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Climate Affects Calf Birth Weights and Calving Difficulty

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When winter temperatures are colder than normal, larger calf birth weights can be expected in the spring with more calving difficulty in two-year-old heifers.

Summary

A six-year study was conducted to investigate effects of winter temperatures on two-year-old cows (n=285) and their subsequent calf birth weights and calving difficulty in the spring. The winter of 1992-93 (coldest) was 11º F colder than the winter of 1994-95 (warmest). The coldest winter was followed by calf birth weights that were 11 pounds heavier with 29 percent greater calving difficulty compared to the warmest winter. Our results indicated that as average winter temperatures decreased 1º F, subsequent calf birth weights increased 1 pound and calving difficulty increased 2.6 percentage points. When blankets were placed on cows before calving, hide temperatures increased slightly, but calf birth weights were unchanged.

Introduction

Calving difficulty of two-year-old heifers is still a major concern of beef producers, even when heifers are bred to low birth weight EPD sires and are managed properly. Consistently, calf birth weight has been shown to be the primary cause of calving difficulty. The genetic heritability of birth weight is about 45 percent, with the remaining 55 percent due to environmental conditions. The environmental influences may be the reason calf birth weights are heavier in some years even though genetics of animals are similar.

Research suggests exposing a pregnant animal to cold temperatures results in increased blood flow to the uterus allowing the fetus to obtain greater nutrients and increased growth. This may explain why calf birth weights are usually heavier in colder climates than warmer climates. In the 1996 Nebraska Beef Report, pp 23-25, research indicated birth weights of calves born in the spring were heavier and more calving difficulty was experienced after a severe cold winter.

Three years of additional data were collected to determine the effects of winter temperatures on calf birth weights to confirm or refute the previous results. Because Nebraska's climatic conditions vary year-to-year, many years of data are needed. Also, a study was conducted to attempt to increase cow body temperature precalving by using blankets (coats) to reduce calf birth weights.

Procedure

Climate on calf birth weight

The data for this study were collected over six years (winters of 1992-93 to 1997-98) on two-year-old cows (n=285 total) at the West Central Research and Extension Center (WCREC) at North Platte, Nebraska. During the first three years of the study, cows were involved in an intensive breeding and calving study to investigate the various causes of calving difficulty. Cattle management and results were reported in the 1997 Nebraska Beef Report, pp 20-23. Climatic conditions were found to significantly affect calf birth weight and calving difficulty. Therefore, an additional three years of data were collected. During these years, the yearling heifers were on estrous synchronization and AI breeding studies which did not influence calf birth weight or calving difficulty of the two-year-old cows.

During this six-year study, MARC II heifer calves (1/4 Angus x 1/4 Hereford x 1/4 Simmental x 1/4 Gelbvieh) raised at the Gudmundsen Sandhills Laboratory near Whitman were used. Each year the yearling heifers were bred by AI to the same Angus sire (ABS Global, Inc.). This sire is a trait leader for calving ease with a birth weight EPD of -1.7 and a yearling weight EPD of +39. In general, the bred heifers were managed similarly each year: on native pasture during the fall and fed bromegrass hay *ad libitum* (10 percent CP) with alfalfa hay (17 percent CP) as a supplement (3 to 4 lb/day) during the winter to meet NRC requirements.

The calving season began in mid-February and ended April 1. Calving data included calf birth weight, birth date, calf sex and a calving difficulty score. The calving difficulty scoring system was from 1 to 5, with 1 = no assistance, 3 = mechanical pull and 5 = caesarean.

Weather data were collected for three months (December, January and February) each winter at a nearby weather station. Data evaluated were high and low air temperatures and wind chills.

Data were analyzed by least squares analyses. Calf birth weights were analyzed by year with calf sex removed. Calving difficulty percentages were tested using a Chi-square analysis.

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Cow blankets on calf birth weight

Two trials were conducted (1995-96 and 1996-97) at WCREC to investigate if applying blankets (coats) on cows precalving would increase cow body temperatures and, in turn, decrease calf birth weight and calving difficulty. Seventy two-year-old cows (Trial 1, n = 31, Trial 2, n = 39) which had been utilized as yearlings in estrous synchronization and AI studies were used. Cows were pregnant from one Angus sire. In early December each year, cows were assigned to two treatments (blanket or control) according to weight, body condition, pelvic size and expected calving date. Cows were placed in adjacent drylots and fed a corn silage and alfalfa hay ration. The same amount of feed per head was given to each treatment group so feed-to-gain ratios could be determined for feed efficiency during the trial.

The blankets used in Trial 1 were made of one-half inch-thick tightly woven fabric with a canvas top to protect it from weather and tearing. The blanket covered the cow from neck to tail, hanging down on each side about to the hocks and held in place by three straps (similar to coats for horses). The blankets were designed and constructed locally. In Trial 2, a one-half inch-thick woolen pad manufactured in New Zealand was added under the canvas to increase warmth. The intent of the blankets was to keep the animal warmer by reducing heat loss and increasing hide temperature.

The blankets were strapped on in early December each year and remained on the cows until just prior to the start of the calving season in mid-February. The duration of the trials were: Trial 1 = 63 days and Trial 2 = 76 days. Surprisingly, the cows adjusted to the blankets quite readily after some initial bucking and jumping. The blankets remained in place, with only minor adjustments, and were not rubbed off on fences or feed bunks. Straps were loosened as animals gained weight and became closer to calving.

Cows were weighed every two weeks and blankets were adjusted as needed. Rectal and hide temperatures were obtained with a digital thermometer on half of the cows in each treatment group. Hide temperatures were obtained by placing thermometer under the hair next to the skin in hip fossa area (in front of hook bone). This area was easy to access and covered by the blanket on cows.

Because cows had been synchronized and AI bred, they calved in a short time period. At calving, cows were watched closely and assisted as needed. Calving data obtained were calf birth date, birth weight and calf sex, plus a calving difficulty score from 1 to 5.

Data were analyzed by least squares analyses. Calf birth weights were analyzed by year with calf sex and gestation length removed. Calving difficulty was tested using a Chi-square analysis.

Results

Climate on calf birth weight

Table 1 shows the average winter temperatures and wind chills (December, January and February) for each year ranked from coldest to warmest. Temperatures were coldest during the winter of 1992-93 and warmest during the winter of 1994-95 with an 11° F difference. The wind chills were also 11° F different. Temperatures for the other years were above normal and moderate. The normal average winter temperature for North Platte is 25°F.

Spring calf birth weights following each winter are also shown in Table 1. Significant differences ($P < .05$) in birth weights were found among years. In general, calf birth weights decreased as winter temperatures increased. After the coldest winter (1992-93), calf birth weights averaged 77.6 pounds; after the warmest winter (1994-95) 66.4 pounds. This difference of 11 pounds matched the 11° F difference in temperatures between the two winters. These data indicate a negative linear relationship between winter temperatures and calf birth weights. In general, as winter temperatures increased 1° F, calf birth weight decreased 1 pound. The exception to this relationship was the winter of 1995-96 which had above normal average temperatures and numerically (not statistically) heavy calf birth weights. One possible reason for this exception: colder than normal temperatures in January.

Percentage of calving difficulty followed the same trend as calf birth weight (Table 1). Calving difficulty was greater ($P < .05$) in the spring of 1993 than in the spring of 1995 (58 percent versus 29 percent). This difference of 29 percent occurred when calf birth weights decreased 11 pounds and winter temperatures increased 11°F. It appears calving difficulty increased 2.6 percent per 1 pound increase in calf birth weight and per 1°F decrease in winter temperatures. Therefore, when winter temperatures are colder than normal, heavier calf birth weights in the spring and more calving difficulty may be experienced.

Many other factors affect calf birth weight and calving difficulty including cow age, cow weight, cow body condition, nutrition, cow pelvic size, genetics,

Table 1. Effects of winter temperatures over six years on calf birth weight and calving difficulty.

Winter	Average temperatures[a] degree (F)	Average wind chill[b] degree (F)	Number of calves	Calf BWT[c], pounds	Calving difficulty[d] %
1992-93 (coldest)	20	12	36	77.6[e]	58[e]
1993-94	26	18	39	72.5[f]	33[fg]
1995-96	27	19	44	75.2[ef]	45[eg]
1996-97	27	20	76	72.4[f]	30[fg]
1997-98	30	22	59	67.4[g]	25[f]
1994-95 (warmest)	31	23	31	66.4[g]	29[fg]
Difference coldest to warmest	11	11		11	29

[a]Winters ranked from coldest to warmest. High and low temperatures for December, January and February were averaged.
[b]Average wind speed x average temperature for 3 months.
[c]Birth weight adjusted for calf sex.
[d]Calving difficulty with scores 3 to 5 on a 1 to 5 scoring system.
[efg]Means within category differ ($P < .05$).

Table 2. Precalving cow weights and body condition scores.

Winter[a]	Number of cows	Precalving cow weight (lb)	Cow condition score[b]
1992-93 (coldest)	36	973	5.2
1993-94	39	961	5.0
1995-96	44	976	5.4
1996-97	76	980	5.5
1997-98	59	994	5.3
1994-95 (warmest)	31	934	5.0

[a] Winter temperatures included December, January and February. Calving seasons were from mid-February to April 1.
[b] Scoring system was 1 to 9 with 5 = moderate.

Table 3. Effects of cow blankets on calf birth weight and calving difficulty.

	Trial 1		Trial 2	
Trait	Blanket	Control	Blanket	Control
No. of cows	16	15	20	19
Beginning wt.[a], lb	946	946	960	955
Gain during trial[a], lb	87	91	118	121
Feed/gain ratio[b]	12.3	11.8	11.2	10.8
Cow rectal temp.[c], F°	101.5	101.5	102.4	102.0
Cow hide temp.[c], F°	94.0[f]	92.6[g]	95.5[f]	91.2[g]
Calf birth wt.[d], lb	75.4	75.9	74.4	74.3
Calving difficulty[e], no.	10	6	6	4

[a]Trials began in early December and lasted until mid-February; Trial 1 = 63 days, Trial 2 = 76 days. Calving began in late February and lasted three weeks.
[b]Ratio is pounds of feed DM consumed per pound of gain.
[c] Rectal and hide temperatures were taken every two weeks. Hide temperatures were taken in hip fossa area which was under blanket in that group.
[d]Birth weight adjusted for calf sex and gestation length.
[e]Calving difficulty with scores 3 to 5 on a 1 to 5 scoring system.
[fg]Means within trial differ (P < .05).

gestation length and calf sex. During the six years of this study, we tried to standardize and monitor these factors to remove their affects. The cows were all two-year-olds of similar genetics with the same AI sire used each year. Precalving cow weights and body condition scores for each year were similar (Table 2). Cows were fed *ad libitum* grass hay each year during the winter, except in November, 1997 when cows were pastured on corn stalks. Cows probably consumed more hay during the cold winters which may have increased nutrients to the fetus. However, other research indicates calf birth weights would change only slightly (1 to 3 pounds) due to these nutrition levels. Average cow pelvic size and calf gestation length were similar each year. Calf sex was removed in the statistical analyses. Therefore, genetics, nutrition and management of cows and calves were similar each year.

This data set over six years provides evidence that severe cold winter temperatures can increase calf birth weights and cause more calving difficulty. Increased blood flow to the uterus during cold temperatures is thought to be the primary factor increasing fetal growth. This research should help explain why beef producers have heavier birth weight calves and more calving difficulty some years even though their genetics and management are similar.

Cow blankets on calf birth weights

Because the two trials were conducted using different thickness of blankets and for different lengths of time, the results for each trial are reported separately in Table 3. No treatment differences were found in cow gain or feed efficiency for either trial. Cows with blankets did not gain more or have better feed conversion than cows with no blankets.

Cow rectal temperatures were very similar for both treatment groups in each trial. Therefore, blankets did not change internal core temperatures. However, hide temperatures were higher (P < .05) for the cows with blankets than for the controls. In Trial 1 the difference was 1.4° F; in Trial 2 it was 4.3° F. The hide was warmer in Trial 2, probably due to the thicker blankets. When taking temperatures on cold winter mornings, the hide under the blankets was definitely warm to the touch. However, the skin temperatures under the hair on cows with no blankets were warmer than expected.

Although blankets were able to increase hide temperatures a small amount, calf birth weights were not affected. Calf birth weights were very similar for the cows with blankets and for those without blankets in both trials. Calving difficulty was not significantly different between treatments. Although numerically more cows with blankets needed assistance at calving, the total number of cows in each group was small.

These results indicate that while the blankets did increase hide temperatures, it apparently was not enough to affect blood flow to the uterus and reduce calf birth weights. The winter temperatures during both of these trials were above normal (average 27°F) which may have also influenced the results of this study. Other methods of warming the body or changing the animals' environment should be investigated.

Since climatic conditions cannot be controlled, beef producers could consider alternative management strategies such as: change calving season of heifers to late spring, summer or fall; move heifers to warmer climates or facilities during the winter or at least provide wind protection or shelter during severe winter temperatures if heifers are calved early in spring.

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