

## **Cattle Breeding in Canada**

### **Canada Agriculture - The First Hundred Years**

#### ***Livestock Records Centralized***

Toward the end of the nineteenth Century, Canada's trade in purebred livestock was becoming well established and in order to assist it, the Department took steps to have the Canadian herd and stud books properly recognized in other countries. In 1900 an Act was passed to provide for the incorporation under federal charter of the various breed record associations. Then in 1905 an amendment to the Act Respecting the Incorporation of Live Stock Records permitted the bringing together of the Canadian National Livestock records in a central office, under financial assistance from the Department. A provision of the amended Act required that not more than one association for each distinct breed of horses, cattle, sheep, and swine could be incorporated under federal charter. A new policy adopted by the Livestock Branch in 1913 was designed to encourage the breeding of better livestock through the use of purebred sires. The Branch undertook the purchase of superior sires and loaned them to associations of farmers, particularly in newly settled areas.

#### ***Lacombe Research Station 1907-1982 (Dr. Howard Fredeen)***

Cattle Bangs disease continued to be a problem with the cattle herd. Calf hood vaccination, initiated as a control procedure in 1946, could not be evaluated until the heifers came into production and the culling of reactor cows was deferred to ensure a "strenuous" test of the efficacy of the vaccination program. This part of the testing work was conducted in conjunction with the Animal Pathology Division of Dominion Science Service. To control spread of the disease the practice of year round breeding was replaced by a 10-week midsummer breeding season, the cow herd was placed under an outdoor management regime, and the only animals to enter the barn were young bulls for performance testing. The change in breeding practices also provided animals of uniform age for the testing program.

The testing program was intended to serve three purposes. One was to develop testing procedures appropriate for genetically meaningful performance evaluation. The second was to provide detailed information on pre- and post-weaning growth curves for beef animals. The third purpose was to provide information to be used in a program of selection for rapid growth rates of potential herd sires. Calves were weighed weekly from birth to 1 year of age, milk production of the dams was measured weekly from calving to weaning, and complete feed consumption records were taken during the post-weaning period. Results from the vaccination program were analyzed in 1949. Full control had not been achieved but the data indicated that any heifer that gave a positive test at the time of vaccination (less than 8 months of age) was unlikely to respond favorably.

Selection studies also began in 1949. Two half-brothers produced within the herd, one with a high growth rate and the other with low one during the post-weaning performance test, were mated to contemporary groups of females. Results from 3 years of matings clearly demonstrated the effectiveness of selection for genetic improvement of growth rate. This evidence, reported by Howard Fredeen to the 1952 annual meeting of the Canadian Society of Animal Production and to the Animal Husbandry Staff Conference convened at the same time by the Dominion Animal Husbandman, Dr. Karl Rasmussen, led to the first cooperative beef breeding project in the experimental farms system. The cooperating centers were Brandon, Indian Head, Scott, and Lacombe.

The high-low beef breeding study and a companion study on growth and development of beef cattle, begun at Lacombe in 1949 and extended as cooperative projects with Scott, Indian Head, and Brandon in 1952, had been intended as pilot studies for performance selection programs. The results obtained provided much of the input to the national record of performance program (beef) when that was designed in 1957 and also paved the way for a controlled selection experiment based on post weaning growth. This project, designed at Lacombe, required a large breeding population and once again co-operative arrangements were made with Brandon, Indian Head, and Scott. Melita, a substation of Brandon, was also involved. Howard Fredeen was project leader and the program was in place for the 1957 breeding season with a total breeding herd of 500 Shorthorn cows. Cows at the five locations shared a common breeding background but the operation, designed as two closed-herd replicates, was later consolidated at two locations, Brandon and Lacombe. Ed Linton was beef herdsman at Lacombe until 1963 and his successor was James Asher who came to Lacombe from Scott, Sask., in 1960.

This was the largest beef cattle selection program ever undertaken in the world and the genetic information it provided over five generations represented the first clear evidence of the efficacy of consistent performance selection with this species. The increase in yearling weight of bulls averaged 10 kg per year, of which approximately 45% resulted from genetic change. Selection for desirable characteristics did not have any undesirable side-effects, and the improvement represented an increase in the growth rate of lean tissue.

The Shorthorn selection project was suspended in 1970 so that the breeding herd could be used to produce crosses for evaluation of new beef breeds being imported from Europe. Prior to 1950 only three breeds, the Hereford, Angus, and Shorthorn, were recognized as beef breeds in Canada. The Charolais, introduced early in the 1950s by some enterprising Canadian cattlemen, came to this country from the United States as animal health regulations prevented direct importation from Europe. In 1964, development started on a maximum-security health inspection and quarantine facility for cattle entering Canada and 2 years later Jack Stothart was commissioned to visit Europe, evaluate the cattle breeds in terms of beef potential under Canadian conditions, and choose representative breeding stock of the best breed for import by the Department. His first choice, the Swiss Simmental, was not available that year. In their stead, Jack selected bulls and eight heifers of the French Simmental (Pie Rouge). Prior to their arrival, Lacombe documented a comprehensive program for evaluation of growth and carcass characteristics of first-generation crossbred F1 [subscript] steers and of the lifetime reproductive performance of F1 heifers produced by mating bulls of the new breeds with the three British breeds available in Canada. Jack Newman also developed contracts with 20 producers in Alberta to use their Hereford and Angus cow herds for production of the F1 crosses for this study.

The Simmental imports, after clearing quarantine in April 1968, were delivered to Lacombe and approximately 500 Angus, Hereford, and Shorthorn cows were bred to Charolais and Simmental sires that summer to initiate the study. Meanwhile, Jack Stothart had returned to Europe to select Limousin breeding stock for the project and Lacombe proposed a collaborative evaluation of the reproductive performance of crossbred females sired by Charolais, Limousin, and Simmental bulls in the contrasting environments of Brandon, Lacombe, and Manyberries. This foreign cattle breed evaluation program (FCBE) proposal was accepted; Brandon and Lacombe undertook production of the F1 [subscript] crosses, John Lawson of Manyberries arranged for purchase of Hereford x Angus heifers to serve as a control population, and the project was launched in June 1970, by transfer of yearling F females to Brandon and Manyberries. A herd of 1150 females was assembled over 3 years and the first progeny of those females were calved in the spring of 1971. In preparation for herd buildup at Brandon, that station's Shorthorn herd was transferred to Lacombe in 1970 and the Limousin breeding herd followed in 1971.

From its inception, this program has been directed by a committee comprising Howard Fredeen (Chairman), John Lawson of Manyberries, Jack Newman and Milton Weiss of Lacombe, and Gunther Rahnefeld of Brandon. Brandon and Manyberries maintained and managed the F1 [subscript] cow herds and Lacombe developed and maintained the data bank and evaluated the feedlot performance and carcasses of calves produced at Manyberries. All calves produced after the heifer production year were three-way crosses sired by Charolais, Chianina, Limousin, and Simmental bulls. The Chianina breed had been imported from Italy in 1970, with Jack Stothart again serving as selector for the Department.

After 1972, the Shorthorn herd at Lacombe was employed by Jack Newman for evaluating crosses of several other "exotic" breeds, including Blonde d'Aquitaine, Gelbvieh, Maine-Anjou, Marchigiana, Murray Grey, Pinzgauer, and Romagnola. Crosses produced by Hereford cows mated with South Devon, Maine-Anjou, and Simmental sires were also evaluated in a cooperative study with Palmer Ranch of Hillspring, Alta. Evaluation criteria for all this work included calving ease, birth weight, weaning weight, feedlot performance, and carcass traits.

Cattle inventories grew during this period. The breeding herd increased to 600 head of Shorthorn, Simmental, Limousin, and Chianina cows, with feedlot and carcass evaluation performed on approximately 1200 head annually. To accommodate these cattle the Kasha property was purchased in 1965, additional pasture was leased for summer grazing, and feedlot facilities were expanded during the period 1970-1972. Jim Asher retired prior to the period of herd expansion and Glen Rafuse, his successor in 1969, introduced the use of saddle horses to the cattle operations, designed efficient corral and weighing facilities, and supervised the transition from pasture breeding to artificial insemination. One of the "cowboys" he trained, Adam Schonheiter (1960-1976), who started employment at Lacombe as a poultryman, took over as head herdsman when Glen resigned in 1972. Ian Turnbull (1969-present), a technician in the beef research program who had a key role in the contractual production of F females for the FCBE program, became herdsman when Adam retired in 1976. Other long-term cattle herdsman were John Van der Zee (1942-1968) who, like Adam, had worked with poultry, Lawrence Christianson (1972-1981), and Darrel Neal (1970-present).

#### ***The Lethbridge Research Station – 1906-1976 (Alex Johnson)***

A crossbreeding experiment with Brahman cattle began in July 1950 in cooperation with Henry and James H. Mitchell of Battle Creek, Sask. They provided a Brahman bull, 13 Shorthorn cows, and 10 Aberdeen Angus cows for the project. The Range Station agreed to provide 12 or more Hereford cows and to keep, feed, and care for all animals involved in the experiment until November 1955. The first Brahman bull, Madera Tippu 2nd, supplied by George G. Ross, Sr. and used in the breeding program during the summer, died on November 19 when the temperature dropped to -24°C (- 12°F). His replacement was housed in a closed shed throughout the following winters. Some of the heifer calves from these crosses were retained for a lifetime-productivity study in comparison with the Hereford breed. The crossbreds wintered with the other range cattle and made equal body weight gains. They were active and foraged willingly away from the feed-grounds whenever the Herefords were able to graze. The performance of the Brahman crossbreds exceeded expectations.

A recommendation from Ottawa that animal breeding should have priority over range management research at Manyberries resulted in an active construction program at the Range Station. A Quonset shed for cattle feeding was built in 1957; a garage and shop, duplex residence, and an office-and-laboratory building in 1958; and an assembly hall and another duplex in 1960. Cattle and sheep corrals, cross-fences in breeding pastures, and a number of water developments were also constructed.

The cattle breeding project with purebred Hereford and Angus cows was revised to include two lines of 30 animals of each breed. By 1958, 46 Hereford and 52 Angus cows were acquired for the project. The male calves were fed a performance-testing pelleted ration, but they frequently became bloated because of the high proportion of finely ground alfalfa hay in the pellets. Use of coarser-ground alfalfa and larger pellets almost eliminated the bloat problem.

A breed development program in cooperation with Ross Ranches began in 1963. Holstein and Brown Swiss bulls (the same bulls that were used in the breeding of the Hays Converters) were crossed with Hereford range cows in 1963 and 1964. Some Red Angus and Shorthorn cows were introduced into the program. Selection of bulls and heifers for replacement was based on yearling weight. A group of Hereford cows was maintained as a control so that the rates of improvement: in the two herds could be compared.

#### ***One Hundred Harvests Research Branch Agriculture Canada 1886-1986 (Dr. Tom Anstey)***

The great central plains of North America, stretching from Texas into Canada, were once the domain of the bison, the only bovine native to North America. Through this region the climate varied from extreme dry heat in summer to frigid blizzard winds in winter. Summer pastures varied from and to semi-forested areas. During the winter, parts were buried in snow, often heavily crusted from periodic chinook winds. Through centuries of natural selection, the bison adapted to these conditions. Herds in uncounted millions, followed the grazing, the water supplies, and the seasons. When necessary, they pawed through snow to feed on the fall-ripened forage. If caught in a blizzard, they faced into the wind until the storm subsided.

The cattle brought from Eastern Canada did not possess these attributes. They performed adequately if intensively managed with particular attention to winter feed and shelter, but they lacked the capacity to survive and reproduce under the extensive management appropriate to range conditions. Settlers quickly learned that more reliable production could be obtained from cattle imported from the western United States. These cattle, many of which had originated as far south as Texas, were extremely hardy, a quality that compensated for their deficiency in conformation and growth characteristics traditional of British breeds. They were not purebreds. Their ancestors were of many different breeds and their hardiness was a direct result of unprogrammed, natural selection, and hybrid vigor.

It was predictable that winter hardiness would be the first issue to attract research attention. Improved winter hardiness resulting from natural bison x cattle crosses had been observed as early as 1750 through practical experience in the south central United States. By 1885, deliberate matings were made by ranchers in Canada and the northern United States. Among the recorded successes was that of an Ontario breeder, M.M. Boyd, who began his crossing program in 1894. He called the hybrid, cattalo. When his herd was dispersed in 1916, E.S. Archibald, Dominion Animal Husbandman, acquired 16 females and four

males for experimental evaluation at Scott, Saskatchewan. In 1919, in cooperation with the Department of the Interior, the herd was moved to Buffalo National Park, Wainwright, Alberta, and was augmented by the introduction of cattle, bison, and yak. Deakin, Muir, and Smith, the scientists responsible for this work, reported that none of the original Boyd cattalo produced offspring, and all results subsequently obtained in the experiment were from the animals introduced after 1919. The final move was to Manyberries, Alberta, in 1950, where the herd came under the direction of H.A. Hargrave and H.E. Peters.

Hybridization with the yak was discontinued in 1928, its progeny having been judged as inferior in winter hardiness to those incorporating bison. The bison crosses with domestic cows resulted in 77 percent calf mortality, and males of this and the reciprocal cross were invariably sterile. Fertility of the hybrid female was also low but, through backcrosses with domestic sires, a cattalo line was produced. Functional males carrying more than one-eighth bison never were observed. This established the maximum limit to the genetic contribution of bison. Subsequent studies indicated that, compared with Herefords, the cattalo had no advantage in growth or carcass performance. The work was discontinued in 1965.

The 1916 decision to purchase the cattalo herd marked the advent of cattle breeding experimentation by the Experimental Farms. No further breeding research was undertaken, however, until 1949 when J.G. Stothart and H.T. Fredeen at the Experimental Station, Lacombe, Alberta, initiated a selection study with Shorthorns that involved two half-sibling bulls of distinctly different feedlot performance. One had an average daily gain of 1.11 kg/day, the other 0.77 kg/day. Each was mated to representative cow herds. The resulting progeny from the high performance bull were heavier both at birth and when weaned than those from the low performance bull. Furthermore, the average daily gain, feed required per kilogram of gain, and age to finish were each in favor of progeny of the high performance bull. The results formed the basis for the national beef ROP testing program adopted in 1957. The study evolved into a large-scale Shorthorn selection project with herds at Brandon, Manitoba; Indian Head and Scott, Saskatchewan; and Lacombe, Alberta. From 1957 to 1970, Newman, Rahnefeld, and Fredeen (62) achieved annual genetic gains in yearling weight of 4.5 kg per animal and established the practice of selecting for performance in beef cattle.

Shortly after the cattalo herd was transferred to Manyberries, Hargrave, Peters, and J.E. Lawson initiated studies to evaluate the reproductive potential under range conditions of crossbred females other than cattalo. They mated Highland and Brahman sires with Hereford cows. Highland cattle, native to the damp mountainous regions of northern Scotland possess long, heavy hair, and gave promise of transmitting winter hardiness to their offspring. The appeal of the Brahman did not stem from its potential hardiness. It had originated in the southern United States from zebu strains imported from India with little promise of adapting to winter climates. What it did possess was a genetic background uniquely different from the British breeds and the scientists reasoned that this difference might provide additional vigor in their female hybrids.

This expectation was fulfilled. The Brahman crosses proved well adapted to the Manyberries range. Though somewhat temperamental, they conceived and calved easily, were good mothers, and consistently produced calves with high weaning weights. The most successful cross was the Brahman x Shorthorn, a prime example of hybrid vigor, since the offspring were substantially more hardy than either

of the parent breeds. Brahman crosses, compared with Herefords, suffered less attrition, lived longer, and during their lifetime produced 25 percent more calves in number and 52 percent more calf weight at weaning.

In 1963, Lawson initiated an experiment with the Angus and Hereford breeds to evaluate their response to selection under a high-energy diet (60 percent barley) and a low-energy diet (100 percent chopped alfalfa). Though not complete yet, the initial results from three generations indicate that the lines selected on the low-energy diet have superior milk production, greater fat, protein, and solids-not-fat content in the milk, and increased calf weights at weaning than those selected under the high-energy diet. These results are expected to influence the way beef animals will be chosen in future.

A new era in Canadian beef production began in 1951 when some enterprising cattlemen imported a few Charolais cattle from the United States. Other cattlemen, impressed with the outstanding carcass and growth potential of Charolais crosses, began to switch their allegiance from the traditional breeds to hybrids. Pressure mounted to open the Canadian border, long closed for reasons of animal health security, to importation of breeds from continental Europe. The Honourable Alvin Hamilton, Minister of Agriculture in 1960, instructed K.F. Wells, Dominion Veterinarian, to arrange some means of safely importing European cattle. By the time all arrangements were complete, the Honourable Harry Hays was Minister of Agriculture. He inaugurated an import scheme in 1964 by establishing quarantine facilities and rigorous health inspection procedures for cattle entering the country.

Charolais and Simmental breeds were the first European imports to clear quarantine in 1967. They were augmented in 1968 by the Limousin, Maine Anjou, and Brown Swiss breeds. Although many others have entered Canada since 1968, these initial breeds have had the greatest impact on cattle production throughout Canada. Growth rate, muscular conformation, and mature size were the attributes that attracted the interest of western Canadian cattlemen. Thus, the initial emphasis was to produce first-generation hybrid calves for slaughter. Some attention was given to selecting superior hybrid females required for breed propagation. It was evident, however, that the difference between these breeds and the British breeds might confer greater heterosis for reproductive traits than had been attained when crossing among the British breeds. This had been the practical experience of those who had worked with Charolais crosses since the early 1950s.

H.T. Fredeen, J.A. Newman, and J.G. Stothart, of the Research Station, Lacombe, Alberta, initiated a study in 1967 to measure the effects of crossing European and British breeds. Their objective was to evaluate the lifetime reproductive performance of hybrid females from matings; of Charolais, Limousin, and Simmental sires with Angus, Hereford, and Shorthorn cows. In 1969 J.E. Lawson at Lethbridge and G.W. Rahnefeld at Brandon joined the team, making additional facilities available to evaluate the hybrid females under diverse environmental conditions. To the Lacombe group came G.M. Weiss, a statistician, and A.H. Martin, a meats specialist.

The program developed into four interrelated phases. Phase I produced hybrid females to evaluate their lifetime reproduction capabilities and hybrid males for feed efficiency and carcass evaluation. Phase II measured the reproductive performance of hybrid females under intensive pasture production at

Brandon and extensive semiarid range production at Manyberries. Phase III examined both cow herds for winter feed requirements and summer lactation. Phase IV, still in progress, evaluates the lifetime reproductive performance of females from backcrossing the hybrid females to sires of their parental breeds. Phases I and II now are completed and are reported (17) by Fredeen and coworkers. The size and complexity of the experiment can be judged by realizing that 10 crossing groups resulted in 5053 pregnancies.

The findings of Phase II validated the original assumption that heterosis of the hybrid females would be related to the genetic diversity of the parent breeds. The lifetime productivity of animals from the Hereford x Angus cross, the breed combination long favored by western cattlemen, was inferior to the productivity of animals from all other crosses. Weaning weights of Hereford x Angus progeny were 10 to 15 percent less than those of the progeny of hybrid dams sired by Charolais and Simmental. Differences between progeny from at least one European breed varied depending upon environment. For instance, the most productive progeny under the conditions at Manyberries were from Charolais x Angus. At Brandon, progeny from Simmental x Shorthorn were superior.

An integrated evaluation of all the evidence revealed that these differences (interactions) were related to the milking potential of the hybrid females. Progeny of the Simmental x Shorthorn cross were superior in weaning weight at both locations, an indication of greater milk production. This superiority was reflected in a longer reproductive cycle and a reduced conception rate under the harsh environment at Manyberries.

These results clearly have demonstrated that heterosis is not a panacea for beef producers in Western Canada. Genetic superiority in the reproductive potential of beef cattle can be detrimental to lifetime productivity unless matched with environmental or management practices adequate to sustain the biological demands imposed by that potential.

Some insight into this problem has been provided by the results of Phase III. Subcutaneous fat represents insulation as well as an important energy source for the brood cow. Experience at Manyberries indicates that cows carrying less than 5 mm of fat when weaned in October do poorly during the winter and have substandard conception rates the following summer. Except for the Hereford x Angus cows, which average 8 to 9 mm of fat at weaning time, all nursing cows of the other crosses at Manyberries range from 0 to 5 mm of fat in the fall. To restore them to an acceptable level of fatness for winter has required up to 50 percent more feed than amounts commonly recommended for the winter period. Phase IV will not be completed for several years.

The beef breeding program has shown the value of careful selection for economic traits, of maintaining high-quality purebred lines, and of using these purebreds in hybrid programs designed to match genetic characteristics with environmental constraints. As the advantages of advanced technologies increase, a fuller understanding of the biology becomes essential.