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## Seventeen years of Kansas central bull tests

### Abstract

Weights, frame scores, scrotal circumferences, and prices of bulls increased significantly over 17 years. Angus had the greatest increase in birth weight, average daily gain (ADG) during test, adjusted yearling weight, and frame score, whereas Simmental had the greatest increase in adjusted weaning weight. Backfat and ribeye area decreased over this period. Large frame score had the greatest effect on increasing sale price of bulls. Gelbvieh bulls with heavy birth weights sold for less, whereas heavy birth weight Limousin and Polled Hereford bulls sold for more. Rank correlations indicated a significant change in rank between 112- and 140-d ADG. About 20% of the 140-d ADG information was obtained during the last 28 d of the test.

### Keywords

Cattlemen's Day, 1990; Kansas Agricultural Experiment Station contribution; no. 90-361-S; Report of progress (Kansas State University, Agricultural Experiment Station and Cooperative Extension Service); 592; Beef; Bull test; Performance

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**K****S****U****SEVENTEEN YEARS OF KANSAS  
CENTRAL BULL TESTS****R. R. Schalles, B. J. Ward,  
K. O. Zoellner, and L. C. Martin**

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**Summary**

Weights, frame scores, scrotal circumferences, and prices of bulls increased significantly over 17 years. Angus had the greatest increase in birth weight, average daily gain (ADG) during test, adjusted yearling weight, and frame score, whereas Simmental had the greatest increase in adjusted weaning weight. Backfat and ribeye area decreased over this period. Large frame score had the greatest effect on increasing sale price of bulls. Gelbvieh bulls with heavy birth weights sold for less, whereas heavy birth weight Limousin and Polled Hereford bulls sold for more. Rank correlations indicated a significant change in rank between 112- and 140-d ADG. About 20% of the 140-d ADG information was obtained during the last 28 d of the test.

(Key Words: Bull Test, Performance.)

**Introduction**

The economics of beef production over the last 20 years and consumer desire for lean beef have dictated a change in the genotype of cattle used for breeding. The Kansas Central Bull Tests have helped facilitate this change by providing a uniform post-weaning environment, under which superior bulls can be identified and selected.

**Experimental Procedures**

Data were collected from 11,494 bulls of 32 breeds that completed the Kansas Central Bull Tests over a 17-yr period. The first test was initiated at Beloit in June, 1971; a second test was started at Yates Center in 1975 and moved to Potwin in 1982.

Bulls were delivered to the test station about 3 wk before the start of the test at an average age of 224 d and were fed in groups of approximately 50 head of the same breed or breeds with similar genotypes. The starting ration had a moderate energy density (NEm = 68 to 80, NEg = 39 to 48 Mcal/cwt) with increasing energy density in the final ration (NEm = 74 to 90, NEg = 46 to 57 Mcal/cwt). Bulls were weighed on two consecutive days at the start and end of the 140-d test, and once on d 56 and d 112. Ribeye area and backfat were estimated by ultrasonic imaging. Birth weight, weaning weight, adjusted weaning weight, and pedigree information were provided by the breeders.

Most analyses were conducted using 2,282 Angus (AN), 745 Charolais (CH), 445 Gelbvieh (GV), 991 Hereford (HH), 448 Limousin (LM), 757 Polled Hereford (HP), and 5,189 Simmental (SM) bulls. Least Squares analysis was used with the effects of birth year, breed,

season of test, test location, and age of bull held constant. Percentage of breed and polled character were analyzed for Charolais, Gelbvieh, Limousin, and Simmental bulls. Rank correlations were calculated between 112- and 140-d average daily gains (ADG).

## Results and Discussion

### Bull performance

Pre-test performance was provided by the bull consignors. Sufficient birth weight data were not available until 1975. Charolais, Gelbvieh, and Simmental bulls had the heaviest weights at birth, weaning (Table 23.1), and at the start of tests. Angus had the greatest increase in birth weight (1.2 lbs per year), whereas Charolais, Gelbvieh and Limousin had a slight decrease. Simmental had the greatest increase in adjusted weaning weight (9.3 lb per year), and Charolais had the smallest increase (2.6 lb per year). Age at the start of test and weaning weight ratio were very similar among breeds, with the Angus being the oldest and Gelbvieh the youngest. The greatest within-herd weaning weight selection was placed on Herefords. Starting test weight has increased 79 lb since the 1970-born calves. Weaning weight ratio and starting test age have both decreased slightly. Spring-born calves (those tested in the winter) were heavier at both birth and weaning than fall-born calves.

The 140-d test ADG increased within all breeds

**Table 23.1. Least Squares Mean Birth Weight and Adjusted Weaning Weight by Breed and Year**

Birth year	Breed						
	AN	CH	GV	HH	LM	HP	SM
	----- birth weight, lb -----						
1975	73	85	—		77	71	84
1976	73	89	—	74	80	67	88
1977	73	84	—	81	89	73	90
1978	71	94	96	81	84	74	89
1979	70	87	81	84	78	73	91
1980	75	89	—	84	82	76	91
1981	75	94	81	82	89	79	93
1982	77	86	82	85	78	83	91
1983	79	90	86	83	78	81	91
1984	80	87	86	83	78	82	92
1985	81	89	87	87	77	82	93
1986	78	90	89	86	78	80	92
	----- adjusted weaning weight, lb -----						
1970	502	494	—	491	578	—	540
1971	547	615	—	491	520	514	527
1972	507	591	—	511	543	523	525
1973	490	611	596	499	505	502	540
1974	496	586	532	488	507	475	550
1975	502	582	—	500	518	465	550
1976	522	563	—	516	570	477	560
1977	529	606	—	536	514	482	563
1978	519	595	686	531	532	481	564
1979	532	632	627	542	582	493	592
1980	540	619	—	558	607	524	617
1981	555	598	621	584	612	531	626
1982	548	617	622	584	557	529	620
1983	547	610	614	541	565	540	607
1984	556	634	608	547	610	552	624
1985	576	626	615	570	633	569	661
1986	594	634	641	562	653	558	664

AN = Angus, CH = Charolais, GV = Gelbvieh, HH = Hereford, LM = Limousin, HP = Polled Hereford, and SM = Simmental.

over the years (Table 23.2), with Angus having the greatest increase and Limousin the least. Adjusted 365-d weight had similar increases, with Angus, Simmental, and Hereford having the greatest increases and Charolais the least. Charolais and Simmental had the heaviest 365-d adjusted weights and Polled Hereford, Hereford, Angus, and Limousin had the lightest.

Over the 17 years, ribeye area and backfat decreased, while scrotal circumference and frame score increased (Table 23.3). Charolais and Limousin had the largest ribeye areas and Hereford, Polled Hereford, and Angus had the smallest. The British breeds had the most backfat, whereas the Continental breeds had the least. Scrotal circumference increased from 1974 through 1986, with Angus, Simmental, and Gelbvieh having the largest scrotal circumferences and Limousin the smallest. Frame score increased from an average of 3.4 in 1973 to 5.9 in 1986. Simmental, Charolais, and Gelbvieh were the largest frame bulls and had the least increases over the 17 years; British breeds had the smallest frames and showed the greatest increases.

Bulls born earlier in the calving season had lighter birth weights, heavier actual weaning and starting test

**Table 23.2. Least Squares Mean 140-day Average Daily Gain and Adjusted 365-day Weight of Bulls**

Birth year	AN	CH	GV	HH	LM	HP	SM	
								----- 140-d average daily gain, lb -----
1970	2.49	3.28	—	2.62	2.36	—	3.20	
1971	2.78	3.15	—	2.68	3.23	2.63	3.52	
1972	2.51	2.87	—	2.51	2.68	2.39	3.00	
1973	2.56	3.12	3.02	2.83	2.72	2.71	3.18	
1974	2.88	3.47	3.26	2.91	3.28	2.80	3.49	
1975	3.01	3.51	—	2.91	3.37	2.80	3.61	
1976	2.84	3.36	—	2.74	2.99	2.76	3.43	
1977	2.96	3.19	—	2.88	2.86	2.91	3.27	
1978	2.66	2.85	2.55	2.65	2.51	2.66	2.94	
1979	2.81	3.16	3.10	2.71	2.88	2.77	3.29	
1980	3.05	3.45	—	3.05	3.01	3.06	3.65	
1981	3.26	3.64	3.68	3.14	3.33	3.11	3.54	
1982	3.25	3.41	3.20	3.20	3.12	3.20	3.40	
1983	3.22	3.57	3.14	3.29	3.15	3.27	3.51	
1984	3.51	3.90	3.64	3.32	3.39	3.45	3.72	
1985	3.64	3.96	3.63	3.42	3.37	3.33	3.82	
1986	3.48	3.68	3.37	3.36	3.13	3.05	3.51	
	----- 365-d weight, lb -----							
1970	941	—	—	—	931	—	1027	
1971	896	1042	—	906	—	894	1076	
1972	892	1036	—	839	—	926	954	
1973	915	1158	1007	938	1008	960	1031	
1974	937	1079	1009	925	954	905	1055	
1975	939	1067	—	937	979	882	1060	
1976	970	1046	—	934	1007	894	1061	
1977	918	1050	—	950	910	908	1039	
1978	942	1022	1128	916	910	890	1015	
1979	986	1077	1056	956	997	904	1063	
1980	1000	1113	—	1001	1015	963	1138	
1981	1006	1091	1133	997	1049	971	1114	
1982	995	1097	1060	1029	998	988	1096	
1983	1051	1089	1038	980	981	988	1084	
1984	1095	1171	1107	1032	1059	1034	1144	
1985	1070	1203	1148	1062	1128	1020	1211	
1986	1097	1141	1123	1045	1071	1000	1161	

AN = Angus, CH = Charolais, GV = Gelbvieh, HH = Hereford, LM = Limousin, HP = Polled Hereford and SM = Simmental.

weights, but lighter adjusted weaning weights. Older bulls gained slightly faster on test and had heavier weights per day of age, larger ribeyes, more backfat, and larger scrotal circumferences at the end of test. Larger frame bulls were heavier at all weights; however, the increase in weight per unit of increase in frame score was less with the larger frame bulls, with little increase in weights above frame score 9. Larger frame bulls had smaller ribeyes and less backfat.

Few differences were found between bulls of various percentage breeding within the Charolais, Gelbvieh, Limousin, and Simmental breeds. Perhaps the heterosis within the lower percentage bulls offset the breeding value differences between foundation and purebred animals used in the breeds. Few differences were found between polled and horned bulls of these breeds.

#### Price of bulls

Bull prices more than doubled over the 17-yr period, with the lowest prices paid for the 1974-born bulls and highest for the 1986-born bulls. No adjustments were made for inflation or supply/demand conditions influencing the cattle market. Simmental and Gelbvieh were the highest selling breeds (Table 23.4). Bulls on the winter test (sold in the spring) averaged \$112 more than bulls sold in the fall; bulls at Beloit sold for \$187 more than bulls at Yates Center and \$308 more than those at Potwin. Buyers of Gelbvieh bulls discriminated against large birth weights (-\$12/lb increase), whereas buyers of Limousin and Polled Hereford bulls paid \$13 and \$10 more for each lb increase in birth weight. Bulls with heavier adjusted weaning weights and larger weaning weight ratios received higher prices in all breeds. Larger frame bulls sold for more money in all breeds, with per unit increases in frame score ranging from \$214 in Polled Hereford to \$422 in Gelbvieh. The value of .1 lb increase

**Table 23.3. Least Square Mean Ribeye, Backfat, Scrotal Circumference and Frame Score of Bulls.**

	Ribeye area, sq. in.	Backfat, in.	Scrotal circum- ference, cm	Frame score
<u>Birth year</u>				
1973	13.4	0.28	—	3.4
1974	12.5	0.28	31.7	3.5
1975	12.3	0.28	32.1	4.0
1976	12.1	0.26	33.2	4.5
1977	11.6	0.23	33.9	4.7
1978	11.7	0.21	35.0	4.2
1979	11.7	0.24	34.2	4.9
1980	12.8	0.21	34.4	5.2
1981	12.3	0.22	34.9	5.2
1982	11.8	0.22	34.9	5.2
1983	11.3	0.20	35.1	5.2
1984	12.1	0.20	36.0	5.5
1985	—	0.19	34.2	6.0
1986	—	0.17	34.6	5.9
<u>Breed</u>				
Angus	11.7	0.30	35.2	4.1
Charolais	12.8	0.17	33.7	5.7
Gelbvieh	12.2	0.18	35.0	5.2
Hereford	11.5	0.29	34.4	4.0
Limousin	12.7	0.18	31.9	5.0
Polled Hereford	11.6	0.31	34.0	3.8
Simmental	12.3	0.18	35.0	5.8

in ADG on test varied from \$.20 in Limousin to \$4.08 in Charolais; an increase of one lb of yearling weight had a value of approximately \$3.

### 112- vs 140-day test

The simple correlation between 112- and 140-d ADG is high (.91), because the gain made the first 112 d is part of the gain made over the 140 d. Correlations of the ranking of bulls at the two times are independent of this part-whole relationship and are given (Table 23.5) for Angus, Charolais, Hereford, and Simmental at the three locations. The rank correlations were generally less than .8 and indicated a significant change in rank among bulls during the last 28 d of the test. Approximately 80% of the 140-d gain information had been obtained by 112 d, and the other 20% was obtained during the last 28 d.

**Table 23.4. Average Prices Paid for Bulls (\$)**

Birth year	Breeds						
	AN	CH	GV	HH	LM	HP	SM
1970	615	574	—	498	—	—	738
1971	732	836	—	568	521	688	805
1972	969	712	—	819	705	937	869
1973	792	912	1125	919	821	873	1100
1974	651	405	316	655	408	576	482
1975	653	577	—	564	520	621	714
1976	746	527	—	605	573	574	766
1977	1022	1140	—	1060	870	752	1189
1978	1484	1538	1000	1219	1340	1000	1706
1979	1312	1276	1025	1159	1192	1030	1420
1980	1201	1184	—	899	1425	832	1507
1981	1058	858	1625	892	688	952	1472
1982	1158	1032	1680	1101	1330	912	1287
1983	1063	1326	1471	1168	1075	915	1204
1984	1180	1618	1468	927	1284	845	1104
1985	1209	1011	1237	714	1002	922	1270
1986	1739	1694	1517	1225	1414	1192	1441

AN = Angus, CH = Charolais, GV = Gelbvieh, HH = Hereford, LM = Limousin, HP = Polled Hereford and SM = Simmental.

**Table 23.5. Rank Correlations: 112- vs 140-day ADG**

Breed	Location		
	Beloit	Potwin	Yates Center
Angus	.753	.767	.774
Charolais	.779	.811	.783
Hereford	.731	.755	.837
Simmental	.790	.642	.791

There was a significant change in rank of bulls during the last 28 days of the test.