

Comparison of Productivity of Young Angus-Holstein Crossbred and Grade Angus Cows

A. C. Boston, G. H. Deutscher, J. V. Whiteman and R. R. Frahm

Story in Brief

The productivity of 69 young $\frac{1}{2}$ Angus- $\frac{1}{2}$ Holstein crossbred cows was compared to that of 41 young grade Angus cows of the same age. All were mated to yearling Angus bulls for spring calving, first as 2-year-olds. The cows were managed under range conditions on native grass the year around. During the winter they were supplemented with prairie hay and cottonseed meal cubes. Traits evaluated were calving percent, milk production, calf weights and cow weight changes. Milk production was estimated by the calf nursing method. Calves were weaned at an average age of 205 days. Cow weights and condition scores were taken three times a year.

The crossbreds in comparison to the Angus cows had a +3, -26 and +13 calving percentage difference as 2, 3 and 4-year-olds, respectively. The Angus dams lost on the average 10 percent more calves each year. This resulted in a percent calf weaned difference of +11 and -35 when comparing the crossbred to Angus dams as 2 and 3-year-olds, respectively. The average calving dates were 5, 11 and 13 days earlier, respectively, for the 2, 3 and 4-year-old crossbred dams. The birth weight of calves of the 2 and 3-year-old crossbred cows was 12.7 and 9.1 pounds more for bull and heifer calves, respectively, than contemporary straightbred calves; but the difference was nonsignificant for 4-year-old dams.

For an adjusted 200 day lactation, the average daily milk production was 8.8 and 12.6 pounds for the 2-year-old and 11.5 and 13.9 pounds for the 3-year-old Angus and crossbred cows, respectively. The average adjusted weaning weight advantage of the backcross calves was 53 and 76

pounds for steers and 69 and 78 pounds for heifers from the 2 and 3-year-old dams, respectively. No significant difference was found within sex between the two calf breed groups in condition or conformation grade at weaning. The crossbred cows were larger in size and carried less condition during their first and second lactations. Both cow breed groups lost weight during their first lactation but gained during their second lactation. The Angus cows lost less weight during the first lactation and gained more during the second lactation.

Three-year-old cows of both breed groups produced more milk, weaned heavier calves, rebred at a higher rate and lost less body weight during lactation than did 2-year-old cows of the same breed. It appeared from this study that the $\frac{1}{2}$ Angus- $\frac{1}{2}$ Holstein cows were capable of producing more milk and heavier weaning calves than the Angus cows as both 2 and 3-year-olds; but the crossbreds apparently needed a higher nutritional level, especially as 2-year-olds, to rebreed and continue to grow.

Introduction

The constant need of beef producers to utilize new ways to increase calf weaning weights has stimulated extensive research. With the advent of the exotic breeds increased research emphasis is being placed on crossbreeding programs and on the performance of the crossbred individual. This expansion in beef research has stimulated interest in dairy-beef crossbreeding as a means of rapidly increasing milk production in the beef cow, since selection progress for this trait is slow. A report from this station in the 1970 Misc. Publ. No. 84 by Deutscher *et al*, summarized a study comparing the performance of 2-year-old Holstein-Angus crossbreds and grade Angus heifers. This study was continued until three years reproductive performance data was obtained on these cows. Another group of 2-year-old Angus-Holstein crossbreds was also included in this continued study. This report will summarize the productivity of the young crossbred and Angus cows.

Materials and Methods

In early 1968, 39 $\frac{1}{2}$ Angus- $\frac{1}{2}$ Holstein crossbred and 41 grade Angus heifer calves were assembled at the Lake Carl Blackwell range west of Stillwater. In late 1968, 30 more $\frac{1}{2}$ Angus- $\frac{1}{2}$ Holstein crossbred heifer calves were added to the herd.

This study was superimposed on the progeny test breeding project at the Blackwell range; thus, these cows were managed as part of that project. Each year each female was randomly allotted within breed and age to a 25 to 30 cow breeding group and exposed to a yearling registered

Angus bull from May 1 to August 1. The first group of 39 crossbred and 41 straightbred heifers was bred as yearlings in 1968, and the second group of 30 crossbreds was bred as yearlings in 1969.

The heifers and cows were managed under range conditions with only native grass during each grazing season. A salt and bonemeal mixture was available free choice. The winter supplemental feed during 1968-69 consisted of 2 pounds of cottonseed meal cubes and 5 pounds of prairie hay per head daily. The cubes were fed from the middle of November to the middle of April, and hay was fed from January 1 to April 15. The same general feeding regime was used during the winter of 1969-70 except that the cubes were increased to 3 pounds per head per day, and all the hay they desired was given from the last part of February until the last of April. This feeding regime was used again in the winter of 1970-71 except that the crossbred cows received from 2 to 4 pounds of cubes per head daily depending upon the cows' condition.

The calving season began each year about February 1. The calves were weighed, tattooed and ear tagged within 24 hours after birth; and calving losses were recorded. Milk production was estimated by the calf nursing method which involved weighing the calves before and immediately after nursing with the difference in weight being used as an estimate of the amount of milk consumed. This procedure was used 2 or 3 times daily, depending on the age of the calves, to estimate the cows' daily milk production. The first estimate was made when a calf was about 2 weeks old and at two week intervals thereafter until the first of May; after which time, a randomly selected group from each breed was tested every four weeks until weaning. To calculate total milk yield, each estimate was used as the average daily yield for the time period in which it was centered.

The calves were weaned, weighed and given conformation and condition scores in late September. All weaning weights were adjusted to 205 days of age. Conformation scores were given from a one to 17 scale with 17 being the top prime grade. Rebreeding performance of the cows was evaluated from a pregnancy check in October and the calving data obtained the next spring. Cow weights and condition scores were taken each year before calving, before breeding and after weaning. The condition scores were based on a scale of one to nine with one being very thin and nine being very fat.

The study reported in this paper ended with the birth data obtained in the spring of 1971. Thus, the data reported for 4-year-old dams is only from the first group of cows assembled in early 1968 as is the weaning data for 3-year-old dams.

Results and Discussion

Breeding and Calving

A summary of the breeding and calving results is given in Table 1. Eighty-six percent of the crossbred and 83 percent of the Angus heifers calved as 2-year-olds. The crossbred heifers lost 9 percent fewer calves and appeared to have less calving difficulty as 2-year-olds. The larger calving percent and smaller percent calves lost resulted in the 2-year-old crossbred heifers having an 11 percent advantage in calves weaned. The crossbreds as 2-year-olds averaged calving five days earlier (March 1) than the Angus heifers (March 6); however, the range in dates was quite large for both groups.

The calving performance of the two groups as 3-year-old cows was quite discouraging and much lower than their 2-year-old performance as seen in Table 1. Only 49 and 75 percent of the crossbreds and Angus respectively, calved as 3-year-olds. The 37 percent drop in calving percent for the crossbreds was quite large compared to the 8 percent drop of the Angus cows. Thus, there was a 26 percent advantage ($P < .005$) in calving percent for the Angus cows as 3-year-olds; whereas, there was a 3 percent disadvantage for them as 2-year-olds. All cows (except two crossbreds) that were open as 3-year-olds had calves as 2-year-olds, and all heifers (except the same two crossbreds) that were open or had lost calves as 2-year-olds produced calves as 3-year-olds. Of those cows which raised a calf as a 2-year-old, 68 and 36 percent of the Angus and crossbred dams, respectively, raised a calf as a 3-year-old.

The mature cow calving performance of the Angus herd, of which these cows were a part, was normal for these years; and thus, these low reproduction levels are probably not just the results of a bad year. The crossbreds showed the greatest reproduction decline. This was probably because of their higher milk production level (Table 2), slower weight gain and poorer condition during the breeding season (Table 5). These data support the idea that beef females of these two types under normal range conditions need a higher plane of nutrition than given in order to support lactation and desired growth and to rebreed consistently as 2-year-olds.

The Angus cows continued as 3-year-olds to lose a larger percent of their calves (Table 1) than the crossbred cows (10 vs. 0 percent); but the Angus cows still had a 35 percent higher weaning rate. As seen in Table 1 the 3-year-old crossbreds continued to calve earlier (11 days); also, the range in calving dates for both breed groups was longer as 3 than as 2-year-olds.

As 4-year-olds the crossbreds reversed the trend and exceeded the Angus dams in calves born by 13 percent (Table 1). Both breed groups

Table 1. Breeding and Calving Results of the Angus-Holstein (AXH) Crossbred and Grade Angus Cows

| Age (Yrs.) | Breed | Exposed Number | Full-term Calving Percentage of Exposed | Calves Lost Percent | Calves Weaned Percentage of Exposed | Calving Date | |
|---------------|-------|-------------------|--|---------------------------|--|------------------------|---------|
| | | | | | | Range (Day of Year) | Average |
| 2 | Angus | 41 | 82.9 ⁷ | 20.6 | 65.9 | 31-118 | Mar. 6 |
| | AXH | 69 | 85.5 ⁷ | 11.3 | 76.8 | 35-118 | Mar. 1 |
| 3 | Angus | 40 ¹ | 75.0 ⁷ | 10.0 | 67.5 | 31-130 | Mar. 15 |
| | AXH | 69 | 49.3 ⁸ | 0.0 ² | 32.5 ⁵ | 32-118 | Mar. 4 |
| 4 | Angus | 39 ^{2,3} | 82.1 ⁷ | --- ⁰ | --- ⁰ | 40-116 | Mar. 6 |
| | AXH | 39 ⁴ | 94.9 ⁷ | --- ⁰ | --- ⁰ | 37-79 | Feb. 21 |

¹ One Angus heifer died as a two-year-old during parturition.

² One Angus cow died as a three-year-old of unknown cause.

³ Five Angus included-pregnancy tested open and culled in fall.

⁴ One AXH culled-open two years in a row.

⁵ Based on only 40 cows exposed.

⁶ Study terminated prior to collection of data.

^{7,8} Percentages with different superscripts within column within age of cow are significantly ($P < .005$) different.

Table 2. Milk Production Adjusted for Lactation Length and Yield Per Day at Early, Late and Entire Lactation for the 2 and 3-year-old Cows by Breed

| Dam | | Calving to May 1 | | | May 1 to Weaning | | | Entire Lactation | | |
|---------------|------------------|------------------|-------------------------------------|---------------------------------|------------------|--------------------------------------|---------------------------------|------------------|--------------------------------------|---------------------------------|
| Age (Yrs.) | Breed | No. | Ave. Adj. 60 Day Yield (lbs.) | Ave. Yield Per Day (lbs.) | No. | Ave. Adj. 140 Day Yield (lbs.) | Ave. Yield Per Day (lbs.) | No. | Ave. Adj. 200 Day Yield (lbs.) | Ave. Yield Per Day (lbs.) |
| 2 | Angus | 26 | 585.0 | 9.75 | 13 | 1191.4 | 8.51 | 13 | 1750.0 | 8.75 |
| | AXH ¹ | 38 | 784.8 | 13.08 | 23 | 1683.3 | 12.02 | 21 | 2510.0 | 12.55 |
| | Diff. | | 199.8** | 3.33** | | 491.9** | 3.51** | | 760.0** | 3.80** |
| 3 | Angus | 9 | 674.4 | 11.24 | 12 | 1558.2 | 11.13 | 6 | 2294.0 | 11.47 |
| | AXH ¹ | 11 | 906.6 | 15.11 | 10 | 1939.0 | 13.85 | 9 | 2776.0 | 13.88 |
| | Diff. | | 232.2** | 3.87** | | 380.8* | 2.72* | | 482.0* | 2.41* |

¹ 1/8 Angus-1/4 Holstein

* ($P < .05$)

** ($P < .01$)

performed at a much higher and more acceptable reproductive rate as 4 than as 3-year-olds. Many of the cows of both breed groups, especially crossbred, did not nurse a calf as a 3-year-old; thus, they had a rest period from the normal reproductive cycle which tended to allow them to grow, mature and recover from what was probably a previous nutritional inadequacy. Also, the winter nutrition level was increased on all cows as 3-year-olds which probably improved their 4-year-old calving performance. The possible effect of the one year rest period was pointed out by the fact that all cows not having a calf as a 3-year-old did have one as a 4-year-old.

The crossbreds continued as 4-year-olds to calve earlier (13 days) on the average than the Angus dams (Table 1). Both breed groups as 4-year-olds had less variation in calving dates than as 3-year-olds, especially the crossbred cows.

Milk Production

The lactation period was divided at May 1 because milk estimates could not be obtained on all cows during the breeding season. Table 2 gives the milk production data of the cows by breed as 2 and 3-year-olds from calving to May 1, May 1 to weaning and for the entire lactation. As 2-year-olds, the crossbreds produced significantly ($P < .01$) more milk during both periods of lactation and for the entire lactation than the Angus. During early lactation, the crossbreds produced 200 pounds more milk in the adjusted 60 day period or 3.3 pounds more per day. The production of the crossbreds during the summer was 492 pounds more or about 3.5 pounds more per day. The adjusted 200 day lactation of the 2-year-old crossbreds was 2510 pounds compared to 1750 pounds for the Angus. This gave the crossbreds a milk production advantage of 760 total pounds or 3.8 pounds per day.

The milk production of the crossbreds as 3-year-olds was significantly ($P < .05$) higher than that of the Angus during both periods and for the entire lactation. The crossbreds produced 232 pounds more milk for the adjusted 60 day early lactation. During the summer, the crossbreds produced 381 pounds more milk. The adjusted 200 day lactation of the 3-year-old crossbreds was 2776 pounds compared to 2294 pounds for the Angus. This difference of 482 pounds represents 2.4 pounds per day more for the crossbreds.

In comparing the 2 vs. 3-year-old crossbreds the 3-year-olds produced about 2 pounds more milk per day during early lactation and 1.8 pounds more per day during the summer. However, the difference for the entire lactation was not statistically significant. The comparison of the Angus 2 vs. 3-year-olds shows that the 3-year-olds produced 1.5 pounds more milk per day during early lactation and 2.6 pounds more per day during

the summer. The 544 pounds advantage for the 3-year-olds for the entire lactation was statistically significant ($P < .01$).

Calf Performance

As shown in Table 3, the average calf birth weight of the backcross calves ($\frac{3}{4}$ Angus- $\frac{1}{4}$ Holstein) of both sexes at each age of dam was heavier than that of the contemporary Angus calves. However, the significant ($P < .01$) advantage of the backcross over the straightbred calves of 2 and 3-year old dams almost completely disappeared when the dams were 4-year-olds. Within both breed groups for each age of dam the bull calves weighed more at birth than their heifer contemporaries. The birth weight advantage of the backcross calves over the straightbreds appeared to give them an advantage from the start, especially calves of 2 and 3-year-old dams, which was seen thru to weaning (Table 4).

Complete data thru weaning was only available on calves of 2 and 3-year old dams. The summary of weaning weights and conformation and condition grades in Table 4 shows a significant ($P < .01$) weaning weight advantage for the backcross calves of both sexes at each age of dam. The backcross steers out of 2 and 3-year-old dams were 53 and 76 pounds heavier, respectively, than the Angus steers; and the backcross heifers out of 2 and 3-year-old dams were 69 and 78 pounds heavier, respectively, than the Angus heifers. Thus, the difference in weaning weights of the two calf breed groups was more for 3 than for 2-year-old dams. The

Table 3. Birth Weights of Calves from Angus-Holstein (AXH) Crossbred and Grade Angus Dams

| Dam | | Calf | | Birth Weight | |
|----------------|-------|--------|-----|-------------------|-----------------|
| Age (Yrs.) | Breed | Sex | No. | Ave. (lbs.) | SE ² |
| 2 | Angus | Bull | 14 | 52.9 ¹ | 1.70 |
| | AXH | | 27 | 65.7 ² | 1.77 |
| | Angus | Heifer | 19 | 51.5 ¹ | 1.46 |
| | AXH | | 26 | 59.9 ² | 1.81 |
| 3 ⁴ | Angus | Bull | 17 | 61.8 ¹ | 1.54 |
| | AXH | | 13 | 74.4 ² | 2.56 |
| | Angus | Heifer | 13 | 56.5 ¹ | 1.76 |
| | AXH | | 21 | 66.3 ² | 2.01 |
| 4 ⁴ | Angus | Bull | 19 | 78.0 ¹ | 1.46 |
| | AXH | | 20 | 81.3 ² | 2.76 |
| | Angus | Heifer | 13 | 72.5 ¹ | 1.76 |
| | AXH | | 17 | 72.8 ² | 2.24 |

^{1,2} Means with different superscripts within column within age of dam within calf sex are significantly ($P < .01$) different.

² Standard Error.

⁴ No statistically significant difference in birth weight was found due to previous reproductive performance of cows in either breed group. Thus, all calves of each breed-sex group represented in these means.

backcross calves were heavier at weaning than the straightbreds probably due to more available milk, larger birth weights and heterosis for gain. The 13 and 9 pound advantages, respectively, of the backcross male and female calves at birth was increased on the average to 65 and 74 pound advantages over their straightbred contemporaries at weaning. The backcross calves gained approximately 0.3 pounds per day faster than the Angus calves from birth to weaning.

The weaning conformation and condition grades were all near low choice (grade 12). No difference between breed groups of calves within age of dam within sex was as large as $\frac{1}{3}$ of a grade. This indicated that the $\frac{1}{4}$ dairy blood did not appreciably affect the quality or beefy appearance of the backcross calves.

Cow Weight Change

Table 5 gives the means and standard errors of the weights and condition scores from before calving to after weaning of the 2 and 3-year-old cows that nursed calves. The 2-year-old crossbreds were significantly ($P < .01$) heavier in weight and lower in condition score than the Angus heifers before calving, before breeding, and after weaning. The crossbreds weighed 98 pounds more before calving but only 45 pounds more after weaning. The Angus scored 0.88 higher before calving and 1.68 higher after weaning. This shows that the crossbreds were larger in size, carried less condition throughout lactation and were very noticeably thinner after weaning. The crossbreds lost 59 pounds from before calving to after weaning compared to only a 7 pound loss by the Angus. Figure 1 shows the weight change curves of these 2-year-olds. Note that the Angus

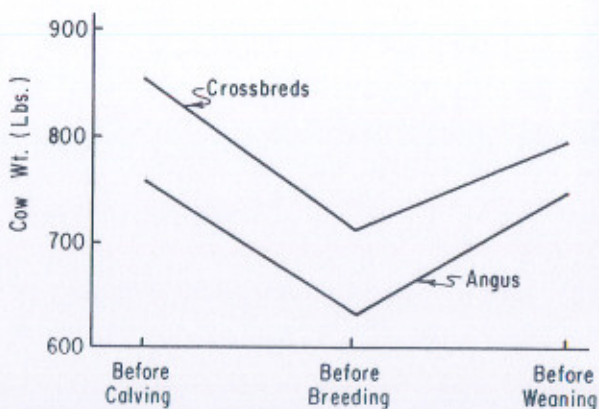


Figure 1. Weight change curves of first calf 2-year-old cows.

Table 4. Adjusted 205 Day Weaning Weights and Grades of Calves from Angus-Holstein (AXH) Crossbred and Grade Angus Dams.

| Dam | | Calf | | Adj. 205 Day Wts. | | Conformation | | Condition | |
|----------------|-------|--------|-----|--------------------|-----------------|--------------|-----------------|------------|-----------------|
| Age (Yrs.) | Breed | Sex | No. | Ave. (lbs.) | SE ² | Ave. Grade | SE ² | Ave. Grade | SE ² |
| 2 | Angus | Steer | 10 | 386.0 ¹ | 14.58 | 12.1 | 0.29 | 12.1 | 0.26 |
| | AXH | | 24 | 438.7 ² | 8.73 | 11.7 | 0.19 | 11.9 | 0.17 |
| | Angus | Heifer | 17 | 343.5 ¹ | 11.18 | 11.6 | 0.23 | 11.9 | 0.24 |
| | AXH | | 23 | 412.2 ² | 8.92 | 11.5 | 0.21 | 12.0 | 0.20 |
| 3 ⁴ | Angus | Steer | 15 | 420.1 ¹ | 11.90 | 12.0 | 0.24 | 12.0 | 0.21 |
| | AXH | | 4 | 496.3 ² | 21.38 | 12.8 | 0.45 | 12.4 | 0.41 |
| | Angus | Heifer | 12 | 383.1 ¹ | 7.14 | 12.2 | 0.15 | 12.1 | 0.15 |
| | AXH | | 9 | 461.4 ² | 14.25 | 12.9 | 0.33 | 12.7 | 0.18 |

^{1,2} Means with different superscripts within column within age of dam within calf sex are significantly ($P < .01$) different.

³ Standard Error.

⁴ No statistically significant difference in weaning weight, conformation, or condition was found due to previous reproductive performance of cows in either breed group. Thus, all calves of each breed-sex group represented in these means.

Table 5. Weights and Scores as 2 and 3-year-olds from Before Calving to After Weaning of Crossbred and Angus Cows that Nursed Calves

| Age (Yrs.) | Dam | | Before Calving | | | | Before Breeding | | | | After Weaning | | | |
|------------|------------------------------|-----|----------------|-----------------|-------|-----------------|-----------------|-----------------|-------|-----------------|---------------|-----------------|-------|-----------------|
| | Breed | No. | Wts. (lbs.) | SE ² | Score | SE ² | Wts. (lbs.) | SE ² | Score | SE ² | Wts. (lbs.) | SE ² | Score | SE ² |
| 2 | Angus | 27 | 759 | 12.1 | 4.30 | .13 | 632 | 11.7 | 3.56 | .13 | 752 | 15.9 | 4.04 | .15 |
| | AXH | 41 | 857 | 12.2 | 3.42 | .07 | 713 | 11.0 | 2.57 | .11 | 798 | 12.0 | 2.36 | .12 |
| 3 | First Calf Angus | 12 | 954 | 23.3 | 5.33 | .25 | 792 | 11.5 | 3.54 | .19 | 885 | 27.7 | 4.83 | .34 |
| | First Calf AXH ¹ | 10 | 1066 | 32.3 | 5.10 | .16 | 892 | 29.7 | 3.04 | .25 | 982 | 21.6 | 3.08 | .27 |
| | Second Calf Angus | 15 | 778 | 20.8 | 3.60 | .22 | 694 | 28.3 | 3.14 | .20 | 845 | 27.3 | 4.00 | .26 |
| | Second Calf AXH ¹ | 3 | 908 | 58.9 | 3.00 | .30 | 830 | 25.0 | 2.50 | 1.00 | 965 | 45.4 | 3.00 | .54 |

¹ 1/8 Angus-1/2 Holstein.

² Standard Error.

regained almost their entire calving weight loss by weaning time; but the crossbreds were not able to regain nearly as much of their loss. The greater weight loss and lack of recovery of the crossbreds may indicate the sacrificing of body weight for higher milk production.

For the 3-year-olds, those which did not nurse a calf as a 2-year-old because they did not breed or they lost their calf were separated for weight data analyses as first calf heifers from those which nursed calves both years (Table 5.). Figure 2 points out the greater 2-year-old weight gain of those which did not nurse calves and thus were heavier as 3-year-olds. Of the 3-year-old first calf heifers (Table 5), the crossbreds were significantly ($P < .05$) heavier at all three periods; but the condition scores were not statistically different even though the Angus scored slightly higher in each period. The crossbreds weighed 112 pounds more before calving and 97 pounds more after weaning. Both breeds lost 160-175 pounds (17 percent) from before calving to before breeding (May 1) which was comparable to the percentage loss of the 2-year-old first calf heifers. These 3-year-old first calf heifers also lost 70-85 pounds (7-8 percent) during the entire lactation which was comparable to the percentage loss of the 2-year-old crossbreds but more than the 2-year-old Angus.

In the 3-year-old second calf groups are cows that rebred after having their first calf as 2-year-olds; therefore, the number of crossbreds

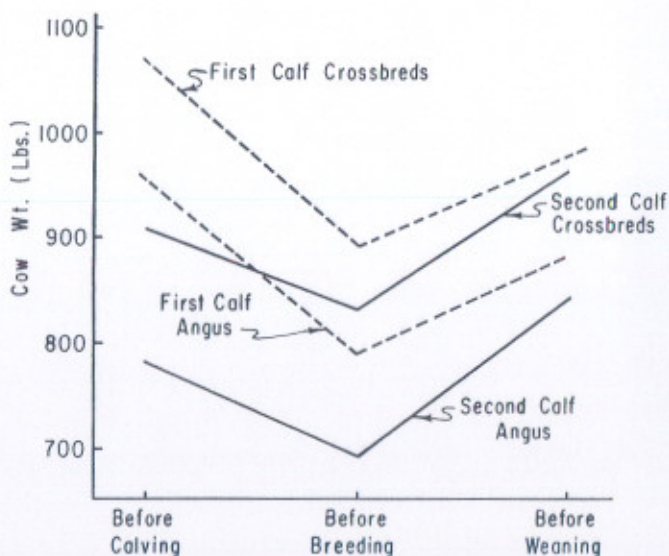


Figure 2. Weight change curves of first and second calf 3-year-old cows.

is quite small due to poor rebreeding. These crossbreds weighed 120-135 pounds more than the Angus at all three periods, but their scores were lower by .6 to 1.0. An interesting point (Figure 2) is that both breed groups of 3-year-old second calf cows lost only half the weight (about 80 pounds) that the 3-year-old first calf cows lost from before calving to before breeding. This represents a 9-11 percent loss for the second calf cows compared to a 17 percent loss for the first calf cows. This difference may have been due to the second calf cows weighing less before calving. Also the 3-year-old second calf cows gained about 60 pounds during their entire lactation which is considerably different from the losses of the first calf 2- and 3-year-olds. A higher level of nutrition was given the cows as 3-year-olds which could explain some of the differences between age groups, but this does not explain the differences within the 3-year-olds.

Figure 2 shows the weight change curves for all four groups of 3-year-old cows. From this graph a comparison within breed of the first and second calf cows can be made. The crossbred cows that had their first calf as 3-year-olds weighed considerably more (158 pounds) before calving than their contemporary second calf cows. However, this difference narrowed to 17 pounds after weaning. When comparing the 3-year-old Angus first to second calf cows, differences were found of 176 pounds before calving and 40 pounds after weaning. This narrowing of the difference after weaning is due to the greater loss of weight before breeding of the first calf cows and the greater weight gain during the summer for the second calf cows.

In summary, the crossbred cows were larger in size and carried less condition during their first and second lactations than the Angus. The first lactation was the most difficult time for both breeds of cows to maintain their weight and condition even if they calved first as 3-year-olds. It appeared that providing some additional feed early in lactation to 2-year-old crossbreds decreased their weight loss and increased conception rates. The condition scores of both breeds seemed to change in accordance with body weight.
