

BEEF CATTLE BREEDING: PAST, PRESENT AND FUTURE

**Roy T. Berg, Professor Emeritus
University of Alberta Edmonton, Alberta**

In 1955 when I returned from the University of Minnesota with a fresh Ph.D., the beef industry in Alberta was dominated by the Hereford and other British breeds. There was an elitist attitude toward purebreds--they were considered to represent the apex of the beef cattle breeding pyramid. Improvement meant improving the purebreds and letting the resultant superiority filter down to the commercial producers. There was also a strong breed loyalty through the whole industry, almost a religious fervor of blind faith. The show ring was the main criteria for determining the merit of beef animals. Pedigrees were also very important, particularly the relationship to outstanding show-winners. Performance testing was in its infancy but was destined for an impressive increase in importance and use. Performance testing stations soon sprouted up and home testing became popular.

Dwarfism had reached a level of serious concern by 1955, particularly in the Hereford breed which was the dominant beef breed in Alberta at that time. There was pressure on me as a budding geneticist to help solve the Dwarfism problem. My approach was not popular. I felt that Dwarfism was caused by what breeders had been doing, not by any act of God or disease. The most likely cause was the emphasis, particularly in the Show Ring, on a "Compact" type characterized by short legs, short and thick body accompanied by very slow growth rate and reduced body size. The Hereford breed elected to go on a pedigree "Witch Hunt" purging those with any relationship to a Dwarf in five generations. I believe vestiges of this witch hunt still exist, although the prevalence of dwarfism has long passed. Reversing the selection basis to an emphasis on growth rate and size eliminated the "compact" animal which was the prime source (as a heterozygote) of the Dwarfism gene.

Crossbreds were considered to be mongrels in 1955 although some crossbreds were grudgingly conceded to have certain useful attributes as market animals. Breeding from crossbreds was considered to be a sure route to disaster. A very small proportion of the commercial beef herd was crossbred in 1955. In 1990 by contrast, fully 90% of beef market animals in Alberta were crossbred.

By 1955 hybrid vigor or heterosis was clearly established as a genetic phenomenon in mammals and its exploitation was the main thrust in poultry

breeding and it was making inroads into swine breeding. Research on hybrid vigor in beef cattle was being conducted under the guidance of scientists in a few locations in North America. Brahman crossbreds were being evaluated in the southern States and the British breeds were being tested as crossbreds in some experiments, the most comprehensive involving Herefords, Angus and Shorthorns in Montana. A.M. Shaw and J.W.G. (Grant) MacEwan (later Lieutenant-Governor of Alberta) at the University of Saskatchewan had completed crossbreeding trials with Hereford, Angus and Shorthorns by the early 1940's.

In Alberta, beef cattle breeding experiments were in progress at Manyberries (first directed by Harry Hargrave, followed by Hobart Peters who had a Ph.D. under the supervision of Dr. Winters at Minnesota) and at Lacombe under the direction of Jack Stothart and Howard Fredeen. Manyberries was in the middle of a lifetime study comparing Brahman X Hereford cows with Herefords on the range. They also were involved in the "Cattalo" project of Bison X Cattle crossbreds. Later, Highland X Hereford cows were compared to Herefords on the Manyberries range.

Interestingly, both crossbred groups (Brahman and Highland by Hereford) exceeded Hereford in lifetime production as did the Cattalo. The industry was not ready to capitalize on these results and the crossbred groups faded into oblivion as did the Cattalo - the conclusion being that since these crossbred groups were "not much superior" to the Hereford, it would be better to concentrate on the purebred, the implication being that "purity" had certain innate value, such as "prepotency" and "uniformity".

The Experimental Farms of Agriculture Canada had early been populated by Shorthorn cattle which were available to Howard Fredeen at Lacombe, He established a comprehensive selection experiment using performance criteria and the Shorthorn breed. This research further demonstrated the heritable nature of performance trials, justifying their consideration in beef cattle improvement programs.

By 1955 the advantage of the use of crossbreds as the base for new lines was clearly demonstrated by Winters with his Minnesota Lines of swine. There was no institutional research where crossbreds were used as a foundation for improved lines of beef cattle. Research on Inbred lines within the Hereford breed were in progress at Miles City directed by Ray Woodward and in Colorado by H.H. Stonaker. There was, however, historical evidence that many breeds of cattle were established by mixing cattle from diverse origins. Some of this mixing resulted from movement of cattle through conquest and human migration where cattle were brought along. The development of the Santa Gertrudis from planned crossing of Brahman and Shorthorn breeds was well documented. Torn Lasater's Beefmaster base was

Brahman, Hereford and Shorthorn crosses accompanied by his unique selection program emphasizing traits of economic importance.

So by 1955 there was ample evidence of the value of cross-breeding to produce hybrid vigor and its associated benefits. There was also a clear indication that economic traits were amenable to improvement by selection. There was to this time no controlled experimentation to test the value of using a crossbred base as the starting point for a beef improvement program.

In 1955 the University of Alberta, through its Department of Animal Science, headed by Dr. L.W. McElroy, was poised to embark on a Beef Cattle breeding program. Previously the Department of Animal Science had concentrated on feeding and nutrition research. Genetics was the first expansion departing from the long tradition of nutritional research. Subsequently the Department would add cold climate physiology, biochemistry, and meat animal growth physiology and reproductive physiology to its roster of specialization.

Not only were we, at the University of Alberta, anxious to begin beef cattle breeding research, the industry was becoming very supportive as were members of the Provincial and Federal Departments of Agriculture. For me there followed five years of writing proposals, building support in the industry and among professionals in government and research services. Principals in the Western Stockgrowers' Association (representing Alberta cattlemen's interests since 1896) were strong supporters. Included among this august group were Charlie McKinnon, Bert Hargrave, George Ross, John Cross, Ali Streeter, Gordon Burton and others. The alphabet society, (ABCPA - Alberta Beef Cattle Performance Association) whose first President was Sherm Ewing, were a group of progressive commercial cattlemen very interested in promoting Beef Cattle Breeding Research.

Harry Strom, Member of the Legislative Assembly from Medicine Hat (later Minister of Agriculture and Premier) probably prodded by his friend and neighbour, Bert Hargrave, presented a bill to the Provincial Legislature to approve support for the purchase of a cattle ranch for the purpose of conducting beef cattle breeding research. Two hundred thousand dollars was made available from the Horned Cattle Trust Fund (accumulated by a .tax on cattle marketed with horns). A ranch of approximately 5400 acres was purchased north of the town of Kinsella, approximately 95 miles SE. of Edmonton. The fund was sufficient to purchase the land (\$17 an acre), make improvements (fencing, two houses, garage-shop) and to purchase foundation stock (170 head). In 1964 a further grant from the Horned Cattle Trust Fund of \$64,000 was received to build a 300 head performance testing facility. Subsequent land acquisition has increased the Ranch to more than 7000 acres, accommodating a breeding herd of 650 to 700 cows.

A long term experiment was started in 1960 to compare selection from a purebred herd with a herd established from a crossbred foundation. While the crossbred herd was being established some supplementary results on the potential for crossbreeding were obtained.

Initially, two distinct herds of cattle were established -- one (the control) a purebred Hereford foundation and the other based on a crossbred foundation, originally referred to as the Hybrid Herd and later renamed Kinsella Synthetic #1. The breeds chosen to establish the hybrid foundation were Charolais (for growth and meatiness), Angus (for mothering ability and carcass merit), and Galloway (for hardiness). Even at the time, I stressed there was no magic in the selection of the specific breeds for the hybrid foundation but an attempt was made to choose breeds which seemed to have the possibility of contributing complementary merit. Truly we knew very little at the time (ignorance is bliss!) about some of the major traits mentioned (carcass merit, hardiness, mothering ability). However complementary research over the years has yielded much knowledge about these and other traits and their possible improvement.

The Hereford and Hybrid herds were subjected to identical conditions and after the populations were sufficient (i.e., over 100 head) the selection of replacements was from within the herd. The Hybrid herd has remained closed for more than 30 years but the Hereford was opened up to introductions in the latter stages to facilitate a control which would be more representative of the breed in general.

Selection in both lines was identical and simple. Bulls were primarily selected on the basis of their growth rate at a year of age and females were required to wean a calf each year or they were culled. Minor selection and culling criteria included freedom from calving difficulty, cow productivity, broken-down udders, general soundness and temperament.

In 1970 a second synthetic population was established by combining three large dairy breeds (Holstein, Brown Swiss and Simmental) with surplus beef breed cows on the ranch. This line called the Dairy Synthetic settled down to contain about 60% of the dairy breeds and 40% of beef breeds.

After 30 years certain conclusions can be drawn relative to breeding improvement from a hybrid versus a purebred base:

- 1) Selection for growth rate was effective in all 3 lines. **Rate of** improvement in growth rate was higher in the Synthetic Lines.
- 2) Reproductive rate was higher in the Synthetic Lines.

3) When comparisons were made on the basis of weaned calf weight per cow exposed to breeding, the Beef Synthetic exceeded the Hereford line by 28% and the Dairy Synthetic was 35% superior to the Hereford.

4) Over a period of about 20 years the A.D.G. from Synthetic #1 bulls rose from 2.8 lb/day to 4.5 lb/day. Compared with other breeds on an official Government supervised test over a 5 year period, the Synthetic #1 bulls were consistently in first place for growth rate and for feed efficiency, a number of the SYI bulls exceeded 5 lb/day in feedlot gain each year.

There were also some negative features discovered through our research:

1) Increased growth rate ultimately increased calving difficulty. I believe this is because selection of bulls has a more rapid turnover than females and the male:female compatibility is compromised, i.e. calves get too big for the heifer to deliver.

2) Increased growth rate leads to increased cow size which may lead to a breakdown in the compatibility of the cow to the environment, resulting in lower reproductive performance.

3) Increased weaning weights are accompanied by increased milk production and thus increased feed requirements for the cow. If the pasture conditions are limiting the result could lead to increased reproductive failure.

These negative results are not restricted to Synthetics. However they will be more pronounced in lines which are more extreme in size or milk production. Often as productivity is increased breeders make management and feeding adjustments (almost without knowing they are doing so). Thus they can be caught on a treadmill that progressively accentuates the problem.

For these reasons, I believe that future selection programs will be designed to produce an optimum cow, adapted to and productive under the conditions imposed by the ranch environment. The final criterion will be profitability which will also control how much intervention in terms of feed, health care, environmental control and associated investment in machinery, buildings and other facilities that could be justified. Most of the performance testing programs promoted and used over the past 40 years have encompassed selection criteria which lead to maximizing of particular performance traits.

My conclusions after 40 years of research is that maximum must give way to optimum - optimum cow size, optimum milk production, optimum birth weights - the optimum finally being determined by net economic return. The optimum would differ under different soil / climatic zones and could well differ from ranch to ranch. Performance testing programs in the future will be designed to aim for a combination of traits that are predicted to produce the most profit for the enterprise. Simulation models will be used to predict the best combination of traits, management alternatives, input costs and returns to produce the greatest profits.

Whatever hopes breeders might have for their breed in commercial production of the future, their breed will have to fit into profitable crossbreeding programs.

*Presentation at International Galloway Congress
Calgary, Alberta, Canada
July, 1997*