1991

# Effects of Breeding Season Length and Calving Season on Range Beef Cow Productivity

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# EFFECTS OF BREEDING SEASON LENGTH AND CALVING SEASON ON RANGE BEEF COW PRODUCTIVITY[1]

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## ABSTRACT

A 5-yr study was conducted beginning in 1983 with 460 cows to evaluate the effects of three breeding seasons (30, 45, and 70 d in length) and two times of spring calving, March (early) and April (late), on cattle production under Nebraska Sandhills range conditions. Criteria evaluated included pregnancy and weaning percentages, calving date and distribution, cow weights and body condition at four intervals, calf birth and weaning weights, and cow productivity. The 30-d breeding season included a 10-d estrus synchronization and AI period; in the other breeding seasons only natural breeding was used. The same sires were used over the entire study period. Percentage of cows pregnant and percentage of calves weaned were lower ($P < .01$) for cows bred for 30 d than for cows bred for 45 or 70 d. Average calving dates were similar among the breeding groups within the early and late calving herds. Pregnancy rates from AI were higher ($P < .01$) for the cows calving in April (64%) than for the cows calving in March (41%). Cows calving in April lost less weight between precalving and prebreeding and were heavier ($P < .05$) at prebreeding time than the cows calving in March. Calf weaning weights were not different ($P > .10$) among any of the breeding season groups or between the two calving herds when calves were weaned at a similar age. Cow productivity (calf weaning weight per breeding female) was highest ($P < .05$) for the cows bred for 70 d (186 kg), intermediate for the cows bred for 45 d (172 kg), and lowest for cows bred for 30 d (162 kg). No difference in cow productivity was found between the two calving herds (early, 172 kg and late, 175 kg). We concluded that cows bred for 70 d had the highest productivity and that an April calving season was as productive as a March calving season in the Nebraska Sandhills.

Key Words: Beef Cows, Calving Season, Breeding Season, Beef Production, Estrus Synchronization

J. Anim. Sci. 1991. 69:3453–3460

## Introduction

Limited breeding and calving seasons generally result in increased calf production and greater efficiency. Calves born early in the calving season weigh more at weaning because of their older age and faster preweaning rate of gain (Lesmeister et al., 1973; Keller and Brinks, 1978). Cows calving early have a greater chance of higher pregnancy rates (Burris and Priode, 1958; Warnick et al., 1967). However, a negative relationship between date of calving and length of postpartum interval has been found (Bellows and Short, 1978; Knight and Nicoll, 1978; Morris et al., 1978; Montgomery et al., 1980). Body condition at calving and energy intake also influence reproductive performance (Richards and Spitzer, 1983; Bartle et al., 1984; Selk et al., 1988).

Research is limited on the effects of month of calving on cow productivity (Bellido et al., 1981; Bagley et al., 1987). One theory holds that the calving season should be timed so that the period of maximal nutritional requirement

[1]Journal Paper No. 9428. Univ. of Nebraska Agric. Res. Div.

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Received November 21, 1990.
Accepted March 21, 1991.

of the cow is synchronized with the maximal production and quality of forage to improve overall efficiency.

Because of the lack of research on various breeding and calving seasons, a 5-yr study was conducted to evaluate the effects of three breeding seasons (30, 45, and 70 d in length) and two times of spring calving (beginning March 1 or April 1) on cow reproductive performance, calf weaning weight, and cow productivity under Nebraska Sandhills range conditions.

### Materials and Methods

A study was initiated in 1982 at the University of Nebraska Gudmundsen Sandhills Laboratory, a 5,100-ha research ranch located in the Nebraska Sandhills. A group of 448, 2-yr-old Hereford × Angus cows that had been bred as yearlings for 45 d beginning May 15, 1981, were randomly allotted across calving dates to one of two calving herds: 1) early spring, begin breeding May 20 to begin calving March 1 or 2) late spring, begin breeding June 20 to begin calving April 1. All matings were natural service by MARC II (composite breed of 1/4 each Simmental, Gelbvieh, Hereford, and Angus) sires from the U.S. Meat Animal Research Center, Clay Center, NE. Duration of breeding seasons in 1982 was 50 d. After calving in the spring of 1983, 410 of these 3-yr-old cows were allotted by blocking on calving date within the early and late herds to three breeding groups (30-, 45-, or 70-d breeding seasons). An additional 50, 2-yr-old 1/2 Simmental × 1/4 Angus × 1/4 Hereford cows were equally allotted by calving date to the breeding groups to increase the numbers in each group. These cows had been bred as yearlings for a 30-d period beginning May 10, 1982. The number of cows in each group was as follows: early spring, 77, 78, and 78 for the 30-, 45-, and 70-d breeding seasons; late spring, 75, 77, and 75 for the 30-, 45-, and 70-d breeding seasons.

Cows remained in their respective groups for the duration of the study unless they were removed because of failure to rebreed or physical injury. No replacements were added during the study. Each year, cows in the 30-d breeding groups were placed in a 16-ha bromegrass pasture at the beginning of the breeding season, and a 10-d estrus synchronization and AI program was conducted. The program consisted of detection of estrus and breeding by AI for 5 d; on d 6, the cows not bred by AI received an injection of 5 ml of prostaglandin $F_{2\alpha}$[4] and AI continued for five more days. One experienced technician inseminated all cows in both the early and late groups each year. After the estrus synchronization program, cows in the 30-d groups were moved to a large breeding pasture that contained MARC II bulls and the cows in the 45- and 70-d breeding groups. Semen used for AI was collected from the same bulls used in natural breeding to eliminate genetic differences in the calves. During the AI procedure, cows were assigned sequentially through the AI chute to semen from different bulls. The same individual bulls were used over the 5-yr period and were randomly assigned each year to the early or late breeding herds. Cows in the 30- and 45-d breeding groups were removed from the breeding pasture at the end of their respective breeding seasons. At the end of the 70-d breeding season, all bulls were removed from the pasture. Cows and calves remained on Sandhills native ranges until weaning.

Each year cows were weighed and given a visual body condition score (using a 1 to 9 system, with 1 being extremely thin and 9 being extremely fat; Selk et al., 1988) at precalving, prebreeding, weaning, and 30 d after weaning. All calves were weighed on approximately September 20, when the calves from the cows in the early group were weaned. Calves from the cows in the late group were weighed again about October 20 when they were weaned. Therefore, calves from the early and late groups were of similar age at weaning. The two weights taken on the calves from the late group of cows allowed the evaluation of suckling gain during the month before weaning. Pregnancy was determined via rectal palpation at weaning time and nonpregnant cows were removed from the study. After all calves were weaned, cow groups were placed together during the fall and winter for ease of management and to avoid confounding with environmental effects. Cows grazed dormant Sandhills range and subirrigated hay meadow regrowth. During snow cover and after calving, cows had ad libitum access to meadow hay (7

[4]Lutalyse, The Upjohn Co., Kalamazoo, MI.

TABLE 1. REPRODUCTIVE PERFORMANCE OF COWS BY BREEDING GROUPS OVER 5 YEARS (LEAST SQUARES MEANS)

| | No. of cows in study | | | | | |
|---|---|---|---|---|---|---|
| Breeding group[a] | Beginning | End | Years retained[b] | Pregnant[c], % | Weaned[d], % | Average calving date |
| Early 30 | 77 | 25 | 3.8 | 79.5 | 72.8 | Mar 12 |
| Early 45 | 78 | 47 | 4.7 | 86.8 | 82.1 | Mar 14 |
| Early 70 | 78 | 61 | 5.3 | 94.6 | 90.2 | Mar 18 |
| Early – avg | 233 | 133 | 4.6 | 87.0 | 81.7 | Mar 14 |
| Late 30 | 75 | 37 | 4.2 | 88.3 | 82.0 | Apr 7 |
| Late 45 | 77 | 50 | 4.9 | 91.6 | 88.6 | Apr 11 |
| Late 70 | 75 | 54 | 5.1 | 93.4 | 89.6 | Apr 10 |
| Late – avg | 277 | 141 | 4.7 | 91.1 | 86.7 | Apr 8 |

[a]Early = begin calving March 1; late = begin calving April 1.

[b]Average number of years cows remained in study. Average of 30-d groups was different ($P < .01$) from average of 45- and 70-d groups.

[c]Average of 30-d groups was different ($P < .01$) from average of 45- and 70-d groups. Average of 45-d groups was different ($P < .05$) from average of 70-d groups.

[d]Average of 30-d groups was different ($P < .01$) from average of 45- and 70-d groups.

to 8% CP). Cows were also given an all-natural 32% CP supplement (Sanson et al., 1990) at .68 to .91 kg daily, depending on hay quality, after calving until they were moved to summer pasture about May 20.

Cows calved in small pastures and were observed frequently. Calving information, including calf birth date, weight, and sex, were recorded. Sterile bulls were placed with all cows from shortly after calving to the beginning of the breeding season each year to help stimulate early cyclicity (Zalesky et al., 1984).

*Statistical Analyses.* All variables were analyzed by weighted least squares procedures (SAS, 1984). All models included main effects of year, cow breed, and breeding group (six combinations of calving time and breeding seasons) and all interactions of these effects. Weightings in the least squares analyses were by the reciprocal of the variance of each year-cow breed-breeding group subclass. Pregnancy and weaning rates were transformed to logits (Cox, 1970), analyzed by weighted least squares, and tested using the chi-square distribution. Five orthogonal contrasts of the breeding group means were used to test main effects (season and length) and interactions. The contrasts were early calving herd vs late calving herd, 30 d vs (45 + 70 d)/2, 45 d vs 70 d, early vs late × 30 vs (45 + 70)/2, and early vs late × 45 vs 70 d. Calf weaning weights were adjusted to a heifer basis but not for calf or cow age. The adjusted weaning weights were also used in the cow productivity value, which was calculated as total kilograms of calf weaning weight divided by the total number of cows in the breeding group exposed to bulls during the breeding season of the previous year. Weighted least squares procedures were used to analyze cow productivity. Cow weight changes were adjusted within subclasses before analysis for significant regressions on calving dates.

## Results and Discussion

*Reproductive Performance.* Cow breed effects were removed by least squares analyses and not reported because of small subclass numbers in one breed. No significant ($P > .10$) year effects or interactions were found for pregnancy percentage or weaning percentage (Table 1). Average pregnancy rate for cows in the early and late groups was similar. Pregnancy rates were lower ($P < .01$) for the cows in the early 30 and late 30 groups than for cows in the other groups. Also, the cows in the 30-d groups had lower ($P < .01$) longevity than cows in the 45- and 70-d groups. Estrus synchronization and AI were a part of the 30-d breeding season to allow for two estrous cycles but were not a part of the 45- and 70-d breeding seasons. Cows in the 45-d groups had a lower pregnancy rate ($P < .05$) than cows in the 70-d groups.

An average of 72% of the cows in the early group and 82% of the cows in the late group were observed in estrus and inseminated during the 10-d period of estrus synchronization. Of the cows inseminated, a higher ($P <$ .01) percentage (76%) of cows in the late group than of cows in the early group (55%) conceived. A higher ($P <$ .01) percentage of cows in the late group (64%) than of cows in the early group (41%) were pregnant from AI. These results indicate that cows in the late group were more fertile early in the breeding season than cows in the early group.

A short breeding season may be more appropriate for cows being bred to calve in April than for cows calving in March. Cows calving in April had a shorter period from calving until they were placed on green pasture and were on this pasture for 30 d before the breeding season began June 20. Bellows and Short (1978) found a negative relationship between spring calving date and length of the postpartum interval, and they suggested that for cows calving early, the feed levels after calving and before going on green pasture are not adequate for short postpartum intervals. Montgomery et al. (1985) reported that later calving in the spring is associated with changes in photoperiod, temperature, and pasture availability that influence resumption of ovarian cycles.

The percentage of calf crop weaned from the cows in the 30-d groups was also lower ($P <$ .01) than that weaned from the cows in the 45- and 70-d groups (Table 1). Comparisons of weaning percentages favored cows bred for 70 d over those bred for 45 d and late over early; however, neither of these differences was significant ($P >$ .10). Weather conditions in some years increased calf losses.

Average calving dates were similar among breeding groups within the early and late herds (Table 1). Cows in the late herd calved earlier in the month than the cows in the early herd (April 8 vs March 14). This again suggests the cows in the late herd had a higher conception rate during the early part of the breeding season. Figure 1 shows the percentage of cows calving during the first 20 d of the calving season for each breeding group over 5 yr. A high percentage of cows (60 to 100%) in all breeding groups calved during the first 20 d, which could have been influenced by the stimulation of early estrus after calving from exposure to sterile bulls (Zalesky et al., 1984). The cows in the late groups averaged higher ($P <$ .05) percentages (86 vs 74%) than the cows in the early groups. In comparing groups over years, cows in the 30-d groups tended to calve earlier each year, whereas cows in the 70-d groups, at least those in the early herd, tended to calve later.

*Cow Weights and Condition Scores.* Weights and condition scores were similar for breeding groups within calving herds; therefore, only the mean weights and scores for the cows in the early and late calving herds are shown in Table 2. Cow weight increased over years and averaged about 500 kg before calving. Cow weights precalving and at weaning were similar, and no differences ($P >$ .10) were found between early and late calving herds. This indicates that cows lost body weight during the winter, but the weight was replaced by conceptus weight; cows then gained weight back during the summer. At prebreeding, cows in the late herd weighed more ($P <$ .05) than cows in the early herd, because the cows in the late herd lost less or gained more weight between precalving and prebreeding (–39 vs –67 kg) than cows in the early herd. Bellido et al. (1981) reported that early-bred cows lost twice as much weight as late-bred cows during a similar period. Weight changes for the cows in the early and late herds over years are shown in Figure 2. Cows in the late herd probably gained considerable weight during the 30 d on summer pasture before the initiation of the breeding season, which could be the reason for their higher fertility. Dunn et al. (1969) and Stricker et al. (1979) reported that conception rates of cows are primarily influenced by nutrition level. Selk et al. (1988) concluded that body weight change from precalving to prebreeding influences the time that ovarian luteal activity occurs after calving.

Cows in the early herd also gained considerable weight during the summer and were similar in weight at weaning to the cows in the late herd. Cows in the late group had smaller fluctuations in weight through the annual cycles of production. Body condition scores were similar for cows in the early and late groups (Table 2). The scores generally fluctuated in a small range.

Significant year, treatment, and year × treatment interaction effects were found ($P <$ .01) for cow weight change during the 30-d period after weaning (Table 2). Cows in the early herd generally maintained their weight from September 20 to October 20, but cows in the late herd lost an average of 19 kg from October 20 to November 20. Results refute the common belief that cows gain

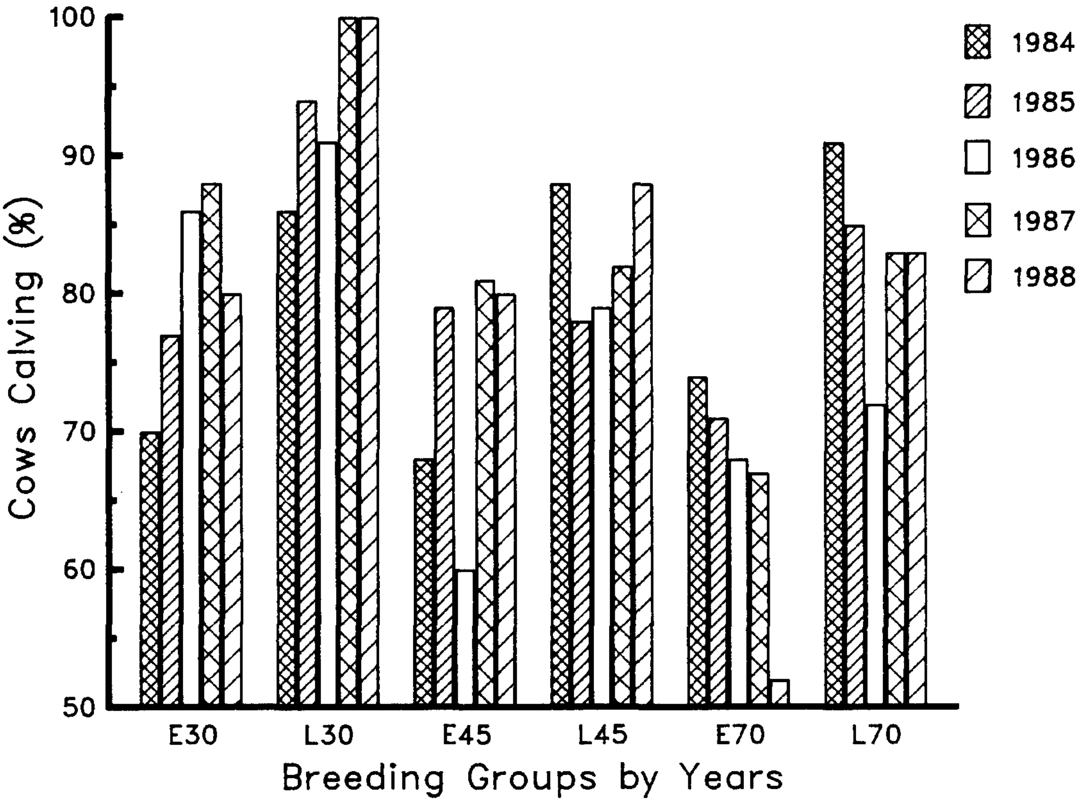


Figure 1. Percentage of cows calving during first 20 d of calving season for breeding groups over 5 yr. (E = early, L = late, and days are length of breeding season.)

weight after weaning if calves are weaned in September. In general, results suggest that cows may maintain their weight in October but start losing weight in November on Sandhills range.

*Calf Performance.* Birth weights of calves from the cows in the 30-d groups were lighter ($P < .01$) than those of calves from cows in the 45- and 70-d groups (Table 3). The reason for the lighter birth weights is not apparent, because the same bulls were used in all breeding groups in each calving herd each year and the semen used in AI was collected from these bulls. Cow nutrition and weather conditions were also similar. Calf birth weights from the cows in the late herd were lighter ($P < .01$) than those from the cows in the early herd. This difference may have been due to the effects of warmer weather, because summer and fall calves are lighter at birth than winter and spring calves (Donald et al., 1962).

Calf weaning weights and ADG were not different ($P > .10$) among any of the breeding groups (Table 3). These results were expected because average calving dates were similar among the groups in a calving herd, even though lengths of breeding season were different. Our results differ from those of Lesmeister et al. (1973), who reported that shorter breeding seasons yield heavier calf weaning weights. No differences ($P > .10$) were found in weaning weight of calves from cows in the early and late herds. Calves were weaned at similar ages, so calf age was not a factor. These results agree with the findings of Pell and Thayne (1978) and Bellido et al. (1981) but differ from the results of Sellers et al. (1970) and Keller and Brinks (1978). Calves from the cows in the late herd gained an average of 15.5 kg (10.5 to 20.5 kg over years) during the 30-d period before weaning. This .5 kg/d gain was about half the rate they gained during the summer. This slower gain should be considered when deciding on the date to wean calves.

*Cow Productivity.* Cow productivity was affected ($P < .05$) by year and breeding group (Table 3). Cows in the early and late herds did

TABLE 2. COW WEIGHTS AND BODY CONDITION SCORES BY BREEDING GROUPS OVER 5 YEARS (LEAST SQUARES MEANS)

| | Cow wt (kg) and condition scores (CS) by periods[a] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Year and breeding group[b] | Precalving | | Prebreeding | | Weaning | | Post-weaning wt | 30-d wt change[c] |
| | Wt | CS | Wt | CS | Wt | CS | | |
| 1984 | | | | | | | | |
| Early | 494 | 6.4 | 410 | 5.5 | 486 | 5.5 | 456 | –30 |
| Late | 468 | 6.2 | 436 | 5.8 | 449 | 4.9 | 431 | –18 |
| 1985 | | | | | | | | |
| Early | 485 | 5.6 | 413 | 5.4 | 516 | 5.7 | 523 | + 7 |
| Late | 488 | 5.6 | 450 | 5.7 | 495 | 5.7 | 498 | + 3 |
| 1986 | | | | | | | | |
| Early | 495 | 5.1 | 464 | 5.4 | 545 | 5.5 | 546 | + 1 |
| Late | 492 | 5.1 | 466 | 5.7 | 538 | 6.0 | 494 | –45 |
| 1987 | | | | | | | | |
| Early | 516 | 6.0 | 436 | 5.7 | 535 | 6.0 | 554 | +19 |
| Late | 515 | 5.9 | 479 | 5.8 | 547 | 6.0 | 524 | –23 |
| 1988 | | | | | | | | |
| Early | 558 | 6.2 | 489 | 5.8 | 522 | 6.0 | 519 | – 3 |
| Late | 555 | 6.0 | 491 | 5.8 | 520 | 6.0 | 509 | –11 |
| Avg | | | | | | | | |
| Early | 510 | 5.9 | 442[d] | 5.6 | 521 | 5.7 | 520[e] | – 1[e] |
| Late | 504 | 5.8 | 465[d] | 5.8 | 510 | 5.7 | 491[e] | –19[e] |

[a]Cow weights and condition scores were taken for early and late groups, respectively, at precalving (Feb. and Mar.), prebreeding (May and June), weaning (Sept. and Oct.) and postweaning, which was 30 d after weaning (Oct. and Nov.). Condition scoring system was 1 = very thin, 5 = moderate, and 9 = very fat.

[b]Early = begin calving March 1, late = begin calving April 1.

[c]Cow weight change for 30 d after weaning.

[d]Values were different ($P < .05$).

[e]Values were different ($P < .01$).

TABLE 3. CALF WEIGHTS AND COW PRODUCTIVITY BY BREEDING GROUPS OVER 5 YEARS (LEAST SQUARES MEANS)

| Breeding group | Calf, birth wt, kg | Calf weaning wt[a], kg | Calf ADG[b], kg | Cow productivity[c], kg calf/cow |
|---|---|---|---|---|
| Early 30 | 38.5[d] | 196.8 | .87 | 157.7[f] |
| Early 45 | 39.6 | 200.9 | .90 | 169.5 |
| Early 70 | 40.3 | 203.2 | .94 | 187.7 |
| Avg | 39.5[e] | 200.5 | .90 | 171.8 |
| Late 30 | 37.4[d] | 199.1 | .86 | 165.9[f] |
| Late 45 | 39.1 | 191.8 | .85 | 174.5 |
| Late 70 | 38.4 | 198.6 | .88 | 184.1 |
| Avg | 38.3[e] | 196.4 | .86 | 175.0 |

[a]Early calves weaned September 20, late calves weaned October 20; same age at weaning.

[b]Average daily gain from birth to weaning.

[c]Productivity was calculated as total kilograms of calf weaning weight divided by total number of cows exposed to bulls in breeding season the previous year.

[d]Average of 30-d groups was different ($P < .01$) than average of 45- and 70-d groups.

[e]Average for early groups was different ($P < .01$) from average of late groups.

[f]Average of 30-d groups was different ($P < .01$) from the average of the 45- and 70-d groups; the 45- and 70-d groups were different ($P < .05$). Average for early and late groups was not different.

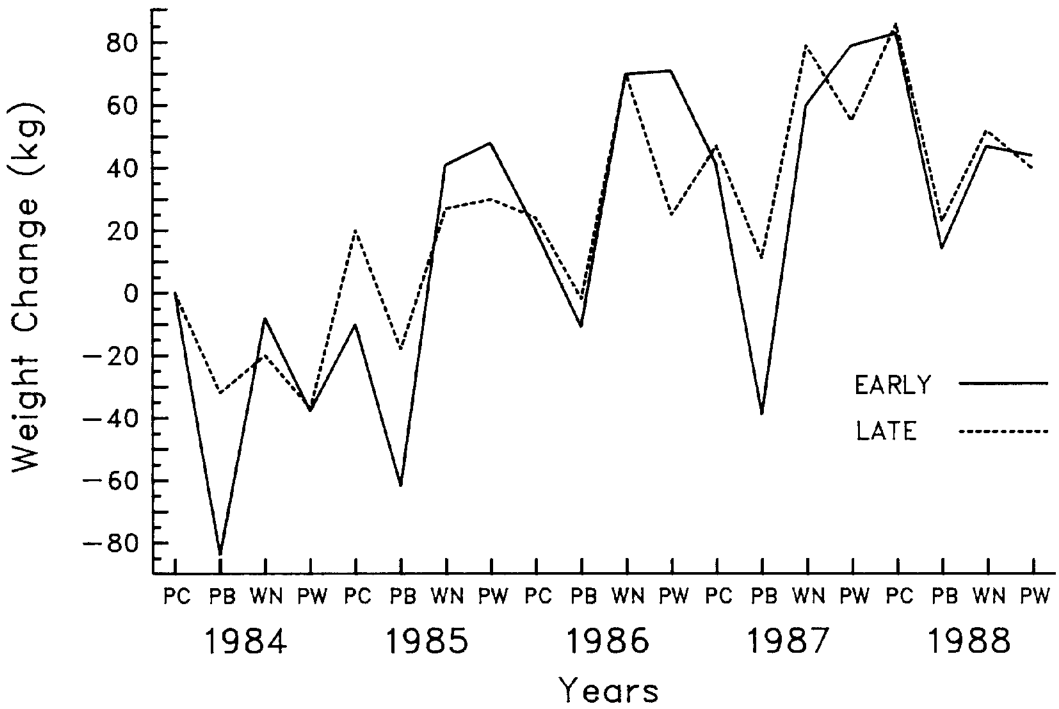


Figure 2. Cow weight change for early and late herds at precalving (PC), prebreeding (PB), weaning (WN), and postweaning (PW) over 5 yr.

not differ in productivity. The cows bred for 70 d were most productive, cows bred for 30 d least productive, and cows bred for 45 d intermediate. These results do not detract from the general recommendation of using a 60-d breeding season for cow herds under range conditions in the Great Plains (Dziuk and Bellows, 1983). Caution should be taken on shortening the breeding season further for mature cow herds. Cows bred for 30 or 45 d had less longevity in the herd than cows bred for 70 d, which is a further disadvantage. Bagley et al. (1987) compared spring and fall calving in Louisiana and found that the fall-calving herd had a higher weaning rate and heavier calf weaning weights, resulting in higher cow productivity and higher monetary returns.

*Discussion.* The "best" month for spring calving is a management decision affected by many variables. Results of this study indicate that cows bred for 70 d in both the March and April calving herds had similar percentages of calf crop weaned, calf weaning weight, and cow productivity. The largest trade-off between the March- and April-calving herds seemed to be a 15.5 kg lighter calf at weaning for the April-calving cows, if all calves were weaned the same day; however, the April-calving cows had 30 d less winter feed after calving until summer grass. An economic analysis (described by Pfeiffer et al., 1990) of this trade-off indicated similar net returns between the March- and April-calving herds. These results, in addition to available labor, facilities, winter feeds and pasture, plus time of marketing, need to be considered in the decision of when to begin the calving season.

## Implications

Under Nebraska range conditions, a calving season beginning April 1 is as productive, in terms of calf weaning weight per breeding female, as a calving season beginning March 1, if calves are weaned at a similar age. Production costs and time of marketing should be used to define the best calving period for individual production units. The best length of breeding season must be determined carefully; the 70-d breeding season was better than 30- and 45-d seasons in this study.

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