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The Effects of Mating and Management Systems On Beef Production  
Angus-Charolais Crossbreeding Project

Progress Report

W. R. Parker and C. A. Dinkel

Angus and Charolais heifers purchased in 1968 as weaning calves were used to initiate a crossbreeding project at Brookings. In phase I of this project these heifers were mated by artificial insemination to either an Angus or Charolais bull to produce straightbred Angus, straightbred Charolais, Angus x Charolais and Charolais x Angus calves. (Crosses are denoted in this report with breed of sire listed first.) Three such calf crops have been produced. The heifers from these three calf crops are being used in phase II of the project which consists of a long-term comparison of straightbred and crossbred cows in two environments, pasture and drylot. Individual feed consumption from weaning through the duration of the project is being obtained on heifers assigned to the drylot portion of the study. In addition, individual feed consumption from weaning to slaughter will be measured on all offspring from phase II drylot cows.

The 1969 and 1970 Beef Cattle Field Day bulletins contain previous progress reports of this project. This report contains information obtained since the writing of the 1970 bulletin as well as summarizes the traits in phase I where data are complete.

Actual and age adjusted fall weights of 1970 and 1971 bull calves from phase I cows are given in table 1. In 1970 and 1971 cows with bull calves and cows with heifer calves were separated shortly after the calving season ended and were managed separately for the rest of the summer. Therefore, comparisons of weights of bull calves in table 1 should not be made with weights of heifer calves in tables 3 and 4. The low weights in 1971 can be partially explained by the young age of calves at the time weights were taken, 197 days for 1970 calves and 122 days for 1971 calves.

The 1970 steer calves were fed to slaughter in a private feedlot. Growth and carcass characteristics are presented in table 2.

Actual and age adjusted weaning and yearling weights of 1970 heifer calves are presented in table 3 and actual and adjusted weaning weights of 1971 heifer calves in table 4.

A three year summary of first service conception rates of phase I cows is presented in table 5. It must be emphasized that only one Angus sire and only one Charolais sire were used in phase I. Therefore, sire differences in conception rates are differences between these two bulls and cannot be considered as breed differences.

Birth weights, gestation lengths and calving difficulty scores for male and female calves are summarized for the three years of phase I of the project in table 6. Cows giving birth to Charolais-sired calves had higher calving difficulty scores than

cows giving birth to Angus-sired calves. However, since only one Angus sire and only one Charolais sire were used, these differences must be looked upon as sire differences and not breed differences. Cows giving birth to male calves had higher calving difficulty scores than cows giving birth to heifer calves. This was associated with heavier birth weights and longer gestation intervals for male calves. These calving difficulty scores and their distribution are summarized in table 7 by mating group and age of cow. Two-year-old cows had considerably greater calving difficulty than three- and four-year-old cows.

The first crop of phase II heifers was born in 1970, bred in 1971 and calved as two-year-olds in 1972. This is the first opportunity in this project to compare the performance of straightbred and crossbred cows.

Measures of individual feed consumption are being obtained on all drylot phase II heifers starting at weaning. The weight gains and feed efficiencies of the 1970 and 1971 drylot heifers are presented in tables 8 and 9, respectively. These heifers were fed a growing ration consisting primarily of sun-cured alfalfa pellets during this period. Data are presented on the 1970 heifers from weaning through November of the following year. However, data on the 1971 heifers are available only through June, 1972. These feed efficiency data will be more meaningful in later years of the project as we are able to relate feed efficiency information to the cow's production.

Age and weight at puberty (first standing estrus) of the 1970 heifers are summarized in table 10. The yearling conception rates of these heifers are given in table 11. Heifers were divided into drylot and pasture groups prior to initiation of the breeding season. All heifers were bred artificially to the same Polled Hereford bull; therefore, differences in conception rates should reflect differences in breed groups of cows. The higher first service conception rates of the straightbred cows over the crossbred cows are not in agreement with other studies.

Average birth weights and calving difficulty scores for these two-year-old, phase II heifers are given in table 12. Note that crossbred heifers had less calving difficulty than straightbred heifers.

This project will continue for another 6 or 7 years and further characterization of the straightbred and crossbred cow will be accomplished. In addition, the performance of the large cow versus the small cow in the economy of beef production will be evaluated.

Table 1. Actual and Adjusted Weights of 1970 and 1971 Bull Calves  
Out of Phase I Cows<sup>a</sup>

Year	Breed group	Number	Actual fall weight (lb.) <sup>b</sup>	Adjusted weight (lb.) <sup>c</sup>
1970	AA	18	325	392
	AC	16	348	427
	CA	10	370	442
	CC	9	350	432
	Total	53	345	419
1971	AA	19	254	367
	AC	14	310	425
	CA	24	277	410
	CC	14	260	415
	Total	71	332	403

<sup>a</sup> Weights of bull calves should not be compared to weights of heifer calves of the same year since they were raised in different environments.

<sup>b</sup> Average age when weights were taken was 197 days for 1970 calves and 122 days for 1971 calves.

<sup>c</sup> Adjusted to 205 days of age.

Table 2. Growth and Carcass Characteristics of 1970 Steer Calves<sup>a</sup>

Breed group	No. <sup>b</sup>	Init. wt. (lb.)	Final wt. (lb.)	Rate of gain (lb.)	Carc. grade <sup>c</sup>	Dress- ing %	Rib- eye area (sq. in.)	Fat thick- ness (in.)	Kidney fat (%)	Marb- ling <sup>e</sup>	Yield grade	Conf. <sup>f</sup>	Cuta- bility (%)
AA	12	324	878	2.00	17.7	61.0	12.0	0.49	3.3	4.2	2.7	23.0	50.5
AC	14	355	955	2.17	17.1	60.8	12.2	0.31	3.2	4.1	2.3	22.5	51.3
CA	7	361	961	2.18	18.1	60.9	13.6	0.22	3.3	4.3	1.6	22.7	52.3
CC	6	349	1033	2.48	17.0	61.2	14.6	0.17	3.2	3.8	1.2	22.3	53.2
Overall	39	346	944	2.17	17.5	60.9	12.8	0.32	3.2	4.1	2.1	22.7	51.6

<sup>a</sup> Fed out in private feedlot.

<sup>b</sup> Does not include 5 AA, 2 AC, 3 CC, and 2 CA steers because of loss of identification.

<sup>c</sup> 17 = Good, 18 = High Good.

<sup>d</sup> Measured between 12th and 13th ribs.

<sup>e</sup> 1 = devoid, 12 = extremely abundant.

<sup>f</sup> 22 = low prime, 23 = prime.

Table 3. Actual and Adjusted Weaning and Yearling Weights of 1970 Heifer Calves<sup>a</sup>

Breed group	No.	Actual weaning weight (lb.)	Adjusted weaning weight (lb.) <sup>b</sup>	Actual yearling weight (lb.)	Adjusted yearling weight (lb.) <sup>c</sup>
AA	21	337	409	612	661
AC	20	347	437	637	699
CA	14	364	450	678	733
CC	10	369	463	689 <sup>d</sup>	752 <sup>d</sup>
Total	65	348	435	645 <sup>e</sup>	701 <sup>e</sup>

<sup>a</sup> Weights of heifer calves should not be compared to weights of bull calves since they were raised in different environments.

<sup>b</sup> Adjusted to 205 days of age.

<sup>c</sup> (Daily gain from weaning x 160) + adjusted weaning weight.

<sup>d</sup> Only 9 heifers included, one heifer died of pneumonia.

<sup>e</sup> Only 64 heifers included.

Table 4. Actual and Adjusted Weaning Weights of 1971 Heifer Calves<sup>a</sup>

Breed group	No.	Actual weaning weight (lb.)	163 day adjusted weight (lb.) <sup>b</sup>	205 day adjusted weight (lb.)
AA	16	321	313	371
AC	9	328	339	408
CA	18 <sup>c</sup>	324	328	392
CC	16	344	339	407
Total	59	329	329	393

<sup>a</sup> Weights of heifer calves should not be compared to weights of bull calves since they were raised in different environments.

<sup>b</sup> Average age of all heifer calves at weaning was 163 days.

<sup>c</sup> Does not include one double muscled heifer.

Table 5. Three Year Summary of First Service Conception Rates of Phase I Cows

Mating Sire x Dam	Percent Conceived at First Service <sup>a,b</sup>			Three year average
	1969	1970	1971	
A x A	67	63	61	64
A x C	53	61	63	58
C x A	51	49	48	49
C x C	30	29	61	38

<sup>a</sup> Cows bred first in 1969 as yearlings.

<sup>b</sup> 1971 conception rates are based on pregnancy examination with cows assumed to have conceived at the last breeding.

Table 6. Three Year Summary of Birth Weight, Gestation Length and Calving Difficulty Scores for Male and Female Calves From Phase I Cows

Mating Sire Dam	Sex of calf	No.	Birth weight (lb.)	Gestation length (days)	Difficulty score <sup>a</sup>
A x A	Male	52	64	281	1.3
	Female	50	59	280	1.1
A x C <sup>b</sup>	Male	43	75	283	1.2
	Female	47	72	280	1.1
C x A	Male	55	80	285	1.6
	Female	52	75	283	1.5
C x C <sup>c</sup>	Male	45	90	287	1.5
	Female	38	81	286	1.5

<sup>a</sup> Scored as 1, no difficulty; 2, slight difficulty; 3, difficult; 4, extremely difficult.

<sup>b</sup> Does not include four sets of twins.

<sup>c</sup> Does not include one set of twins, one calf aborted at 186 days after breeding and one calf born premature at 255 days gestation.

Table 7. Average Calving Difficulty Scores and Calving Difficulty Score Distribution for Phase I Cows Summarized Over Three Years

Mating Sire Dam		Age of cow (years)	No. calves born	Avg. score <sup>a</sup>	Difficulty score distribution <sup>a</sup>			
					1	2	3	4
					Number of cows			
A x A		2	48	1.3	36	9	3	0
		3	35	1.1	33	1	1	0
		4	19	1.0	19	0	0	0
		Total	102	1.2	88	10	4	0
A x C <sup>c</sup>		2	47	1.3	37	5	5	0
		3	21	1.0	21	0	0	0
		4	21	1.0	21	0	0	0
		Total	<del>95</del> 89	1.2	<del>87</del> 79	5	5	0
C x A		2	34	2.1	12	13	1	8 (7)
		3	44	1.4	35	2	6	1 (1)
		4	30	1.0	30	0	0	0
		Total	108	1.5	77	15	7	9 (8)
C x C <sup>d</sup>		2	24	2.5	6	6	7	5 (2)
		3	35	1.1	32	2	0	1
		4	24	1.3	22	1	0	1 (1)
		Total	<del>86</del> 83	1.5	<del>60</del> 60	9	7	7 (3)
Total		2	153	1.7	91	33	16	13 (9)
		3	135	1.2	121	5	7	2 (1)
		4	94	1.0	92	1	0	1 (1)
Grand Total			382	1.3	304	39	23	16 (11)

- <sup>a</sup> Scored as 1, no difficulty; 2, slight difficulty; 3, difficult; 4, extremely difficult.
- <sup>b</sup> Numbers in parentheses indicate the number of calves lost due to calving difficulty in each group.
- <sup>c</sup> Does not include four sets of twins.
- <sup>d</sup> Does not include one set of twins, one calf aborted at 186 days after breeding and one calf born premature at 255 days of gestation.



Table 8. Weight Gain and Feed Efficiency Summary of Individually Fed Drylot Heifers of 1970 Calf Crop

Breed of heifer	No.	Starting weight (lb.) 12-3-70	Weight (lb.) 11-19-71	Average daily gain (lb.)	Feed efficiency <sup>a</sup> (12-3-70 to 11-19-71)
AA	12	391	787	1.13	12.3
AC	11	402	784	1.09	12.6
CA	8	409	869	1.31	11.6
CC	6	431	880	1.28	11.8

<sup>a</sup> Pounds dry matter per pound of gain.

Table 9. Weight Gain and Feed Efficiency Summary of Individually Fed Drylot Heifers of 1971 Calf Crop

Breed of heifer	No.	Starting weight (lb.) 11-19-71	Weight (lb.) 6-30-72	Average daily gain (lb.)	Feed efficiency <sup>a</sup> (11-19-71 to 6-30-72)
AA	9	332	637	1.36	10.8
AC	5	349	663	1.40	10.9
CA	10	349	693	1.54	10.8
CC	10	357	660	1.35	11.7

<sup>a</sup> Pounds dry matter per pound of gain.

Table 10. Age and Weight at Puberty of 1970 Heifer Calves

Breed of heifer	No. heifers	Age at first estrus (days)	Weight at first estrus (lb.)	Weight per day of age at first estrus (lb.)
AA	21	386	613	1.59
AC	20	376	645	1.71
CA	14	386	698	1.81
CC	9	398	725	1.82
Total	64	385	657	1.71

Table 11. Conception Summary of Yearling Phase II Heifers -- 1971<sup>a</sup>

Treatment group	Cows inseminated	Percent conceiving at each service <sup>b</sup>				Final pregnancy rate (%)	Services per conception (No.)
		1st	2nd	3rd	4th		
Pasture	27	59 (27) <sup>c</sup>	78 ( 9)	0 (2)	0 (1)	85	1.70
Drylot	37	68 (37)	67 (12)	50 (2)	--	92	1.50
AA <sup>d</sup>	21	81 (21)	75 ( 4)	0 (1)	--	95	1.30
AC	20	55 (20)	63 ( 8)	0 (2)	0 (1)	80	1.94
CA	14	43 (14)	86 ( 7)	100 (1)	--	93	1.69
CC	9	78 ( 9)	50 ( 2)	--	--	89	1.38
Total	64	64 (64)	71 (21)	25 (4)	0 (1)	89	1.58

<sup>a</sup> All heifers bred artificially to the same Polled Hereford bull.

<sup>b</sup> Based on examination by rectal palpation; heifers assumed to have conceived at last breeding.

<sup>c</sup> Numbers in parentheses indicate the number of heifers inseminated in each group.

<sup>d</sup> Includes both drylot and pasture animals.

Table 12. Birth Weight and Calving Difficulty Score Distribution for 1972 Calf Crop -- Phase II Two-Year-Old Heifers

Mating Sire <sup>a</sup> Dam		No. calves	Avg. birth wt. (lb.)	Avg. difficulty score <sup>b</sup>	Difficulty score distribution <sup>b</sup>			
					1	2	3	4
					Number of heifers			
PH x AA		20	71	1.7	11	6	2	1
PH x AC		13	70	1.2	11	2	0	0
PH x CA		12	72	1.1	11	1	0	0
PH x CC		7	77	1.7	4	1	2	0
Total		52	72	1.4	37	10	4	1

<sup>a</sup> All heifers bred to a single Polled Hereford bull.

<sup>b</sup> Scored as 1, no difficulty; 2, slight difficulty; 3, difficult; 4, extremely difficult.