Seasonal Weight Changes and Prepartum Weight:Height Ratio in Angus and Brahman Cows Grazing Common Bermudagrass or Endophyte-Infected Tall Fescue

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Story in Brief

Cow weights, hip heights, and reproductive data taken from 1986 to 1992 on 80 Angus (AN) and 80 Brahman (BR) cows grazing common bermudagrass (BG)or tall fescue (E+) were used to evaluate the effects of breed, forage environment, and production status on seasonal weight changes and prepartum body condition. Cows were managed as commercial females and supplemental feed was provided in both forage environments from late November to late April. Heifers were managed to calve as 3-yr olds to preclude parity differences between the breeds and were exposed to bulls during 75-d breeding seasons starting in late May/early June. Cow gains were computed for winter (October/November to February), spring (February to May/June), and summer (June to October) seasons prior to the subsequent calving season the next year. Weight:height ratios (lb/in) were computed from hip height data taken in February of each year of the study to estimate body condition prior to calving and breeding. Cows in each breed-forage subclass were classified into four groups based on all possible combinations of prior year and subsequent year calving data. There was a breed x forage interaction for spring ADG in both primiparous and multiparous cows ($P < 0.10$); BR and AN had similar ADG on E+ but BR had higher ADG on BG than AN ($P < 0.01$). There was a breed x forage interaction for summer ADG in both primiparous and multiparous cows ($P < 0.01$); BR and AN had similar ADG on BG but BR had higher ADG on E+ than AN ($P < 0.01$). These data indicate the best predictor of subsequent reproduction in spring-calving cows is summer weight change from late May/early June to late October/early November.

Introduction

Nutrition derived from forages by beef cows plays a major role in the efficiency of cow-calf production. In heifers, winter and spring gains prior to the first breeding season are associated with reproductive performance. Postpartum weight changes can have an additive effect on subsequent rebreeding performance in conjunction with body condition at calving. However, there is little information on the impact of breed and forage type on seasonal weight gains and prepartum body condition in reproductive beef females. Consequently, the objectives of this research were to evaluate the effects of breed, forage environment, and production status on seasonal weight changes and prepartum body condition in Angus (AN) and Brahman (BR) heifers and cows grazing common bermudagrass(BG) or endophyte-infected tall fescue(E+) pastures.

Experimental Procedures

Five years of data from approximately 80 Angus and 80 Brahman females born in the spring of 1985 were used in this study. In the winter of 1985 and early spring of 1986, heifers were stratified by source and breed and assigned at random to one of four 40-acre BG or one of four 40-acre E+ pastures. Stocking rate for each pasture within forage environment ranged from 19 to 24 females with approximately equal numbers of BR and AN. Normal fertilization procedures were followed throughout the study.

Prior to the first breeding season in 1987, heifers were managed to gain approximately 0.77 lb/d by supplementing with approximately 1.87 lb/d grain (cottonseed meal, chopped corn), and E+ or BG hay. Supplemental feed was provided from late November to late April to cows in both forages; supplemental grain (1.87 lb/d) was continued in the E+ pastures in the late fall and early spring in an attempt to moderate potential toxicity. Minerals were fed free choice throughout the year. Females were managed to calve first as 3-yr olds in both breeds and were bred during a 75-d breeding season starting in early June in 1987 and late May in 1988, 1989, 1990, and 1991. Four BR and four AN sires were rotated among breeding pastures in both forage treatments each year. Breed of sire was alternated in a breeding pasture to facilitate sire of calf identification. Cows were culled only on the basis of structural unsoundness and, infrequently, temperament until the fall of 1990. After pregnancy check in the fall of 1990, 18 AN and 11 BR cows were culled on the basis of reproductive performance or structural unsoundness.

Calves were born from late February to late May each year and were weighed and tagged at birth. A cow was credited with having a calf if she had a full-term calf, alive or dead. The exception to this was three AN cows from tall fescue and one BR cow from BG that were palpated as pregnant in the fall of 1990, culled subsequently, and credited with a full-term calf for the 1991 calf crop. The 25 cows palpated as open and culled in the fall of 1990 were counted as open for the 1991 calf crop. Cows remaining for the 1992 calf crop had at least one calf born from 1988 to 1991 and were exposed to four Beefmaster and four BR sires during the 1991 breeding season.

Cows in the study were weighed annually in late October or early November; February; and in late May or early June. Cow gains were computed for winter (October/November to February), spring (February to May/June), and summer (June to October) grazing seasons prior to the subsequent calving season. Weight:height ratios (lb/in) were computed from hip height data taken in February of each year of the study to estimate body condition (Klosterman et al., 1968) prior to calving and breeding. Thus, the gain and condition data corresponded to seasons prior to the subsequent calf crop. Dates for each season and calf crop are given in Table 1.

Cows in each breed-forage subclass were classified into groups based on prior year and subsequent year calving data. Class 1 cows were open during the winter, spring, and summer prior to the subject

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calf crop year and open for the subject calf crop year (1988 to 1992). Class 2 cows were open during the same seasons and calved during the subject calf crop year. Class 3 cows were pregnant during the winter and calved in the spring prior to the subject calf crop year and were open the subject calf crop year. Class 4 cows were pregnant during the winter and calved in the spring prior to the subject calf crop year and calved during the subject calf crop year. Because the first-calf heifers calving in 1988 did not contain Class 3 or 4 data, the 1988 calf crop (primiparous heifers) was analyzed separately from the 1989 through 1992 calf crops (multiparous cows).

Data were analyzed by methods of mixed model least squares. Linear models for winter, spring, and summer ADG and precalving condition for the 1988 calf crop included the fixed effects of breed, forage, class (Class 1 or 2) and appropriate interactions among these effects. Calf crop was added to the model (fixed effect) for the 1989 through 1992 data and was analyzed as a repeated measure with individual cow as the subject. Tests of hypothesis concerning breed, forage, class or interaction effects were done using t-tests and associated observed significance levels.

Results and Discussion

Winter ADG. Least-squares means and standard errors for winter ADG for each parity, class, breed, and forage are given in Table 2. In multiparous cows, there was of a breed x forage x class interaction (P = 0.12). Winter ADG was similar in cows that calved the next calf crop compared to cows that were open the next calf crop. Forage differences in winter ADG were higher in AN than BR cows (P < 0.01), with AN cows on E+ exceeding AN cows on BG by 0.72 lb/d (P < 0.01) and BR cows on E+ exceeding BR cows on BG by 0.51 lb/d (P < 0.01). In this study, winter gains were not significantly associated with whether a heifer or cow became pregnant in the subsequent breeding season, suggesting that management for moderate weight gains was acceptable with respect to reproduction. Additionally, winter ADG means in multiparous cows reflected the nutritional advantage of supplemented growing tall fescue over supplemented dormant BG in both AN and BR cows, but the advantage of E+ over BG was less in BR than AN cows.

Spring ADG. Least-squares means and standard errors for spring ADG for each parity, class, breed, and forage are given in Table 3. Angus heifers on E+ exceeded AN heifers on BG by 0.79 lb/d (P < 0.01) while BR heifers on E+ exceeded BR heifers on BG by 0.46 lb/d (P < 0.01). However, spring ADG was similar in heifers that calved in 1988 compared to those that were open in 1988 (P = 0.99). In multiparous cows, class differences depended on breed (P < 0.05). There was no difference in spring ADG between Classes 1 and 2 in either AN or BR cows averaged over forage (P = 0.51 and P = 0.32, respectively). Cows that were open during the winter and spring gained similarly, whether they calved the subsequent year, or not. However, spring ADG in Class 3 cows differed (P < 0.01) from that of Class 4 AN cows. Essentially, AN cows in Class 4 lost less weight in the spring compared to AN cows in Class 3. Spring gains in open heifers or cows did not appear to influence reproduction, but AN cows that calved in the spring and calved the next year either lost less weight during calving and/or managed to recover a higher proportion of weight after calving compared to contemporaries that calved in the spring but did not rebreed. A similar response was not found in BR multiparous cows, but it is possible that the lower birth weights in BR cows (Brown et al., 2000) may have an influence on subsequent recovery and reproduction. In this study, spring ADG means in primiparous and multiparous cows reflected both the more moderate spring weather and the tolerance of the BR to E+ toxicity (Brown et al., 2000) with gains of AN and BR similar on tall fescue.

Summer ADG. Least-squares means and standard errors for summer ADG for each parity, class, breed, and forage are given in Table 4. A breed x forage interaction in summer ADG was evident (P < 0.05) for primiparous heifers. Primiparous AN and BR heifers gained similarly on BG during the summer, but BR heifers on E+ had higher ADG than AN heifers on E+ (0.66 vs 0.42 lb/d, P < 0.01). There was also a class difference in summer ADG; heifers calving in 1988 had higher ADG during the breeding season than heifers open in 1988 (0.83 vs 0.60 lb/d, P < 0.01). There was a breed x forage interaction in multiparous cows (P < 0.01). Summer ADG was similar in AN and BR cows on BG while summer ADG was higher in Brahman cows on E+ compared to AN cows on E+ (0.35 vs 0.07 lb/d, P < 0.01). There was no difference in summer ADG between Class 1 and Class 2 cows suggesting summer ADG had little impact on subsequent pregnancy when the cows did not calve the previous spring. However, there was a difference in summer ADG between Class 3 and Class 4 cows (0.17 vs 0.37 lb/d, P < 0.01). Thus, summer ADG during the breeding season was a useful indicator of subsequent reproduction in primiparous heifers and in cows that had calved the previous spring, but not in cows that had not calved. These data indicate that the best predictor of subsequent reproduction in spring-calving cows is summer weight change from late May/early June to late October/early November.

Prepartum Weight:height Ratio. Least-squares means and standard errors for prepartum weight:height ratio for each parity, class, breed, and forage are given in Table 5. There was a breed x forage x class interaction in primiparous heifers with a class difference in BR heifers on BG (P < 0.05) but no class differences in other breed x forage means. Weight:height ratios in AN heifers were similar on BG and E+ (P = 0.54) while weight:height ratios of BR heifers on BG were larger than those of BR heifers on E+ (2.59 vs 2.15, P < 0.01). Class differences in condition were evident with open cows (Classes 1 and 2) having lower weight:height ratios than pregnant cows (Classes 3 and 4) (3.1 vs 3.35, P < 0.01, data not shown). Weight height:ratios in AN cows were similar on BG and E+ (P = 0.27) while weight:height ratios of BR cows on BG were larger than BR cows on E+ (3.02 vs 2.86, P < 0.05).

Implications

Cow-calf management systems should be designed to take advantage of prior knowledge of breed characteristics, reproductive status, body condition and body weight changes resultant from forage growth and quality during each season of the year. Forage growth and quality will partly determine the season to make body condition and body weight changes in spring-calving cows. This is especially true in the upper-mid south where production systems often involve bermudagrass and endophyte-infected fescue pastures.

Literature Cited

Brown, M.A., et al., 2000. J. Anim. Sci. 78: 546-551.
Klosterman, E.W., et al. 1968. J. Anim. Sci. 27:242-246.

Table 1. Dates associated with winter, spring, and summer ADG for calf crops 1988 through 1992.

	Season		
Calf Crop Year	Winter	Spring	Summer
1988	11/4/1986-2/24/1987	2/24/1987-5/19/1987	5/19/1987-11/3/1987
1989	11/3/1987-2/22/1988	2/22/1988-6/1/1988	6/1/1988-10/25/1988
1990	10/25/1988-2/21/1989	2/21/1989-6/14/1989	6/14/1989-10/24/1989
1991	10/24/1989-2/13/1990	2/13/1990-6/6/1990	6/6/1990-10/28/1990
1992	10/28/1990-2/7/1991	2/7/1991-5/16/1991	5/16/1991-10/30/1991

Table 2. Winter ADG for Angus and Brahman heifers and cows on common bermudagrass and E+ tall fescue (lb/d).

		Angus			Brahman		
Parity[a]	Class[b]	Bermuda	Fescue	Avg.	Bermuda	Fescue	Avg.
Primiparous	1	0.62 ± 0.11	0.84 ± 0.13	0.73 ± 0.09	0.26 ± 0.22	0.37 ± 0.09	0.33± 0.13
	2	0.64 ± 0.05	0.90 ± 0.05	0.77 ± 0.03	0.15 ± 0.05	0.35 ± 0.05	0.26 ± 0.03
	Avg	0.63 ± 0.05	0.88 ± 0.07	0.75 ± 0.05[w]	0.22 ± 0.11	0.36 ± 0.05	0.28 ± 0.07[x]
	B vs F	P < 0.01			P = 0.22		
Multiparous	1	-0.07 ± 0.26	0.95 ± 0.15	0.44 ± 0.15	-0.11 ± 0.17	0.38 ± 0.24	0.13 ± 0.15
	2	0.15 ± 0.09	1.08 ± 0.11	0.62 ± 0.07	-0.17 ± 0.11	0.37 ± 0.11	0.09 ± 0.09
	3	0.66 ± 0.07[o]	0.99 ± 0.07	0.81 ± 0.05	0.05 ± 0.09	0.53 ± 0.09	0.29 ± 0.07
	4	0.48 ± 0.05[p]	1.12 ± 0.05	0.81 ± 0.03	0.07 ± 0.05	0.53 ± 0.05	0.31 ± 0.03
	Avg	0.31 ± 0.07	1.03 ± 0.05	0.68 ± 0.05[w]	-0.05 ± 0.07	0.46 ± 0.07	0.20 ± 0.05[x]
	B vs F	P < 0.01			P < 0.01		

[a] Primiparous=2-yr-old first calf heifers bred in 1987 to calve in 1988; Multiparous=3-yr-old and older bred 1988-1991.
[b] 1=open winter, spring, summer; open post-breeding season; 2=open winter, spring, summer; calved next year
3=pregnant winter, calved spring; open post-breeding season; 4=pregnant winter, calved spring; calved next year
[w,x] Means in the same row with different superscripts differ (P < 0.01)
[o,p] Means in the same column with different superscripts differ (P < 0.01)

Table 3. Spring ADG for Angus and Brahman heifers and cows on common bermudagrass and E+ tall fescue (lb/d).

		Angus			Brahman		
Parity[a]	Class[b]	Bermuda	Fescue	Avg.	Bermuda	Fescue	Avg.
Primiparous	1	0.28 ± 0.13	1.06 ± 0.15	0.68 ± 0.11	0.48 ± 0.26	0.84 ± 0.09	0.66 ± 0.15
	2	0.20 ± 0.05	1.01 ± 0.05	0.59 ± 0.03	0.44 ± 0.05	1.03 ± 0.05	0.73 ± 0.05
	Avg	0.24 ± 0.07	1.03 ± 0.09	0.64 ± 0.05	0.46 ± 0.13	0.92 ± 0.07	0.70 ± 0.07
	B vs F	P < 0.01			P < 0.01		
Multiparous	1	0.59 ± 0.35	0.66 ± 0.20	0.64 ± 0.20	0.33 ± 0.24	0.37 ± 0.33	0.35 ± 0.20
	2	0.09 ± 0.13	0.86 ± 0.15	0.48 ± 0.11	0.31± 0.15	0.86 ± 0.15	0.57 ± 0.11
	3	-1.78 ± 0.09[o]	-0.75 ± 0.09	-1.25 ± 0.07[o]	-0.97 ± 0.011	-0.68 ± 0.011	-0.81 ± 0.07
	4	-1.41 ± 0.05[p]	-0.55 ± 0.07	-0.99 ± 0.05[p]	-1.06± 0.07	-0.59 ± 0.07	-0.81 ± 0.05
	Avg	-0.62 ± 0.11	0.07 ± 0.07	-0.29 ± 0.07	-0.35 ± 0.07	-0.00 ± 0.09	-0.18 ± 0.07
	B vs F	P < 0.01			P < 0.01		

[a] Primiparous=2-yr-old first calf heifers bred in 1987 to calve in 1988; Multiparous=3-yr-old and older bred 1988-1991.
[b] 1=open winter, spring, summer; open post-breeding season; 2=open winter, spring, summer; calved next year
3=pregnant winter, calved spring; open post-breeding season; 4=pregnant winter, calved spring; calved next year
[o,p] Means in the same column with different superscripts differ (P < 0.01)

Table 4. Summer ADG for Angus and Brahman heifers and cows on common bermudagrass and E+ tall fescue (lb/d).

		Angus			Brahman		
Parity[a]	Class[b]	Bermuda	Fescue	Avg.	Bermuda	Fescue	Avg.
Primiparous	1	0.86 ± 0.09	0.29 ± 0.11[q]	0.57 ± 0.07[q]	0.57 ± 0.15	0.51 ± 0.07[o]	0.64 ± 0.09[o]
	2	0.95 ± 0.05	0.56 ± 0.05[r]	0.75 ± 0.03[r]	0.99 ± 0.03	0.81± 0.05[p]	0.90 ± 0.03[p]
	Avg	0.90± 0.05	0.42 ± 0.07	0.66 ± 0.05[y]	0.88 ± 0.07	0.66 ± 0.05	0.77 ± 0.05[z]
	B vs F	P < 0.01			P < 0.05		
Multiparous	1	1.36 ± 0.24	0.44 ± 0.15	0.90 ± 0.15	1.12 ± 0.15	0.73 ± 0.20	0.90 ± 0.13
	2	1.30 ± 0.09	0.40 ± 0.11	0.84 ± 0.07	1.21 ± 0.011	0.81 ± 0.09	1.01 ± 0.07
	3	0.59 ± 0.07[q]	-0.37 ± 0.07[q]	0.11 ± 0.05[o]	0.57 ± 0.07[q]	-0.09 ± 0.09[s]	0.24 ± 0.05[o]
	4	0.77 ± 0.05[r]	-0.15 ± 0.05[r]	0.31 ± 0.03[p]	0.36 ± 0.05[r]	0.79 ± 0.07[t]	0.42 ± 0.03[p]
	Avg	1.01 ± 0.07	0.07 ± 0.05	0.55 ± 0.05[y]	0.92 ± 0.05	0.35 ± 0.07	0.64 ± 0.05[z]
	B vs F	P < 0.01			P < 0.01		

[a] Primiparous=2-yr-old first calf heifers bred in 1987 to calve in 1988; Multiparous=3-yr-old and older bred 1988-1991.
[b] 1=open winter, spring, summer; open post-breeding season; 2=open winter, spring, summer; calved next year
3=pregnant winter, calved spring; open post-breeding season; 4=pregnant winter, calved spring; calved next year
[y,z] Means in the same row with different superscripts differ (P < 0.10)
[o,p] Means in the same column with different superscripts differ (P < 0.01);
[q,r] Means in the same column with different superscripts differ (P < 0.05)
[s,t] Means in the same column with different superscripts differ (P < 0.10)

Table 5. Precalving weight:height ratios for Angus and Brahman heifers and cows on common bermudagrass and E+ tall fescue (lb/in).

		Angus			Brahman		
Parity[a]	Class[b]	Bermuda	Fescue	Avg.	Bermuda	Fescue	Avg.
Primiparous	1	2.58 ± 0.09	2.61 ± 0.13	2.60 ± 0.08	2.84 ± 0.22[q]	2.13 ± 0.08	2.49 ± 0.11[s]
	2	2.74 ± 0.03	2.61 ± 0.03	2.68 ± 0.02	2.35± 0.03r	2.17 ± 0.04	2.26 ± 0.02[t]
	Avg	2.66 ± 0.05	2.61 ± 0.07	2.64± 0.04[u]	2.59 ± 0.11	2.15 ± 0.04	2.37 ± 0.06[v]
	B vs F				P < 0.01		
Multiparous	1	3.12 ± 0.19	3.49 ± 0.11	3.31 ± 0.11	3.02 ± 0.13	2.61 ± 0.17	2.81 ± 0.11
	2	3.36 ± 0.07	3.54 ± 0.08	3.45 ± 0.05	2.93 ± 0.09	2.76 ± 0.09	2.85 ± 0.06
	3	3.79 ± 0.05[q]	3.59 ± 0.05	3.69 ± 0.03	3.01 ± 0.06[s]	3.04 ± 0.06	3.03 ± 0.04
	4	3.65 ± 0.02[r]	3.59 ± 0.03	3.62 ± 0.02	3.13 ± 0.02[t]	3.02 ± 0.03	3.07 ± 0.02
	Avg	3.48 ± 0.05	3.55 ± 0.03	3.52 ± 0.03[u]	3.02 ± 0.04	2.86 ± 0.05	2.95 ± 0.03[v]
	B vs F				P < 0.05		

[a] Primiparous=2-yr-old first calf heifers bred in 1987 to calve in 1988; Multiparous=3-yr-old and older bred 1988-1991.
[b] 1=open winter, spring, summer; open post-breeding season; 2=open winter, spring, summer; calved next year
3=pregnant winter, calved spring; open post-breeding season; 4=pregnant winter, calved spring; calved next year
[u,v] Means in the same row with different superscripts differ (P < 0.01)
[q,r] Means in the same column with different superscripts differ (P < 0.05)
[s,t] Means in the same column with different superscripts differ (P < 0.10).