

1988

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Recommended Citation

Pruitt, R.J. and Momont, P.A., "Effects of Body Condition on Reproductive Performance of Range Beef Cows" (1988). *South Dakota Beef Report, 1988*. Paper 12.

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EFFECTS OF BODY CONDITION ON REPRODUCTIVE PERFORMANCE OF RANGE BEEF COWS

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CATTLE 88-11

Summary

Mature Simmental x Angus crossbred cows were fed differing levels of nutrition from December to May in each of 3 years to create a wide range in cow body condition or fleshiness at the beginning of the calving season (beginning mid-March) and when turned to summer pasture (early May) 1 month prior to the beginning of a 60-day breeding season (early June). Cows that were fleshier in March, May or June cycled earlier and conceived earlier. Being thin in May or June had a more detrimental effect on pregnancy rate for cows that calved late in the calving season. A condition score of 4 for early calving cows and 5 for late calving cows at calving and breeding were the minimum body condition for high reproductive performance.

(Key Words: Beef Cow, Body Condition, Reproduction, Nutrition.)

Introduction

Many researchers have shown that body condition of beef cows affects reproductive performance. Previous studies have linked higher cow body conditions with shorter intervals from calving to first estrus and increased percentage of cows pregnant. It is not clear as to the minimum degree of body condition at various stages of production that will lead to adequate reproductive performance under different conditions.

The objectives of this study are to (1) establish the minimum cow body condition before calving and breeding necessary for adequate reproductive performance and (2) evaluate subjective and objective measurements to describe body condition of beef cows. The results reported in this paper relate to objective 1.

Materials and Methods

Mature Simmental x Angus crossbred cows wintered at the SDSU Range and Livestock Research Station near Philip and summer grazed near Sturgis, South Dakota, were allotted each December by age and previous calving date to one of two levels of early winter nutrition. Within 1 week following calving, cows were reallocated by calving date, calf sex, cow age and early winter treatment to one of two late winter treatments fed until early May. Early and late winter treatments were designed to create a wide range in cow body condition prior to calving and in early May.

All cows grazed native range as a group from early May to early December each year. The 60 to 70-day breeding season began on June 6 each year. For the first 2 years, cows were exposed to Charolais bulls. During the third year, cows were observed for estrus for the first 25 days of the breeding season and artificially inseminated to Simmental or Angus bulls. Cows were then exposed to Simmental or Angus bulls for the remainder of the breeding season.

Cow body condition scores (Table 1), cow weights (after overnight withdrawal from feed and water), backfat needle probes (Cook's probe taken between 12th and 13th ribs) and weight/height ratios (weight/height at top of the hook bones) were monitored monthly from December through July. Blood from each cow was collected twice monthly (7-10 days apart) in early May, June and July for detection of cyclic activity via serum progesterone as

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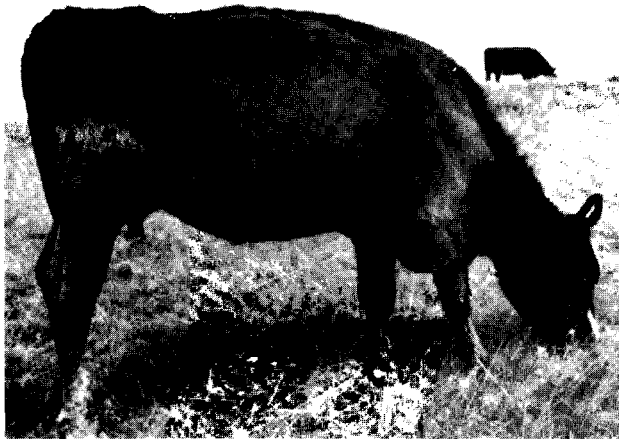
TABLE 1. KEY POINTS FOR CONDITION SCORING BEEF COWS

Reference point	Condition score								
	1	2	3	4	5	6	7	8	9
Physically weak ^a	yes	no	no	no	no	no	no	no	no
Muscle atrophy ^a	yes	yes	slight	no	no	no	no	no	no
Outline of spine visible	yes	yes	yes	slight	no	no	no	no	no
Outline of ribs visible	all	all	all	3-5	1-2	0	0	0	0
Fat in brisket and flanks	no	no	no	no	no	some	full	full	extreme
Outline of hip and pin bones visible	yes	yes	yes	yes	yes	yes	slight	no	no
Fat udder and patchy fat around tail head	no	no	no	no	no	no	no	slight	yes

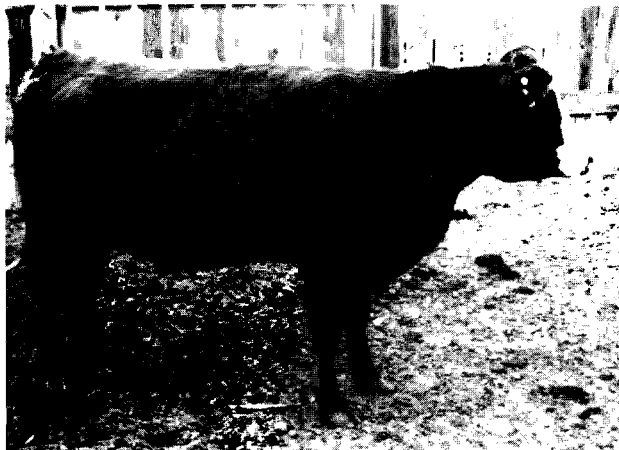
^a Muscles of loin, rump and rearquarter are concave, indicating loss of muscle tissue.



CONDITION SCORE 1



CONDITION SCORE 3



CONDITION SCORE 5



Left: Condition Score 7; Right: Condition Score 2

CONDITION SCORE 7

determined by radioimmunoassay. Pregnancy was determined by rectal palpation in October. Conception date was estimated by subtracting an assumed 285-day gestation length from calving dates the following spring. Only records from cows nursing calves were included in statistical analyses.

Treatment effects were analyzed as a 2 x 2 factorial using the General Linear Model procedure (GLM) of the Statistical Analysis System (SAS). Means were separated by the Predicted Difference option. Conception to artificial insemination was analyzed by Chi-square Analysis. Prediction equations to analyze the effects of condition score and days from calving to the beginning of the breeding season were developed using the Logist Procedure of SAS (cycling, conception during the first 21 days of breeding season, pregnancy) and GLM (conception date).

Results and Discussion

The nutritional treatments imposed produced differences in weight change and body condition (Tables 2-4). Those treatments that produced greater winter weight loss and lower body condition scores resulted in fewer cows cycling prior to and during the breeding season and later conception dates.

TABLE 2. EFFECTS OF EARLY AND LATE WINTER TREATMENTS (1984-85)

Early winter treatment Late winter treatment	High		Low	
	High	Low	High	Low
No. cows	18	19	21	19
Cow wt, lb, 12/13/84	1030	983	1021	1045
Cow condition score				
12/13/84	5.4	5.2	5.4	5.4
3/12/85	5.8	5.6	5.4 _b	5.0
5/7/85	5.4 ^a	4.6 ^b	4.5 ^b	4.2 ^b
6/5/85	5.1	4.7	4.5	4.9
Cow wt change, lb				
12/13/84-2/15/85	46 ^a	51 ^a	-11 ^b	-42 ^c
2/15/85-3/12/85	22 ^a	15 ^a	42 ^b	53 ^b
3/12/85-5/7/85	-176	-191	-172	-174
12/13/84-5/7/85	-114 ^a	-134 ^{ab}	-145 ^{bc}	-167 ^c
5/7/85-6/5/85	46 ^{ab}	57 ^{ab}	31 ^a	64 ^b
Cow cycling, %				
5/7/85	33	37	10	26
6/5/85	75 ^a	56 ^{ab}	33 ^b	35 ^b
7/2/85	100	100	90	100
Cows pregnant, fall 1985, %	100	100	90	100
Conception date, 1985	June 15 ^a	June 22 ^{ab}	June 26 ^b	June 27 ^b

a,b,c Means in a row without common superscripts differ (P<.05).

TABLE 3. EFFECTS OF EARLY AND LATE WINTER TREATMENTS (1985-86)

Early winter treatment Late winter treatment	High		Low	
	High	Low	High	Low
No. cows	25	23	22	24
Cow wt, lb, 12/9/85	1030	1047	1012	1012
Cow condition score				
12/9/85	5.7	5.3	5.6 _{bc}	5.4 _c
3/7/86	5.5 _a	5.1 _{ab}	4.9 _{bc}	4.6 _c
5/9/86	4.5 _a	3.6 _b	4.1 _a	2.9 _c
6/5/86	5.3 _a	4.6 _b	5.1 _a	4.1 _c
Cow wt change, lb				
12/9/85-2/7/86	29 _a	33 _a	-40 _b	-40 _b
2/7/86-3/7/86	-22 _a	-18 _a	4 _b	7 _b
3/7/86-5/9/86	-130 _a	-180 _c	-106 _b	-158 _c
12/9/85-5/9/86	-121 _a	-165 _b	-143 _{ab}	-191 _c
5/9/86-6/5/86	119	125	121	112
Cows cycling, %				
5/9/86	20	13	9	4 _b
6/5/86	56 _a	48 _{ab}	50 _a	25 _b
7/2/86	80 _a	61 _{ab}	77 _{ab}	54 _b
Cows pregnant, fall 1986, %	92	96	95	100
Conception date, 1986	June 21 _{ab}	June 23 _{ab}	June 17 _a	June 24 _b

a, b, c Means in a row without common superscripts differ (P<.05).

TABLE 4. EFFECTS OF EARLY AND LATE WINTER TREATMENTS (1986-87)

Early winter treatment Late winter treatment	High		Low	
	High	Low	High	Low
No. cows	25	24	21	24
Cow wt, lb, 12/13/86	1133	1135	1133	1115
Cow condition score				
12/5/86	6.2	6.4	6.2 _b	6.3 _b
3/6/87	6.2 _a	6.0 _a	5.3 _b	5.2 _b
5/8/87	4.8 _a	3.6 _b	4.5 _a	2.5 _c
6/5/87	5.0 _a	4.3 _b	4.4 _{ab}	3.4 _c
Cow wt change, lb				
12/5/86-2/13/87	53 _a	48 _a	-8 _b	-40 _c
2/13/87-3/6/87	21 _a	15 _a	42 _b	51 _b
3/6/87-5/8/87	-233 _a	-310 _b	-198 _c	-264 _d
12/5/86-5/8/87	-174 _a	-253 _b	-218 _c	-295 _d
5/8/87-6/5/87	62 _a	86 _b	75 _{ab}	84 _b
Cows cycling, %				
5/7/85	32 _a	17 _{ab}	24 _a	4 _b
6/5/85	72 _a	42 _b	62 _a	13 _c
7/2/85	96 _a	96 _a	95 _a	63 _b
Cows pregnant, fall 1987, %	100	96	91	83
Conception date, 1987	June 29 _{ab}	June 26 _a	July 1 _{ab}	July 7 _b

a, b, c Means in a row without common superscripts differ (P<.06).

The probability of a cow cycling prior to the breeding season and conceiving in the first 21 days of the breeding season and pregnancy was greater for cows that were fleshier in March, May and June (Table 5). Cows that calved earlier, allowing more time from calving to the beginning of the breeding season, were more likely to cycle early and conceive in the first 21 days of the breeding season (Table 6). To help evaluate the importance of body condition under different situations, data were analyzed separately for those cows that calved early in the calving season (greater than 60 days from calving to the beginning of the breeding season) and late calving cows (less than or equal to 60 days from calving to the breeding season).

TABLE 5. EFFECT OF CONDITION SCORE ON REPRODUCTIVE PERFORMANCE
BASED ON PREDICTION EQUATIONS

March condition score	Proba- bility	May condition score	Proba- ability	June condition score	Proba- ability
Probability of cycling at the beginning of the breeding season					
1		1	.08 ^a	1	
2		2	.15	2	.05 ^a
3	.09 ^a	3	.26	3	.12
4	.19	4	.42	4	.28
5	.35	5	.59	5	.52
6	.55	6	.75	6	.74
7	.74	7	.86	7	.89
8	.86	8		8	
Probability of conceiving in the first 21 days of the breeding season					
1		1	.33 ^a	1	
2		2	.44	2	.27 ^a
3	.44 ^a	3	.56	3	.41
4	.53	4	.66	4	.57
5	.62	5	.76	5	.72
6	.71	6	.83	6	.83
7	.78	7	.89	7	.90
8	.84	8		8	
Probability of pregnancy during 60-day breeding season					
1		1	.76 ^a	1	
2		2	.87	2	.74 ^a
3	.86 ^b	3	.93	3	.87
4	.92	4	.97	4	.94
5	.95	5	.98	5	.98
6	.97	6	.99	6	.99
7	.98	7	1.00	7	1.00
8	.99	8		8	

^a Probability that slope equals zero is <.01.

^b Probability that slope equals zero is =.10.

TABLE 6. EFFECT OF DAYS FROM CALVING TO THE BEGINNING OF THE BREEDING SEASON ON REPRODUCTIVE PERFORMANCE BASED ON PREDICTION EQUATIONS

Days after calving	May condition score		June condition score	
	3	6	3	6
Probability of cycling prior to the breeding season				
30 ^a	.05	.32	.02	.30
50	.14	.56	.06	.55
70	.31	.78	.15	.78
90	.55	.91	.34	.91
Probability of conceiving in the first 21 days of the breeding season				
30 ^a	.37	.70	.25	.70
50	.47	.78	.33	.78
70	.58	.84	.43	.84
90	.67	.89	.54	.89

^a Probability that slope for days after calving equals zero is <.0001.

Pregnancy rates were surprisingly high despite average winter weight loss of as much as 26% of cow weight for one combination of treatments during the third year.

Based on the information in Table 7, pregnancy rates were greater than 90% if early calving cows were a condition score 3 or greater in June. Condition in March and May was less closely related to pregnancy rate. However, if cows calved late in the calving season, they needed to be one condition score higher in June to have the same probability of being pregnant. Condition in May, 30 days prior to the breeding season, was more closely related to pregnancy rate for later calvers. Having cows in condition score 3 or less in May and June was much more detrimental to pregnancy rate for cows calving late in the calving season.

Although early calving cows have a higher probability of becoming pregnant even if thin (CS 3 or less), a more detrimental effect is the reduced probability of cycling prior to the beginning of the breeding season (Table 5) and conceiving in the first 21 days of the breeding season (Table 7). There was no interaction between condition score prior to calving with condition score in May or June for day of conception. This indicates that we would expect the same effect of condition score in May or June regardless of how fleshy the cows were at calving time.

It has been suggested that thinner cows may have higher conception rates to a single service than fleshy cows. Results in Table 8 indicate that conception rates of those artificially inseminated was actually lower for thin cows. When calculated as a percentage of cows conceiving during the 25-day artificial insemination of all cows in the herd, conception rates were much lower for thin cows. It should be noted that very few cows could be considered fat (condition score 7 or greater) in May or June. This would indicate that for cows to be too fleshy to allow high conception rates they would need to be a condition score 7 or greater.

In summary, cows that are fleshier at calving and prior to the breeding season cycle sooner after calving and are more likely to conceive early in the breeding season. For cows that calve later in the calving season, a condition score of less than 4 at the beginning of the breeding season and less than 3 at 30 days prior to the breeding season resulted in pregnancy rates less than 90% during a 60-day breeding season.

TABLE 7. EFFECT OF CONDITION SCORE AND CALVING DATE ON SUBSEQUENT REPRODUCTIVE PERFORMANCE BASED ON PREDICTION EQUATIONS

March			May			June		
condition	Early	Late	condition	Early	Late	condition	Early	Late
score	calvers	calvers	score	calvers	calvers	score	calvers	calvers
Probability of pregnancy during 60-day breeding season								
1			1	.89	.53 ^a	1		
2			2	.93	.75	2	.81 ^b	.60 ^a
3	.88		3	.95	.89	3	.91	.80
4	.93	.88	4	.97	.96	4	.96	.91
5	.96	.93	5	.98	.98	5	.98	.97
6	.98	.96	6	.99	.99	6	.99	.99
7	.99	.97	7	.99	1.00	7	1.00	.99
8	.99	.99	8			8		
Probability of conceiving in the first 21 days of the breeding season								
1			1	.46 ^a	.13 ^a	1		
2			2	.54	.24	2	.29 ^a	.23 ^a
3	.51 ^b		3	.61	.40	3	.44	.36
4	.58	.41 ^a	4	.69	.59	4	.60	.50
5	.65	.56	5	.75	.75	5	.75	.65
6	.72	.70	6	.81	.87	6	.85	.77
7	.77	.81	7	.85	.93	7	.92	.86
8	.82	.89	8			8		
Day of conception (Julian date)								
1			1	184.7 ^a	198.5 ^a	1		
2			2	181.8	192.8	2	187.6 ^a	195.7 ^a
3	187.1 ^b		3	178.9	187.1	3	183.1	190.2
4	182.6	188.5 ^a	4	176.0	181.4	4	178.6	184.6
5	178.1	182.5	5	173.0	175.7	5	174.1	179.0
6	173.6	176.6	6	170.1	170.0	6	169.6	173.4
7	169.2	170.7	7	167.2	164.3	7	165.1	167.8
8	164.7	164.7	8			8		

^a Probability that slope is equal to zero <.05.

^b Probability that slope is equal to zero <.10.

TABLE 8. COWS CONCEIVING TO ARTIFICIAL INSEMINATION, 1987

	May condition score			June condition score	
	1,2,3	4	5,6,7	2,3,4	5,6,7
	No. cows	46	31	28	71
No. cows inseminated	25	24	22	41	30
Conception to AI of cows inseminated, %	68.0	70.8	77.3	63.4 ^c	83.3 ^d
Cows conceiving to AI of all cows, %	37.0 ^c	54.8 ^d	60.7 ^d	36.6 ^a	73.5 ^b

a,b Within month means in a row without common superscripts differ (P<.05).

c,d Within month means in a row without common superscripts differ (P<.10).

Cows that calved early in the calving season could be thinner than late calvers for the same level of reproductive performance. This points out the importance of managing yearling heifers to have a high percentage calving earlier in the calving season as 2-year-olds to insure a high likelihood of pregnancy in subsequent years. For cows that calve early in the calving season, the detrimental effect of delayed conception would result in lower pregnancy rates if thin for two or more years in a row.

The minimum body condition recommended from this study would depend on the level of performance expected. To achieve a goal of approximately 95% pregnancy rate and 60% conceiving in the first 21 days of the breeding season would require a minimum condition score of 4 at the beginning of the breeding season for cows calving early in the calving season and 5 for late calvers. To ensure that the thinnest cows are a condition score 4, it would be appropriate to have a goal of 5 for a herd average. In this study where abundant forage was available for 30 days prior to and during the breeding season, cows could be 1 condition score less 30 days prior to the breeding season, making a herd average of condition score 4 an appropriate goal at that time. In situations where such weight gain is not possible, a goal of 5 at 30 days prior to the breeding season would be advisable.

The higher pregnancy rate of early calving cows at any body condition points out the importance of managing to have a high percentage of young cows calve early. In years when cows are thinner than planned due to drought or extreme winter weather, relatively high pregnancy rate can still be obtained without lengthening the breeding season if a high percentage of cows are calving early in the calving season.