Effects of Brown Swiss, Charolais, Holstein, and Hereford Breeding on Production in a Grade Beef Herd

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CONTENTS

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INTEREST IN CROSSBREEDING for commercial beef production has increased in recent years. Research has adequately demonstrated the existence of heterosis for reproduction and growth.

Cundiff *(3)* in a comprehensive review of crossbreeding concluded that in the British breeds a conservative estimate of the increase in production due to the cumulative effects of heterosis on fertility, maternal ability, and growth rate would be 20 to 25 percent. With the exception of reproduction in one phase, the findings at this Station as reported by Collins *et al. (2)* agree with the conclusions reached by Cundiff in his review. In addition, Cundiff reported that preliminary results from several studies indicate that dairy females bred to beef bulls wean heavier calves than beef cows bred to the same bulls. A report by Deutscher and Whiteman *(4)* indicated that Angus x Holstein 2-year-olds backcrossed to Angus bulls produced more milk and weaned heavier calves than Angus 2-year-olds producing straight Angus calves. However, only 13 percent of the crossbred cows that nursed calves rebred as compared to 63 percent of the Angus cows. The authors concluded that the low performance was probably due to poor nutrition under range conditions.

The primary purpose of the study was to evaluate the influence of Charolais and dairy breeding in cows managed as a com-

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mercial beef herd. Comparisons were made with straightbred Herefords.

EXPERIMENTAL PROCEDURE

Data were collected on 234 calves produced from 293 matings to four Hereford bulls. This study was conducted at the Upper Coastal Plain Substation, Winfield, Alabama from 1967 through 1970. The females used, with the exception of the Holstein crosses, were produced in a previous study and the results reported by Patterson *et al. (7)*. The Holstein crosses were produced by mating the Hereford bulls to grade Holstein cows. All physically sound females were retained for 4 successive years and bred to calve first as 3-year-olds. Calves were produced from 3, 4, 5, and 6-year-old cows in each breeding group. The four female breeding groups were namely: grade Hereford, Brown Swiss x Hereford, Charolais x Hereford, and Hereford x Holstein. Throughout this bulletin the breed of sire will be listed first.

Three Hereford bulls were purchased from the same source and were of similar breeding. They were selected on the basis of performance records. It was intended that the same bulls be used throughout the study. However, one Hereford bull was killed accidentally after use for only 1 year on the experiment and was replaced by an older bull of similar breeding.

The breeding season was from February 15 through May 31. Cows were divided initially on the basis of breeding and age among the bull units. Thereafter, cows were re-allotted and replacement heifers assigned on the basis of breeding in order to minimize group differences. Only cows with physical defects and those that failed to produce a calf in 2 of the first 3 years were removed from the experiment.

All cows were maintained under practical conditions and, except during the breeding season, were managed as a single herd with no deliberate environmental differences imposed. Winter feeding consisted of a full feed of corn silage supplemented with 1 pound per head per day of 41 percent cottonseed meal during the week days and Coastal bermudagrass hay was fed *ad. libitum* on weekends. In addition, wheat pasture was available about 60 percent of each winter period and cows were limit grazed for about 1 hour per day. During the spring, summer, and fall months, cows were grazed on permanent pastures con-

sisting of Coastal bermudagrass overseeded with vetch and on a dallisgrass-white clover mixture. These pastures were used in sequences, utilizing the vetch and white clover in the spring, the Coastal bermuda and dallisgrass in late spring and summer, and dallisgrass in the fall. All calves were raised on pasture without creep feed. Calves were weaned at an average age of 242 days, weighed, and assigned feeder and condition scores.

Data were analyzed by the least-squares procedure with unequal subclass numbers as outlined by Harvey *(5)*. The linear model used to analyze the reproductive data contained the main effects of year, sires within year, breed of cow, age of cow, and the two-way interaction between year and breed of cow. The linear model used to analyze the production data contained the main effects of year, age of dam, breed of dam (completely confounded with breed of calf), sex of calf, and some interactions. These analyses for reproduction and production are given in appendix tables 1 and 2, respectively. Kramer's *(6)* modification of Duncan's multiple range test was used to test significance between individual means. Analysis of variance *(9)* using year by breed unweighted means and Duncan's multiple range test were used test the difference in pounds of calf weaned per cow bred among the breeding groups.

RESULTS AND DISCUSSION

Reproduction

Brown Swiss x Hereford cows calved and weaned a higher percent calf crop than Charolais x Hereford and Hereford x Holstein cows, Table 1. Although there was no significant difference in percentages of cows calving, the Brown Swiss x Hereford cows weaned a higher percentage of their calves than Hereford cows. There were no significant differences among Charolais x Here-

TABLE 1. AVERAGE REPRODUCTIVE PERFORMANCE[1] BY BREEDING OF COW

Performance measure	Breeding of cow			
	Hereford	Brown Swiss x Hereford	Charolais x Hereford	Hereford x Holstein
Number of cows exposed	67	72	79	75
Number of calves born	59	65	65	59
Percent of cows calving	88.1^{ab}	90.3^{a}	82.3^{b}	78.7^{b}
Number of calves weaned	54	64	63	54
Percent of cows weaning calves	80.6^{b}	88.9^{a}	79.8^{b}	72.0^{b}

[1] Means with different superscripts differ at $P<0.05$.

TABLE 2. AVERAGE REPRODUCTIVE PERFORMANCE[1] BY YEARS

Performance measure	Year			
	1967	1968	1969	1970
Number of cows exposed	55	84	103	51
Number of calves born	53	82	77	36
Percent of cows calving	96.4[a]	97.6[a]	74.8[b]	70.6[b]
Number of calves weaned	51	77	71	36
Percent of cows weaning calves	92.7[a]	91.7[a]	68.9[b]	70.6[b]

[1] Means with different superscripts differ at $P<0.01$.

ford, Hereford x Holstein, and Hereford cows for percentage of calves born or weaned.

There was a significant difference in calving and weaning percentages when the first 2 years are compared to the last 2 years, Table 2. The poor reproductive performance for 1969 and 1970 can be attributed to the bull used as a replacement for the bull that was killed. Cows bred to the replacement bull calved and weaned 49 and 37 percent of calves, respectively in the 1969 season as contrasted to 88 and 85 percent born and weaned, respectively for cows bred to the other bulls in the same year. Even though this bull was eliminated after only one season, the redistribution of cows among the other two bull units could have resulted in the spread of a disease. This is likely since a poor 70.6 percent calf crop was born and weaned for 1970 and the onset of poor reproduction coincides with his introduction. However, because of the method of re-allotting cows each year and the even distribution of cows on the basis of breeding and age, it is doubtful that the poor reproduction during the last 2 years biased the results of reproduction differences among the breeding groups of cows.

Calf Weights and Grades

The ¾ Hereford-¼ Holstein calves were heavier at birth than the straight Hereford calves, Table 3. There were no other significant differences in average birth weights among the other possible comparisons.

The backcross calves out of crossbred cows were heavier at weaning than the straightbred Hereford calves. In addition, the ¾ Hereford-¼ Brown Swiss and the ¾ Hereford-¼ Holstein calves had heavier weaning weights than the ¾ Hereford-¼ Charolais calves. The advantage at weaning over the straight Hereford calves was 53, 75, and 83 pounds, respectively for the

TABLE 3. LEAST-SQUARES MEANS[1] OF PRE-WEANING TRAITS

Performance trait	Breeding of calves			
	Hereford	¾ Hereford ¼ Brown Swiss	¾ Hereford ¼ Charolais	¾ Hereford ¼ Holstein
Number of calves	54	64	63	53[2]
Birth weight, lb.	64.1[a]	67.1[ab]	67.9[ab]	70.0[b]
Weight at 242 days, lb.	422.5[a]	505.1[c]	475.5[b]	479.6[c]
Pounds of calf weaned per cow bred, lb.	340.5[a]	449.0[b]	379.4[a]	358.3[a]
Conformation score[3]	12.4[ab]	12.1[b]	12.6[a]	12.4[ab]
Condition score[3]	9.1[a]	10.0[b]	9.6[ab]	9.7[ab]

[1] Means with different superscripts differ at $P<0.01$ except for Pounds of calf weaned per cow bred and Conformation and Condition scores.

[2] One calf born early before calving season not included.

[3] 9 = low Good; 10 = average Good; 11 = high Good; 12 = low Choice; 13 = average Choice.

¾ Hereford-¼Charolais, ¾ Hereford-¼ Holstein, and ¾ Hereford-¼ Brown Swiss.

The advantage of the part Brown Swiss cows over the other groups is best seen by examining the average pounds of calf per cow bred also seen in Table 3. The Brown Swiss x Hereford cows weaned an average of 449 pounds of calf per cow bred compared to the weighted average 360 pounds for the other three groups combined, a difference of 89 pounds. These results are similar to the production of Angus x Hereford cows backcrossed to Hereford bulls, Collins *et al. (1)* and Patterson et al. *(8)*.

The ¾ Hereford-¼Brown Swiss calves had a lower average conformation score than the ¾ Hereford-¼Charolais calves. However, these calves were fatter than the average of the straight Hereford calves as indicated by condition score, Table 3.

The Brown Swiss x Hereford crossbred cows have combined the essential ingredients of a successful cow-calf operation, which are the ability to calve regularly, to wean a high percentage of these calves, and to wean a heavy calf with conformation and quality acceptable to the industry. The Hereford x Holstein cows produced the heavy weaning weights but lacked the ability to breed back and wean a calf the following year. The Hereford cows had an acceptable percentage of calves born but probably due to lack of vigor, had a high percent death loss prior to weaning. As a result, all crossbred groups of cows produced more pounds of calf per cow bred than the straight Herefords.

These conclusions are based on limited numbers of cows sired by only a few bulls of each breed. Further, these cows were maintained on an adequate nutrition level which is essential if they are expected to perform regularly at these higher levels.

SUMMARY

Comparisons were made between straightbred Hereford cows, crossbred Brown Swiss x Hereford, Charolais x Hereford, and Hereford x Holstein cows when all cows were bred to Hereford bulls. The following results were obtained in a 4-year study:

1. Brown Swiss x Hereford cows had a higher calving percentage than Charolais x Hereford or Hereford x Holstein cows.

2. Brown Swiss x Hereford cows weaned a higher percentage of their calves than any other breeding of cows tested.

3. Year differences in percent calf crop born and weaned were attributed to the introduction of another bull during the third year of the test.

4. Hereford x Holstein cows produced calves that were significantly heavier at birth than calves from straight Hereford cows.

5. Brown Swiss x Hereford and Hereford x Holstein cows (cows with dairy breeding) weaned calves that were heavier than calves from Charolais x Hereford and Hereford cows.

6. All crossbred cow groups weaned heavier calves than Hereford cows.

7. On the basis of pounds of calf weaned per cow bred, the Brown Swiss x Hereford cows produced at a considerably higher level than cows in the other breeding groups.

8. Conformation scores for the ¾ Hereford-¼ Brown Swiss calves were only slightly lower than the other calves, but they had the highest condition scores of any calves.

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APPENDIX

APPENDIX TABLE 1. ANALYSES OF VARIANCE FOR REPRODUCTIVE PERFORMANCE

Source	df	Mean squares for	
		Percent cows calving	Percent cows weaning calves
Years	3	1.84**	1.94**
Breeding of cows	3	0.39*	0.66**
Age of cows	3	0.41*	0.64**
Years x breeding	9	0.11	0.08
Sires within years	6	0.67**	1.11**
Error	268	0.10	0.12

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

APPENDIX TABLE 2. ANALYSIS OF VARIANCE FOR PERFORMANCE TRAITS FROM BIRTH THROUGH WEANING

Source	df	Birth weight	Weaning Weight	Conformation score	Condition score	Pounds of calf weaned per cow bred
Years	3	161.9	104,512.9**	1.28	54.14**	45,470.4**
Age of cows	3	118.0	19,825.3**	1.64	11.82**	
Breeding of calves	3	200.9*	53,241.6**	1.66	5.41*	8,654.2*
Sex of calf	1	457.2**	51,151.9**	17.97**	9.17*	
Year x breeding of calves	9	1.0	2,243.4	0.74	0.94	
Year x sex of calf	3	38.0	562.9	1.76	1.97	
Breeding x sex of calf	3	116.4	3,143.9	1.54	3.49	
Year x breeding x sex	9	52.5	3,592.9	1.01	1.45	
Birth date regression						
Linear	1	530.3**	1,576.1	0.00	0.60	
Quadratic	1	466.4**	1,454.4	0.01	0.69	
Cubic	1	421.2**	1,798.7	0.01	0.80	
Error	196	67.8	2,402.3	0.72	2.02	1,371.2[1]

[1] Error df for pounds of calf per cow bred was 9.
* $P<0.05$.
** $P<0.01$.

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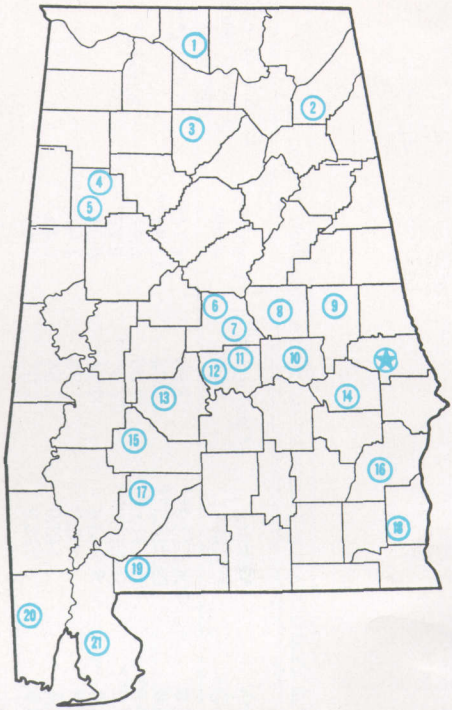

Research Unit Identification

★ 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.
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