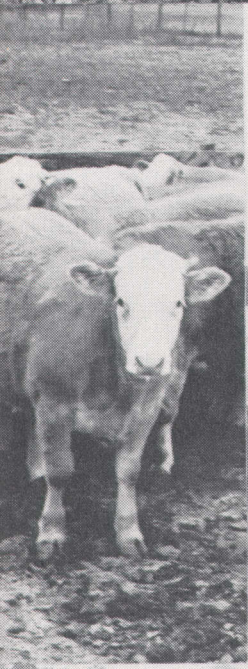
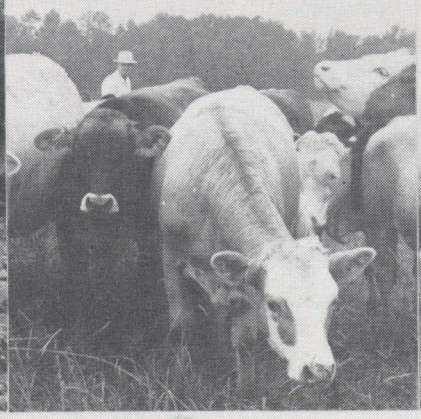
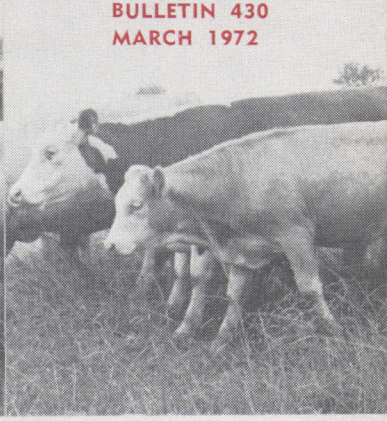
Brown Swiss, Charolais, and Hereford Breeding in a Grade Beef Herd — Effect on Performance and Carcass Characteristics







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CONTENTS

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Brown Swiss, Charolais, and Hereford Breeding in a Grade Beef Herd—Effect on Performance and Carass Characteristics

T. B. PATTERSON, W. W. COTNEY, and ROBERT A. MOORE*

MANY COMMERCIAL BEEF HERDS in the Southeast were established using common cows of predominately dairy breeding as foundation females. Calves sired by beef bulls were usually sold for slaughter at weaning and few were fed to heavier weights.

There have been reports indicating that dairy or dual purpose cattle can be utilized for beef production *(17,23)*. Several show that dairy cows can be used successfully as beef cows when bred to beef bulls *(7,17,18,21,22,29)*. Breeds and crosses that include Holstein and Brown Swiss have been highly productive. Such cows wean significantly heavier calves *(7,21,28)*, and steers produced by these cows perform well in the feedlot *(3,7,8,9,12,16, 18,29)*.

In general, dairy or dairy cross carcasses have less fat, less marbling, and lower quality grades; however, these leaner carcasses compare favorably in cutability and eatability with carcasses from straight beef breeds *(1,2,3,4,8,11,12,14,28,30,31)*.

Damon *et al. (5)* reported the first significant research involving Charolais bulls for crossbreeding. They found that crossbred calves sired by Charolais bulls were heaviest at weaning and with one exception gained faster than steers sired by other breeds. Carcass data from these steers *(6)* indicated that the Charolais cross carcasses had less fat and more lean and were more tender than carcasses of other breed crosses. Other studies *(7,13,19,20, 24,27)* and a review by Temple *(26)* confirmed that Charolais cross calves grow faster and yield leaner carcasses, though it is not un-

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common for quality grade to be lower because of lack of marbling. From an experiment using Angus, Hereford, and Charolais cows, Lasley *(15)* and Sagebiel *(25)* reported lower per cent calf crop and higher rates of dystocia, respectively, when semen from Charolais bulls was used as compared with semen from Angus and Hereford bulls. However, other reports *(5,13,26,27)* suggest that Charolais cattle compare favorably with other breeds in per cent calf crop.

The data reported herein were obtained at the Upper Coastal Plain Substation, Winfield. Grade Hereford cows were mated to Hereford, Brown Swiss, and Charolais bulls to produce straight Hereford (H), Brown Swiss x Hereford (BS x H), and Charolais x Hereford (C x H) calves. The females thus produced were used in a breeding project, while the steer calves yielded additional information for the present study.

EXPERIMENTAL PROCEDURE

Seventy-five grade cows of predominately Hereford breeding were divided into similar groups of 25 each on the basis of age and previous production record for the 3-year project. Each group was bred to a Brown Swiss, Charolais, or Hereford bull. Thereafter, bulls were replaced annually and the remaining cows and replacement heifers reassigned to minimize cow differences. Death loss and removal of cows with physical defects resulted in slight differences in the number of cows bred. The Hereford bulls were produced in the Auburn University purebred herd and were not closely related. Likewise, the Charolais bulls were not related and came from the same herd. All Hereford and Charolais bulls were selected on the basis of performance records. The two Brown Swiss bulls that sired calves were obtained from separate dairy herds and no performance records were available.

All cows were maintained under practical conditions and, other than during the breeding season, were managed as a single herd with no deliberate environmental differences. All calves were raised on pasture without creep. After weaning (at an average age of 250 days), all calves remained on pasture for an average of 94 days. All steers were then full-fed in drylot for an average of 174 days. The ration was a blended mixture containing 30 per cent roughage. The steers were slaughtered at commercial packing plants where USDA graders furnished qual-

ity and yield grades. Rib samples were obtained from all carcasses and evaluated for tenderness in the Auburn University Meats Laboratory by Warner-Bratzler shear.

The data were analyzed by the method of least squares as described by Harvey *(10)*. These analyses are given in Appendix Tables 1, 2, and 3.

RESULTS AND DISCUSSION

Reproductive Performance

There were no significant differences in per cent calf crop born or weaned among the breeding groups, Table 1. This was true even in the last 2 years of the test when cows exposed to Brown Swiss bulls had 7 per cent more calves born and 11 per cent more calves weaned than cows in groups exposed to Hereford and Charolais bulls. The Brown Swiss bull used the first year was completely sterile.

TABLE 1. AVERAGE REPRODUCTIVE PERFORMANCE, 1963-65

Performance measure	Breeding group		
	Hereford	Charolais X Hereford	Brown Swiss X Hereford[1]
Number of cows exposed	75	72	43
Per cent of cows calving	86.6	90.3	95.3
Number of calves weaned	64	60	41
Per cent cows weaning calves	85.3[2]	83.3[2]	95.3

[1] Two years in all tables since the first Brown Swiss bull was completely sterile.
[2] One Hereford and three Charolais calves were born dead. Only one of the three Charolais calves was above average in birth weight.

Calf Weights and Grades

There was no difference between average birth weights of C x H and BS x H calves. However, calves by Hereford bulls were lighter at birth than the crossbred calves, Table 2. Three C x H calves were born dead and two died shortly after birth, as compared with only one Hereford calf that was born dead. Excessive birth weight was apparently not a factor since only one of the five C x H calves was heavier at birth than the average of the breed group. All calves were born without aid and there was no evidence of dystocia. With the exception of replacement

TABLE 2. AVERAGE BIRTH WEIGHT, WEANING WEIGHT, AND WEANING SCORE, 1963-65[1]

Performance measure	Breeding group		
	Hereford	Charolais X Hereford	Brown Swiss X Hereford
Number of calves[2]	62	59	39
Average birth weight, lb.	63_a[3]	70_b	69_b
Average adjusted weaning weight (250 days), lb.	433_a	467_b	452_{ab}
Average weaning grade[4]	9.2_a	9.4_a	8.1_b

[1] The averages reported in all tables are least squares means.
[2] Not equal to number of calves weaned in Table 1 because 2 Hereford, 1 Charolais cross, and 1 Brown Swiss cross calves were excluded because of illness or injury.
[3] Averages with different subscripts are different at $P < 0.01$.
[4] 8 = high Standard; 9 = low Good.

heifers, all cows used in this study had produced at least one calf before joining the experiment. In addition, the 69- and 70-pound average birth weights for the BS x H and C x H calves, respectively, are not considered large. All BS x H calves were alive at birth and survived to weaning.

Calves sired by Charolais bulls were heaviest at weaning, followed by Brown Swiss and Hereford sired calves. The C x H calves were significantly heavier, by an average of 34 pounds, than the Hereford calves. The BS x H calves averaged 15 pounds lighter than the C x H calves and 19 pounds heavier than the Hereford calves. These differences were not significant. The Hereford and C x H calves graded significantly higher at weaning than the BS x H calves.

Pasture Gains

After weaning, all calves were grazed on late summer-early fall permanent pasture without supplemental feed. The C x H calves

TABLE 3. AVERAGE DAYS, DAILY GAIN, AND FINAL PASTURE WEIGHT, 1964-66

Performance measure	Breeding groups		
	Hereford	Charolais X Hereford	Brown Swiss X Hereford
Number of calves	62	59	39
Average number of days on pasture	98	98	84
Average daily gain, lb.	0.86_a[1]	1.12_b	0.90_a
Average final weight, lb.	513_a	577_c	539_b

[1] Averages with different subscripts are different at $P<0.01$.

gained faster on pasture than did Hereford and BS x H calves, Table 3. The C x H calves were also heavier at the end of the pasture period than the other two groups of calves and BS x H were heavier than H. The steer calves gained 13 pounds more than the heifer calves, for the 3 years, Appendix Table 1.

Feedlot Performance

The BS x H steers gained faster in the feedlot than the C x H steers, Table 4. Average daily feedlot gain of Hereford steers was not different from that of C x H steers or BS x H steers. However, at slaughter the C x H steers were heavier than the Herefords. The Hereford steers required 111 and 55 pounds less feed per hundredweight gain than did the C x H and BS x H steers, respectively. Part of these differences may be attributed to higher maintenance requirements of the heavier steers and part to differences in feedlot gain. There were differences in average slaughter grade among the breeding groups even though the difference between high and low was only 2/3 of a grade.

TABLE 4. AVERAGE FEEDLOT PERFORMANCE FOR STEER CALVES, 1964-66

Performance measure	Breeding group		
	Hereford	Charolais X Hereford	Brown Swiss X Hereford
Number of steers	37	34	21
Average number of days on feed	173	171	181
Average initial weight, lb.	543_{a}[1]	619_{b}	559_{ab}
Average daily gain, lb.	2.33_{ab}[2]	2.27_{a}	2.36_{b}
Average final shrunk weight, lb.	946_{a}[1]	$1,008_{b}$	986_{ab}
Average feed/cwt. gain, lb.	927	1,038	982
Average WDA at slaughter, lb.	1.88_{a}[1]	1.92_{b}	1.87_{ab}
Average slaughter score[3]	12.2_{a}[1]	11.3_{b}	10.0_{c}

[1] Averages with different subscripts are different at $P<0.01$.
[2] Averages with different subscripts are different at $P<0.05$.
[3] 10 = Good; 11 = high Good; 12 = low Choice.

Carcass Data

The C x H carcasses were heavier and had less fat than those from Hereford steers, Table 5. In addition, the C x H carcasses were more tender and had better yield grades than the BS x H ones. Carcasses from the Hereford steers were fatter, had more marbling, and therefore a higher average quality grade than from either of the crossbred groups. Eighty-seven per cent of the

TABLE 5. AVERAGES OF CARCASS CHARACTERISTICS, 1965-67

Performance measure	Breeding group		
	Hereford	Charolais X Hereford	Brown Swiss X Hereford
Number of steers	37	34	21
Average market weight, lb.	946_{a}[1]	$1{,}008_{b}$	986_{ab}
Average hot carcass weight, lb.	561_{a}	610_{b}	581_{ab}
Average marbling score[2]	5.3_{a}	4.5_{b}	4.6_{b}
Average quality grade[3]	12.0_{a}	11.1_{b}	10.5_{b}
Average adjusted rib fat, in.	0.34_{a}	0.24_{b}	0.25_{b}
Average yield grade[4]	2.85_{b}	1.93_{a}	2.45_{c}
Average tenderness score[5]	17_{ab}	16_{a}	19_{b}

[1] Averages with different subscripts are different at $P<0.01$.
[2] 3 = trace; 4 = slight; 5 = small; 6 = modest.
[3] 10 = Good; 11 = high Good; 12 = low Choice.
[4] 1 = best, 5 = poorest.
[5] Warner-Bratzler shear. Expressed as pounds pressure per square inch so that the lower values are more tender.

Hereford carcasses graded Choice, as contrasted with only 18 and 14 per cent, respectively, of the C x H and BS x H carcasses. Under present methods of wholesale and retail distribution of beef, only quality grade affects the price received by the producer. Yield grade is an accurate indicator of per cent lean meat in a carcass. Nevertheless, until the butcher and/or the consumer demands less fat and more lean meat, prices will be determined primarily on the basis of quality grade.

Economic Analysis

For the economic analysis of post weaning steer performance in Table 6, initial values per steer were determined on the basis of weaning weight, grade, and prevailing market prices. The $15 advantage for the C x H steers over the Hereford steers was a result of heavier average weaning weight. The $30 advantage over the BS x H steers reflects both higher average grade and heavier average weaning weight. Even though the Hereford calves were lighter at weaning, their higher price per hundredweight resulted in an advantage of $15 per head over the BS x H steers. The total cost charge against each steer included the initial value, cost of pasture gain at 10¢ per head per day, and actual feed cost. The C x H steers required more feed per unit of gain, which resulted in higher cost of feedlot gain than for the Hereford steers. Higher cost of feedlot gain for the BS x H

TABLE 6. ECONOMIC ANALYSIS OF POST WEANING PERFORMANCE FOR STEER CALVES, 1964-66

Performance measure	Breeding group		
	Hereford	Charolais X Hereford	Brown Swiss X Hereford
Number of steer calves	37	34	21
Average adjusted weight, at weaning, lb.	456	505	468
Average market value per steer, dol.[1]	141.36	156.55	126.36
Average gain on pasture, lb.	87	114	91
Average cost of pasture gain, dol.[2]	9.60	9.60	9.60
Average gain in feedlot, lb.	403	389	427
Average cost of feedlot gain, dol.[3]	93.42	100.95	104.83
Average total cost, dol.	244.38	267.10	240.79
Average final weight, lb.	946	1,008	986
Average carcass weight, lb.	561	610	581
Average market value per steer, dol.[4]	273.21	289.90	275.56
Gross returns, dol.[5]	28.83	22.80	34.77

[1] On the basis of 12 = $31.50/cwt.; 11 = $30.50/cwt.; down to 8 = $27.00/cwt.
[2] Charged at 10¢/head/day.
[3] On the basis of feed/cwt. gain and $2.50/cwt. for feed.
[4] On the basis of $50/cwt. for Choice and $47/cwt. for Good carcasses.
[5] Return to interest on investment, labor, and management.

steers was a result of both more gain and a higher feed requirement per unit of gain. Gross returns for the post-weaning period were $34.77, $28.83, and $22.80 for the BS x H, Hereford, and C x H steers, respectively. The C x H steers maintained the advantage that existed at weaning over the Hereford steers. However, roughly half of the advantage over the BS x H steers was offset by an increase in grade for the Brown Swiss crosses. The final value of the Hereford and BS x H steers was approximately equal.

SUMMARY

Comparisons were made between straight-bred Hereford calves and crossbred calves sired by Charolais and Brown Swiss bulls out of grade Hereford cows. The following results were obtained during a 3-year study:

1. There were no differences in percentage of calves born or weaned among the breeding groups.

2. The crossbred calves were heavier at birth and at weaning than the straight-bred calves.

3. Calves by the Brown Swiss bulls graded lower at weaning.

4. The crossbred calves gained faster on pasture and were heavier at the end of the feedlot period than the Hereford calves.

5. The crossbred steers had heavier carcasses with less fat and better yield grades.

6. The Hereford steers produced carcasses that had more marbling and higher quality grades.

7. Steaks from the C x H carcasses were more tender and steaks from the BS x H carcasses were less tender than those of the Herefords.

8. At weaning and at slaughter, calves sired by Charolais bulls had a higher market value.

9. Hereford calves had a higher market value at weaning than BS x H calves, but at slaughter there was no difference between the two groups of steers.

10. Gross returns from feedlot finishing favored the BS x H steers because of their increased value as a result of feeding.

11. The Herefords showed a small advantage over the Charolais crosses primarily because of lower feed cost.

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APPENDIX

Appendix Table 1. Analyses of Variance for Performance Traits from Birth Through Pasture Phase

Source	df	Mean squares for			
		Birth weight	Weaning weight	Conformation score	Pasture ADG
Age of dam	11	26.4	2254.3	3.4	0.04
Year	2	800.1**	12104.6*	5.3	2.74**
Breed	2	718.4**	16630.1**	17.5**	1.13**
Sex of calf	1	1376.2**	39873.5**	5.3	0.71**
Year X breed	3	55.8	1359.5	3.6	0.05
Year X sex	2	89.8	547.7	2.1	0.02
Breed X sex	2	88.9	2411.4	0.9	0.08
Birth date regression					
Linear	1	73.2	1777.9	3.8	0.03
Quadratic	1	61.2	1743.4	4.2	0.02
Cubic	1	43.5	1600.5	4.2	0.03
Error	133	52.9	2934.4	2.2	0.06

* $P<0.05$.
** $P<0.01$.

Appendix Table 2. Analyses of Variance for Steer Post Weaning Performance Traits

Source	df	Mean squares for				
		ADG		Final weight	Final WDA	Slaughter grade
		Feedlot	Pasture			
Years	2	1.7**	2.2**	36057.7**	0.00	13.2**
Breeds	2	0.8**	0.3	34270.0*	0.04	29.0**
Years X breeds	3	0.1	0.1	1070.1	0.00	1.4
Error	84	0.1	0.1	7114.1	0.02	1.1

* $P<0.05$.
** $P<0.01$.

Appendix Table 3. Analyses of Variance for Steer Carcass Characteristics

Source	df	Mean squares for					
		Carcass weight	Rib fat	Marbling score	Quality grade	Steak tenderness	Yield grade
Years	2	17741.6**	0.02**	6.6**	10.7**	211.6**	1.5**
Breeds	2	20496.2**	0.09**	6.4**	15.5**	51.8**	7.5**
Year X breeds	3	47.2	0.02**	2.2	1.3	26.3	0.1
Error	84	3169.7	0.003	1.3	1.4	12.5	0.2

** $P<0.01$.

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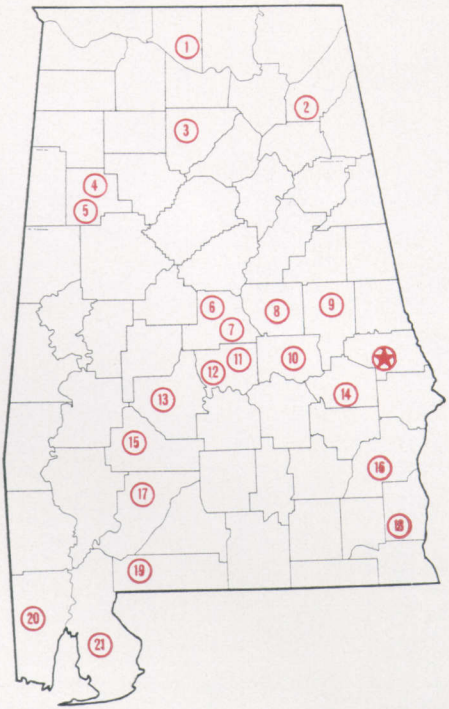

Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Thorsby Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. Tuskegee Experiment Field, Tuskegee.
15. Lower Coastal Plain Substation, Camden.
16. Forestry Unit, Barbour County.
17. Monroeville Experiment Field, Monroeville.
18. Wiregrass Substation, Headland.
19. Brewton Experiment Field, Brewton.
20. Ornamental Horticulture Field Station, Spring Hill.
21. Gulf Coast Substation, Fairhope.