected by delaying weaning of fall-born calves. Late-weaning results in less weight and condition gain during the late-spring and early-summer months when compared to cows that are weaned normally at 7 mo of age. Thus, NW cows are both heavier and fatter than LW cows at the time of calving. However, despite similar management post-partum, NW cows experienced more drastic weight and condition loss, resulting in both NW and LW cows entering the breeding season at BCS 5.0. The detection of a significant interaction between cow age class and weaning date for interval to pregnancy and pregnancy rate indicate that producers may benefit from matching weaning date to cow age class. It appears more advantageous to delay weaning of calves born to dams 4 yr or older, while maintaining normal weaning for dams 3 yr or younger at time of calving.

Additionally, calf pre-weaning growth was affected by the date which the previous calf was weaned. Progeny of NW cows grew faster pre-weaning and were significantly heavier at the time of weaning in April compared to progeny of LW cows. This difference in pre-weaning performance appears to be related to increased milk production of NW cows.

While the impetus for delaying weaning is the gain in calf BW, it appears that when considering only the progeny of cows having weaned at least one calf at the prescribed weaning date, delaying weaning does not have a dramatic effect on July calf weights when compared to NW calves retained to the LW date. Nevertheless, LW calves grow significantly faster during the spring and summer months and are numerically heavier than NW calves in July. With no detection of detrimental effects on performance of mature, late-weaned cows, this research indicates late-weaning provides producers with a viable alternative weaning option for mature cows.

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