Managing for Profit: Nutritional Priorities   Cow Age and Body Condition

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Introduction

The Standard Performance Analysis (SPA) data generated by the NCA for the past year indicates that Florida is, on average, a low cow-maintenance-cost state. Cattlemen in Florida are spending on average $250 per cow per year to maintain a cow and produce marketable calves. The national average is $340. National statistics are also available for the feed costs per cow per year, $185 (55% of maintenance costs), and the national calf crop percentage, 84% [(weaned calves/exposed females) * 100]. Unfortunately, Florida data is not as readily available for feed costs per cow or calving percentage. However, the calf crop percentage for Florida is probably between 72 and 82%. Are we getting the most out of the Florida cow? Are we feeding her to perform to her potential? Is it economical? This paper will not provide all the answers but may provide food for thought.

Optimal calf production is dependent on high reproductive efficiency in beef cattle. Inadequate nutrient intake, namely energy and/or protein, lowers the pregnancy rate and reduces the first service conception rate by prolonging the interval from calving to the first postpartum estrus (Short). Protein and energy deficiencies appear to affect hormonal release, producing a less fertile ovarian environment than is found in cattle that are maintained at adequate nutritional levels (Rutter; Rasby).

The nutritional state of the cow can be appraised by scoring the body condition (Herd; Spitzer; Richards). The body condition score (BCS) is a subjective measure of nutrient reserves; it is a simple, functional indicator closely associated with the body composition of mature slaughtered cows.As with nutritional studies, female body condition has been related to certain reproductive parameters such as the postpartum return to estrus, services per conception, pregnancy rate, and calving interval (Wiltbank, 1961; Wiltbank, 1964; Kunkle; Dunn; Rakestraw). It has been shown that cows that maintained optimal body condition after parturition, regardless of the calculated nutrient requirements, had enhanced pituitary function and reproductive performance compared with cows that lost body condition (Rutter).

We have asked questions about nutritional priorities of Florida cattle and in a series of trials have tried to answer some of them.

Trial 1: *What is the relationship of parity (age) and body condition score to pregnancy rates in Florida beef cattle?* (Rae).

Data were collected over a 2 year period from 8 commercial beef herds in Florida. Data at a south-central Florida ranch were collected on 4 herds in 1989 (Herds 1,2,3, and 4) and on 3 herds in 1990 (Herds 2,5, and 6). Herd 2 was included in both years; data for each year for Herd 2 were pooled to estimate variables. Data for Herds 7 and 8 were collected in 1990 on ranches located in north-central Florida. Although breed composition in all the herds was diverse, all 4114 cows in the study were indigenous crossbred cattle.

Breeding management regimens varied at the various ranches with regard to the length of the breeding season, time of year, and bull-to-cow ratio. Herds 1 through 6 had a 150-day breeding season (January 1 to May 31) and a 1:20 bull-to-cow ratio. Herd 7 had a 120-day breeding season (April 15 to August 15) and a 1:60 bull-to-cow ratio. Herd 8 had a 120-day breeding season (April 1 to August 1) and a 1:25 bull-to-cow ratio. Heifers from Herds 1 through 6 were bred to first calve at 36 months of age; heifers in Herds 7 and 8 were bred to calve first at 24 months of age.

Examination for pregnancy diagnosis was performed at 60 to 100 days, following bull removal. Because of herd differences relative to age at first exposure to a bull, an estimate of parity was employed to facilitate comparison among herds. Parity of individual animals was calculated by subtracting age of the cow at the first exposure to a bull (for the herd) from age of the cow at the time of pregnancy examination; thus, a 3-year-old cow, which was first exposed to a bull at age 1, was classified as Parity 2; a 3-year-old cow which was first exposed to a bull at age 2 was classified as Parity 1. Summary of herds (Table 1).

What did we find?

1) The BCS by pregnancy rate demonstrated a consistent and significant pattern across the 8 herds; the pregnancy rate improved with increasing cow body condition score, Table 1.
2) Cows in parities 4 to 7 had the highest pregnancy rate. These cows are presumed to be the most productive of the herd. Annual selection and culling practices resulted in a population of the most healthy, fertile cows, Table 2.
3) Pregnancy rate increased with increasing BCS category in all parity groups, but the effect of a low BCS on the pregnancy rate appeared most distinct in young cows, Table 2.
4) Heifers which calved at 24 months of age had a high demand placed on their body reserves for postpartum involution, for continued growth, and for lactation.

Trial 2: *What is the relationship of age, body condition score, pregnancy rate and* *__time-to-conception__* *in Florida beef cattle?* (Rae, unpublished).

Data were gathered at pregnancy examination for 4 cow-calf operations (6 herds) in north-central Florida in 1991. A summary of herd descriptive variables is shown in Table 3. Each herd had a late winter calving season, early to mid-spring breeding season, breeding season length from 67 to 120 days, natural breeding exclusively (except herd 1, which utilized estrus synchronization and artificial insemination during the first 30 days of breeding), and an annual herd pregnancy examination at calf weaning between August and November. Heifers were bred to calve first at 24 months of age in each of the herds. Animals were identified by ear tag and/or fire branded number.

At pregnancy examination, information was collected for each cow, including: year born, body condition score, pregnancy status, and pregnancy duration. The data set included only cows between 1 and 5 years of age, inclusive, and between 3 and 6 in body condition score, inclusive. Age and body condition score extremes were eliminated. Records of 1303 cows were analyzed, Table 3.

What did we find?

1) Body condition score by pregnancy rate showed a consistent and significant pattern of increasing pregnancy rate with increasing body condition, Table 4.
2) Pregnancy rate was lowest in yearling heifers, Table 4.
3) Across age groups, cows that became pregnant did not differ greatly in the time required in the breeding season to become pregnant, Table 4.
4) Across body condition scores, cows that became pregnant took longer, when in poorer body condition (i.e., 3), to become pregnant in the breeding season, Table 4.

5) Breed-type may have influenced time to conception, Table 3.
6) Estrus synchronization and artificial insemination may reduce time to conception in cows in good body condition, Table 3.

Trial 3: *What is the influence of change in body condition score, spring to fall, on pregnancy rates in Florida beef cattle?* (Rae, unpublished).

Data were collected in 1992 from 461 beef cows (4 breeds) in 3 herds at a central Florida cattle operation. The three herd groups were composed of Angus (171 head), Brahman (130 head), and Hereford/Senepol cattle (71 and 89 head, respectively). Each cow was individually identified and year of birth recorded. The cows were maintained on improved, native pastures during the spring and summer. The cows were exposed to bulls in mid to late March, with breeding management as follows:

- Angus exposed from March 30 to June 26, an 88-day breeding season;
- Brahman exposed from March 25 to July 17, a 119-day breeding season; and
- Hereford/Senepol exposed from March 20 to June 19, a 91-day breeding season.

Examination for pregnancy diagnosis was performed at 60 to 81 days following bull removal. At pregnancy examination, information collected for each cow included: fall, body condition score (BCF), lactation, and pregnancy status. Lactation status was determined by visual and manual assessment of udder fill and milk presence. The difference in body condition score was the gain (+) or loss (-) of body condition from spring to fall. Summary of herd is provided in Table 5.

What did we find?

1) Cows maintaining or increasing BCS from spring to fall have improved pregnancy rates, Tables 6 and 7.
2) Cows losing body condition during the spring have reduced pregnancy rates, Table 6 and 7.
3) Lactation appears to be the primary drain of cow body condition during the spring, Table 7.
4) Lactating cows gaining body condition have improved pregnancy rates, Table 7.

Priorities

The nutritional priorities for Florida cows include:

- young bred heifers and first calf heifers which continue to have demands for growth, for reproduction, and then lactation to support calf growth;
- cows losing body condition following calving, i.e., lactating cows; and
- older cows, probably suffering from tooth wear.

These are not new observations. Most cattlemen have observed these same results in their cattle. Our efforts have been to quantify these effects and establish or prioritize the nutritional needs of Florida beef cattle. What are the nutritional/feeding options? When and how should strategic nutritional management be implemented? What will it cost? These are questions left to other presenters and future short courses.

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Table 1. Summary of the study herds and least squares mean pregnancy rate by body condition score within herd.

				Pregnancy rate[d] by body condition score[b]			
Herd	n[a]	BCS[b]	Parity[c]	≤3	4	≥5	Overall[d]
1	364	4.6	3.7	20.4	47.5	93.5	79.7
2	1022	4.9	3.7	35.7	74.3	87.3	85.9
3	452	4.4	4.8	24.8	58.3	92.2	75.2
4	216	4.7	2.8	9.3	34.1	78.4	66.2
5	341	4.9	4.3	23.3	68.6	90.4	88.0
6	412	4.8	4.7	65.8	75.9	92.5	91.5
7	262	4.3	4.0	1.5	44.5	86.0	61.9
8	665	4.6	3.3	66.5	79.6	92.5	88.4
All	3734	4.7	3.9	30.9[x]	60.4[y]	89.1[z]	82.4
n(%)				222(5.9%)	722(19.3%)	2790(72.7%)	3734

[a] Number of observations per herd.
[b] Body condition score at pregnancy examination.
[c] Mean parity of the herd.
[d] Pregnancy rate (%).
[e] Herd 2 represents observations over 2 years; n_{89}=511, n_{90}=512.
[f] Number of observations in category and percentage of all observations.
[x,y,z] Values in rows with different superscripts differ ($P < 0.05$).

Table 2. Least squares mean pregnancy rate[a] by body condition score within parity

Parity[c]	Body condition score[b] ≤3	4	≥5	All	N(%)[d]
1	19.6	53.2	90.3	84.1[x]	806(22%)
2	27.8	50	84.2	70.8[y]	660(18%)
3	22.5	59.7	89.9	85.0[x]	534(14%)
4-7	47.5	71.6	92.2	86.7[x]	1537(41%)
≥8	37.1	67.3	89	74.1[y]	193(5%)

[a] Pregnancy rate.
[b] Body condition score at pregnancy examination.
[c] Parity categorization as an estimate of number of offspring.
[d] Number of observations in category and percentage of all observations.
[x,y] Values in a column with different superscripts differ ($P < 0.05$).

Table 3. Summary of 6 herds (4 cow-calf operations).

		Breeding season		Pregnancy exam status			
Herd Breed-type	n[a]	days	Methods (days)	BC[b]	Age[c]	PR[d]	TTC[e]
1 Angus X	202	69	AI(30)/natural(39)	5.0	2.6	86.1	25.4
2 Angus	110	90	Natural	5.0	3.8	80.9	40.9
3 Brahman	71	120	Natural	4.8	3.7	66.2	62.3
4 Hereford X	74	90	Natural	4.4	3.2	63.5	47.1
5 Beefmaster X	165	92	Natural	4.0	4.9	63.0	42.4
6 Crossbred	681	98	Natural	4.5	2.7	61.7	38.6
Average	217			3.1	3.1	67.6	38.4
Total	1303						

[a] Number of observations per herd.
[b] Body condition score at pregnancy examination.
[c] Mean age of the herd.
[d] Pregnancy rate (%) determined per rectal examination.
[e] Time-to-conception within the breeding season (days).

Table 4. Mean time-to-conception and pregnancy rate by age and body condition score.

	Pregnancy Rate *Mean (#[a])*	Time of Conception[c] *Mean (#[a])*
Age (years)		
1	42.9(252)[x]	40.0(108)[w]
2	78.3(217)[w]	34.4(170)[w]
3	70.6(337)[w]	39.1(237)[w]
4	79.0(124)[w]	40.8(99)[w]
5	71.7(374)[w]	39.2(268)[w]
Body Condition Score[b]		
3	33.3(120)[w]	54.6(40)[w]
4	62.6(449)[x]	42.9(280)[x]
5	73.6(583)[y]	35.0(429)[x]
6	86.8(152)[z]	36.0(133)[x]

[a] Number of animals.
[b] Body condition score; 1-9 system.
[c] Time-to-conception within the breeding season (days).
[w,x,y,z] Values in rows with different superscripts differ ($P < 0.05$).

Table 5. Summary of study herd.

n[a]	Age[b]	BCS[c]	BCF[d]	LAC[e]	PR[f]
461	4.9	4.6	5.1	68.2	81.0

[a] Number of observations per breed group.
[b] Age in years.
[c] Body condition score, spring, prebreeding examination.
[d] Body condition score, fall, postbreeding, pregnancy examination.
[e] Lactation rate (fall).
[f] Pregnancy rate (%) determined by per rectum examination.

Table 6. Pregnancy rate and sample size for beef cows by spring and fall body condition scores categorized as ≥ 5 and ≤ 4.

	Pregnancy rate		
	BCF ≤4[a]	BCF≥5	ALL
BCS[b] . . . . ≤4	66.4(137)[c]	89.6(106)	76.5(243)
. . . . ≥5	55.2(29)	90.6(192)	86.0(221)
ALL	64.4(166)	90.2(295)	81.0(461)

[a] Body condition score, fall, categorized as ≥ 5 or ≤ 4.
[b] Body condition score, spring, categorized as ≥ 5 or ≤ 4.
[c] Pregnancy rate and (number of observations per category).

Table 7. Pregnancy rate and sample size ( )[a] for beef cows by change in body condition score (spring to fall) and lactational state.

Body condition change spring to fall	Pregnancy rate		
	Means[b]	Non-Lactating[c]	Lactating[c]
Loss	60.0 (45)	63.6 (11)	58.8 (34)
No Change	75.1 (173)	94.4 (36)	70.1 (137)
Gained	89.0 (237)	92.8 (97)	86.4 (140)
Lactational state[d]			
Non-Lactating	91.0^{x} (144)		
Lactating	76.2^{y} (311)		

[a] Number of observations per breed group.
[b] Mean pregnancy rate by body condition score.
[c] Lactational state: lac = lactating, non-lac = non-lactating at fall examination.
[x,y] Means with common superscript letters (by variable) are similar (p>0.05).