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REPRODUCTIVE PERFORMANCE OF FOREIGN X DOMESTIC HYBRID COWS UNDER TWO MANAGEMENT SYSTEMS

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In 1968, the Canada Department of Agriculture started a project to evaluate the reproductive performance of hybrid females produced by mating Charolais, Limousin, and Simmental bulls with Angus, Hereford, and Shorthorn cows. Most of the Shorthorn hybrid females were produced from cows at the Brandon and Lacombe research stations. Angus and Hereford hybrids were produced in herds similar to those used for commercial production in the Prairie Provinces. All matings were by artificial insemination using 8-10 bulls chosen at random annually from each sire breed. Bulls were allocated equally and at random to cows of each herd participating in the project.

After weaning at about 7 months of age on the ranch of origin, the hybrid heifers were transferred to Brandon or Lacombe for rearing. On completion of the rearing period (14 months of age), they were reallocated at random to two contrasting environments—Manyberries, Alta., and Brandon, Man. At each location management and nutrition conformed to the commercial practices in that region.

The mating plan to produce the original hybrid females resulted in nine hybrid combinations—three sire breeds X three dam breeds. A tenth combination, the commercially popular Hereford X Angus cross, was added at Manyberries and Brandon to serve as a control group. Hybrid females, introduced to the project over a 3-year period, produced their first calves in 1972, 1973, or 1974.

The total number of animals assembled for this project was 1150, including the 150 control females. The number of females of each breed cross is summarized in Table 1.

In this project, the annual breeding season at both locations is restricted to a 9-week period beginning June 15. Service is by artificial insemination (AI), and vasectomized bulls are used to assist in heat detection. No clean-up bulls are used after termination of the AI season. The calves are weaned during November 1-10. Herd management at Brandon is intensive and uses restricted areas of cultivated pasture during the grazing season with the cows confined in drylot for winter maintenance. At Manyberries, which is located in the semiarid short grass plains of southeastern Alberta, the herd is managed under the extensive native range conditions characteristic of the region. The cows are left on the range throughout the year, but supplementary feeding is supplied during part of the winter.

Because of extreme drought during the summer of 1973, the cow herd at Manyberries was relocated in mid-September of that year. The new loca-

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tion provided adequate summer range, but as a result of heavy snow the herd had to be fed during the winters of 1973 and 1974. At the new location, exposure of the herd to scour organisms along with bad weather during the calving period resulted in a fairly high incidence of calf scours in 1974 and 1975. The herd was returned to Manyberries after weaning in November 1975.

The yearling hybrid females were mated with Red Angus or Beefmaster bulls. These terminal sire breeds were chosen to avoid excessively high birth weights and thus to minimize potential calving difficulties. For subsequent matings, the terminal sires were Charolais, Chianina, Limousin, and Simmental. The mating plan was designed to produce three-way-cross calves only, and none of the females were back-crossed to their sire breed.

Weaning of the calves produced in 1975 was the midpoint of this project. These calves represented the second, third, or fourth calvings of the three age groups of females in the herd. This publication summarizes conception and calf survival for four consecutive breeding seasons beginning in 1971 and involving 3412 exposures to service. Summaries of the weights of calves at birth and at weaning are based on second and later calvings.

CONCEPTION RATES

Exposures to mating, that is, the total number of females entering the breeding pastures during the test years, were 1716 (including 238 controls) at Brandon and 1696 (including 240 controls) at Manyberries. Conception rates based on the number of calves produced were higher at Brandon by 2.4% (Table 2). Controls averaged 2.6% above the other hybrid groups at both locations (82.4 vs. 79.8% at Brandon and 80.0 vs. 77.4% at Manyberries). Failure of cows to cycle during the breeding season under the more rigorous environment at Manyberries was the main reason for the difference in conception rate at the two locations.

Ranking of the hybrids by sire breed was the same at both locations. Charolais was the highest and Limousin the lowest. The lowest conception rate was recorded by the Limousin X Hereford.

CALF SURVIVAL

Total preweaning calf mortality was highest at Manyberries: 8.9 vs. 6.2% for controls, and 13.7 vs. 7.4% for all other hybrid groups (Table 3). Because the number of calves stillborn or dying during delivery was identical at both stations, these location differences resulted from differences in postnatal mortality. Calf scour was the main cause of postnatal mortality.

The general ranking of the nine groups of hybrid females in terms of total calf mortality was similar at both locations. One exception was the change in rank of the Limousin X Hereford group, which changed from well-below average at Brandon (5.5%) to well-above average at Manyberries (20.8%).

WEIGHTS AT BIRTH AND WEANING

Birth weights of the nine groups of hybrid females at Brandon averaged 44.2 kg (97.4 lb) for males and 41.1 kg (90.6 lb) for females. At Manyberries the

averages were 42.8 kg (94.3 lb) and 39.2 kg (86.4 lb). These sex differences, 3.1 kg (6.8 lb) at Brandon and 3.5 kg (7.9 lb) at Manyberries, were similar to those observed for controls at the two locations; however, control calves at Brandon were lighter than those at Manyberries, 38.5 vs. 39 kg (84.8 vs. 85.9 lb).

At both stations, calves from the nine groups of hybrid females averaged heavier at birth than controls of the same age (Table 4). The overall difference was 4.2 kg (9.2 lb) at Brandon and 2 kg (4.5 lb) at Manyberries. Two of the hybrid female groups at Manyberries, the Limousin X Hereford and the Limousin X Angus, produced calves lighter than the controls at that station. At both stations, the lightest calves were produced by females with Limousin sires or Angus dams.

The average 200-day adjusted weaning weight for calves from the nine groups of hybrid females was 212 kg (468 lb) at Brandon and 196 kg (433 lb) at Manyberries. At both locations, weaning weights of calves from most hybrid-dam groups exceeded the weight of the controls of the same age (Table 5). The only exceptions were calves from the Limousin X Hereford and Limousin X Angus at Manyberries, which averaged slightly less (1%) than the control calves. Differences associated with breed of dam's dam were relatively small. However, differences associated with breed of dam's sire were large and consistent at both locations, with Simmental > Charolais > Limousin.

WEIGHTS OF COWS

At 14 months of age (first breeding), the heaviest hybrid females were the Charolais X Shorthorn and the lightest were the Limousin X Angus. The difference in weights was 41 kg (90 lb). Differences in the average weight for individual hybrid groups at the two locations were negligible.

At 4 years of age, the ranking of individual hybrid groups remained unchanged. The heaviest cows at Brandon were still the Charolais X Shorthorn and the lightest were the Limousin X Angus with a weight difference of 43 kg (95 lb) (Table 6). At Manyberries, the difference in weight between these two groups was 39.5 kg (87 lb). However, cows at Manyberries averaged about 91 kg (200 lb) lighter than those of the same age at Brandon. This difference in weight reflects the cumulative effect of different environmental conditions of the two locations.

Limited evidence, based on the hybrid females born in 1970, indicates that cows at Brandon were still increasing in weight at 5 years of age, whereas at Manyberries there was a loss in weight after 4 years of age (Fig. 1). This loss may have been caused by the rigorous wintering conditions associated with the change in environment when the Manyberries herd was relocated in the fall of 1973.

COW PRODUCTIVITY

Production efficiency is a joint function of conception, calf survival, and the weaning weight of the calves produced. It may be estimated by dividing the total weight of calves weaned from a given hybrid group by the sum of the number of mating opportunities given to the cows of that group.

Estimates based on this procedure (Table 7) suggest that hybrid females sired by Limousin were less productive than the control females at both locations and that those sired by Simmental gave the best results at both locations. However, the margin of Simmental-cross superiority was much greater under the favorable environment at Brandon than under the rigorous conditions at Manyberries, and the relative ranking of the Limousin-cross females was much lower under the rigorous environment.

CURRENT STATUS OF THIS PROGRAM

This interim summary consolidates results from three age groups of cows, the oldest females having weaned four successive calf crops, and the youngest females two crops. The estimates of productivity are tentative and may require revision as additional data are accumulated. The evaluation program will continue until each group of females has produced at least five successive calf crops.

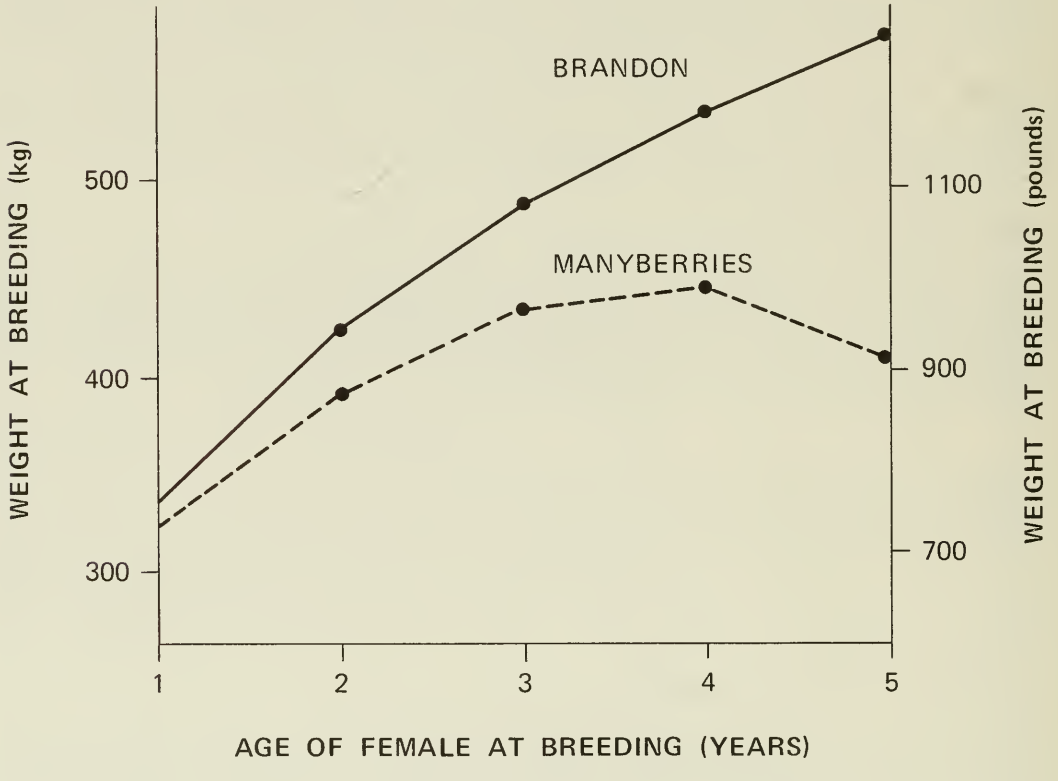

Fig. 1. Time trends in the average weight of cow at Brandon and Manyberries.

TABLE 1. NUMBER OF HYBRID FEMALES BY BREED OF SIRE AND DAM

Breed of sire	Breed of dam			Total for breed of sire
	Hereford	Angus	Shorthorn	
Charolais	107	102	87	296
Simmental	124	118	124	366
Limousin	97	101	140	338
Total for breed of dam	328	321	351	

TABLE 2. PERCENTAGE OF CONCEPTION BASED ON CALVES PRODUCED FROM ALL HYBRID FEMALES ASSIGNED TO THE BREEDING PASTURES

Breed of dam's sire	Breed of dam's dam			Av for breed of dam's sire, %
	Hereford, %	Angus, %	Shorthorn, %	
		Brandon		
Charolais	79.6	86.5	78.9	81.8
Simmental	76.9	82.8	82.9	80.8
Limousin	69.1	76.3	82.2	76.5
Av for breed of dam's dam	75.6	82.1	81.6	79.8*
Control (H X A)		82.4		
		Manyberries		
Charolais	78.3	76.9	85.3	79.7
Simmental	76.5	77.7	77.2	77.1
Limousin	74.4	76.3	75.9	75.6
Av for breed of dam's dam	76.5	77.0	78.6	77.4*
Control (H X A)		80.0		

*Averages for the nine groups of hybrid females.

TABLE 3. PREWEANING CALF MORTALITY EXPRESSED AS A PERCENTAGE OF THE TOTAL NUMBER OF CALVINGS

Breed of dam's sire	Breed of dam's dam			Av for breed of dam's sire, %
	Hereford, %	Angus, %	Shorthorn, %	
		Brandon		
Charolais	8.1	7.2	8.2	7.9
Simmental	5.3	6.7	6.5	6.2
Limousin	5.5	10.9	9.3	8.8
Av for breed of dam's dam	6.3	7.9	8.0	7.4*
Control (H X A)		6.2		
		Manyberries		
Charolais	12.7	9.0	16.5	12.6
Simmental	12.4	8.7	12.3	11.1
Limousin	20.8	21.9	13.9	18.1
Av for breed of dam's dam	14.7	12.3	14.0	13.7*
Control (H X A)		8.9		

*Averages for the nine groups of hybrid females.

TABLE 4. AVERAGE BIRTH WEIGHT DEVIATIONS OF THE CALVES PRODUCED IN SECOND AND LATER GESTATIONS BY THE NINE GROUPS OF HYBRID FEMALES COMPARED WITH THE CALVES FROM THE CONTROL (H X A) DAMS

Breed of dam's sire	Breed of dam's dam						Av for breed of dam's sire	
	Hereford		Angus		Shorthorn			
	kg	(lb)	kg	(lb)	kg	(lb)	kg	(lb)
				Brandon				
Charolais	4.2	(9.2)	2.8	(6.2)	5.9	(13.1)	4.3	(9.5)
Simmental	6.6	(14.6)	4.0	(8.8)	5.8	(12.9)	5.5	(12.1)
Limousin	2.9	(6.5)	0.2	(0.4)	4.1	(9.1)	2.5	(5.6)
Av for breed of dam's dam	4.7	(10.4)	2.4	(5.4)	5.3	(11.7)	4.2*	(9.2)
Av birth weight of control calves (H X A) kg (lb)			38.5	(84.8)				
				Manyberries				
Charolais	4.0	(8.8)	1.9	(4.1)	3.3	(7.3)	3.0	(6.8)
Simmental	3.3	(7.2)	2.1	(4.7)	2.9	(6.5)	2.8	(6.1)
Limousin	- 0.4	(-0.8)	-1.4	(-3.1)	1.2	(2.8)	0.06	(0.01)
Av for breed of dam's dam	2.5	(5.5)	1.0	(2.3)	2.4	(5.5)	2.0*	(4.5)
Av birth weight of control calves (H X A) kg (lb)			38.9	(85.9)				

*Averages for the nine groups of hybrid females.

TABLE 5. AVERAGE WEANING WEIGHTS ADJUSTED FOR SEX AND AGE OF CALF FROM SECOND AND LATER GESTATIONS EXPRESSED AS A PERCENTAGE OF THE CONTEMPORARY CONTROL

Breed of dam's sire	Breed of dam's dam			Av for breed of dam's sire, %
	Hereford, %	Angus, %	Shorthorn, %	
		Brandon		
Charolais	104	107	108	106
Simmental	112	114	115	113
Limousin	103	102	106	104
Av for breed of dam's dam	107	108	109	108*
Av weaning weight of control calves (H X A) kg (lb)		197 (434)		
		Manyberries		
Charolais	107	106	103	106
Simmental	112	114	108	112
Limousin	99	99	103	101
Av for breed of dam's dam	107	108	105	106*
Av weaning weight of control calves (H X A) kg (lb)		184 (406)		

*Averages for the nine groups of hybrid females.

TABLE 6. AVERAGE BREEDING WEIGHT OF HYBRID FEMALES AT 4 YEARS OF AGE

Breed of dam's sire	Breed of dam's dam						Av for breed of dam's sire	
	Hereford		Angus		Shorthorn			
	kg	(lb)	kg	(lb)	kg	(lb)	kg	(lb)
				Brandon				
Charolais	537	(1183)	523	(1152)	543	(1198)	534	(1178)
Simmental	531	(1170)	520	(1146)	524	(1156)	525	(1157)
Limousin	510	(1125)	500	(1103)	495	(1096)	503	(1108)
Av for breed of dam's dam	526	(1159)	514	(1134)	521	(1150)	520	(1148)
Control (H X A)			507	(1118)				
				Manyberries				
Charolais	457	(1008)	432	(953)	454	(1001)	447	(987)
Simmental	432	(953)	433	(955)	411	(906)	426	(938)
Limousin	421	(928)	415	(914)	415	(915)	417	(919)
Av for breed of dam's dam	437	(963)	427	(941)	427	(941)	430	(948)
Control (H X A)			376	(828)				

*Averages for the nine groups of hybrid females.

TABLE 7. WEIGHT OF CALF WEANED PER COW EXPOSED TO BREEDING EXPRESSED AS A PERCENTAGE OF THE WEIGHT FOR THE CONTROL

Breed of dam's sire	Breed of dam's dam			Av for breed of dam's sire, %
	Hereford, %	Angus, %	Shorthorn, %	
		Brandon		
Charolais	99	110	100	103
Simmental	107	114	117	112
Limousin	86	90	103	94
Av for breed of dam's dam	98	105	107	104 *
Control (H X A) kg (lb)		149 (328)		
		Manyberries		
Charolais	101	100	99	100
Simmental	103	111	100	105
Limousin	80	78	92	85
Av for breed of dam's dam	96	98	96	97 *
Control (H X A) kg (lb)		134 (296)		

*Averages for the nine groups of hybrid females.

CONVERSION FACTORS FOR METRIC SYSTEM

Imperial units	Approximate conversion factor	Results in:	
LINEAR			
inch	x 25	**millimetre**	**(mm)**
foot	x 30	**centimetre**	**(cm)**
yard	x 0.9	**metre**	**(m)**
mile	x 1.6	**kilometre**	**(km)**
AREA			
square inch	x 6.5	**square centimetre**	**(cm^2)**
square foot	x 0.09	**square metre**	**(m^2)**
acre	x 0.40	**hectare**	**(ha)**
VOLUME			
cubic inch	x 16	**cubic centimetre**	**(cm^3)**
cubic foot	x 28	**cubic decimetre**	**(dm^3)**
cubic yard	x 0.8	**cubic metre**	**(m^3)**
fluid ounce	x 28	**millilitre**	**(mL)**
pint	x 0.57	**litre**	**(L)**
quart	x 1.1	**litre**	**(L)**
gallon	x 4.5	**litre**	**(L)**
WEIGHT			
ounce	x 28	**gram**	**(g)**
pound	x 0.45	**kilogram**	**(kg)**
short ton (2000 lb)	x 0.9	**tonne**	**(t)**
TEMPERATURE			
degrees Fahrenheit	(°F-32) x 0.56 or (°F-32) x 5/9	**degrees Celsius**	**(°C)**
PRESSURE			
pounds per square inch	x 6.9	**kilopascal**	**(kPa)**
POWER			
horsepower	x 746	**watt**	**(W)**
	x 0.75	**kilowatt**	**(kW)**
SPEED			
feet per second	x 0.30	**metres per second**	**(m/s)**
miles per hour	x 1.6	**kilometres per hour**	**(km/h)**
AGRICULTURE			
gallons per acre	x 11.23	**litres per hectare**	**(L/ha)**
quarts per acre	x 2.8	**litres per hectare**	**(L/ha)**
pints per acre	x 1.4	**litres per hectare**	**(L/ha)**
fluid ounces per acre	x 70	**millilitres per hectare**	**(mL/ha)**
tons per acre	x 2.24	**tonnes per hectare**	**(t/ha)**
pounds per acre	x 1.12	**kilograms per hectare**	**(kg/ha)**
ounces per acre	x 70	**grams per hectare**	**(g/ha)**
plants per acre	x 2.47	**plants per hectare**	**(plants/ha)**