

CALVING DIFFICULTIES AMONG PURE-BRED CHAROLAIS,  
LIMOUSIN, MAINE-ANJOU AND HEREFORD CATTLE IN FRANCE

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SUMMARY

Calving difficulties were examined in pure-bred Charolais, Limousin, Maine-Anjou and Hereford cattle maintained in stalls at Bourges, France. The cows were born in 1970 and raised together from weaning. Records of calving performance, birth weights, gestation lengths and dam weights after calving from 2 to 5 years of age were analysed to compare breeds and to estimate maternal and direct genetic components of breed differences.

There were significant differences among breeds in all traits. Calving difficulties were greatest among Maine-Anjou then Charolais, Hereford and Limousin in that order. Birth weights reflected the differences among the French breeds but Herefords had the lightest calves. Calving difficulties were greatest at 2 years of age when breed differences were also greater although rankings were the same. Breed differences in dam weight and gestation length were not related to the differences in calving difficulties. Among the French cattle, breed maternal effects accounted for approximately half the breed differences in calving difficulties over all calvings but at 2 years of age direct genetic effects were more important.

INTRODUCTION

In recent years Australian cattle breeders have shown interest in the potential of large European breeds for crossing and the establishment of new types. Any use of these animals necessitates the establishment of pure-bred herds as continued importations are uncertain, expensive and do not allow adaptation to local conditions. For a rational choice of breed and eventual use, breeders need to know the relative performance of available breeds and the genetic and maternal basis of any differences between them. As this information is not available for Australian conditions it is necessary to evaluate information from countries where the breeds are used.

The growth potential and lean beef characteristics of the French beef breeds are well known from practical experience and the results of crossbreeding experiments (eg Koch et al. 1976). However of equal importance for the establishment of breeding herds are the reproductive characteristics of those breeds, especially calving performance, where the local breeds with which they may be crossed differ considerably in body size, and where selection criteria for maximum meat production conflict with ease of calving.

This paper presents results from an experiment designed to evaluate the productivity of three important French breeds. In particular, calving difficulties are examined and the relative importance of maternal and direct genetic effects on breed differences in this and related traits are determined.

MATERIALS AND METHODS

Animals and Matings

Two beef breeds (Charolais and Limousin) and the dual purpose Maine-Anjou were used in a reciprocal-cross design. A group of 20 Canadian Herefords were also included as a control. Approximately 60 females (born in 1970) of each of

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the French breeds were purchased as weaners and raised together. Within each French breed, bulls available at AI stations were ranked in order of the mean birth weight of their progeny. They were then divided into 6 strata with equal numbers and one bull chosen from each. The bulls from the 2 lowest strata were used at the first mating and at the 2nd mating of heifers which did not calve in 1972. All 6 bulls were used at the other matings. The Hereford semen used came from 6 bulls chosen on the same basis in the U.S.A.

The first breeding was in 1971 and the first calving in 1972. The breeding season commenced in late April or early May each year. AI was used exclusively and, among each of the French breeds, 20 cows were inseminated with semen from the bulls of each breed. The cows were rotated among the bull groups in subsequent years. Cows were culled if they became physically unsound or did not conceive in two consecutive years.

#### Location and Management

The experiment was carried out at Bourges approximately 200 km south of Paris. All animals were maintained in stalls throughout the experiment except for a brief period of grazing after calving. Other experimental details and preliminary results were given by Ménéssier *et al.* (1974).

#### Data and Analysis

Complete records were collected on reproductive performance, growth, size, productivity and carcass characteristics. This paper deals with calving difficulties and associated characteristics in pure-bred cattle only. Calving difficulty was assessed by score where 1 = no difficulty, 2 = light difficulty, 3 = moderate difficulty, 4 = severe difficulty with strong assistance and 5 = caesarean section. It was analysed using the score and also the frequency of "very difficult calvings" (scores 4 and 5).

Preliminary analyses showed that transformation of the individual scores to logs or to scores on the normal and logistic distributions did not markedly affect the results so only the raw data are presented here. As age and parity of dam were confounded (together with year effects) the calvings were classified into 6 groups: 1 = first calving at two years; 2 = first calving at three years; 3 = second calving at 3 years; 4 = second calving at four years; 5 = third calving at four years; 6 = all calvings at 5 years. For brevity, only the results from the average of all calvings and 1st calving at 2 years are presented.

Analyses were carried out by least squares methods with a fixed effects model including calf genotype, sex, age/parity and genotype x age/parity interaction. Other interactions were not significant. Estimates of breed maternal and direct genetic effects were derived from appropriate combinations of the constants obtained in the least-squares analyses of the reciprocal cross data. The model proposed by Dickerson (1973) and outlined by Gregory *et al.* (1978) was used to estimate maternal and direct genetic effects.

#### RESULTS

Least-squares means and standard errors for calving difficulties, birth weight and gestation length of all calvings and for the first calving at 2 years of age are given in Table 1. Over all calvings, difficulties were most severe among the Maine-Anjou followed by Charolais, Hereford and Limousin. This pattern was the same for first calving at 2 years although average levels were higher. All differences among breeds in calving difficulties were significant for the average of all calvings. Breed differences were greater for calving at 2 years but the differences between Herefords and both Charolais and Limousin were not significant because of smaller numbers.

Among the French breeds, birth weights followed the pattern of calving

difficulties but the Herefords were lightest. All between-breed differences were significant except that, at first calving when weights were lower, the differences between Maine-Anjou and Charolais and between Limousin and Hereford were not significant. Mean gestation lengths were comparatively uniform and were not related to the between-breed differences in calving difficulties. Over all calvings the average gestation length of the Limousin group was greater than that of each other breed and these were the only significant differences.

TABLE 1 Calving difficulties, birth weights and gestation lengths for all calving and for first calving at two years of age

Calvings and Breed	(n)	Calving difficulty score (1-5)		Very difficult calvings (%)		Birth weight (kg)		Gestation length (d)	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
<u>ALL CALVINGS</u>									
Limousin	(56)	1.32	0.18	5.3	5.8	36.7	0.90	289.8	1.40
Charolais	(54)	2.30	0.17	22.6	5.3	41.7	0.82	285.7	1.28
Maine-Anjou	(55)	2.84	0.17	40.3	5.5	47.5	0.85	285.0	1.33
Hereford	(56)	1.82	0.17	7.6	5.3	33.0	0.82	283.4	1.28
<u>CALVING AT 2 YEARS</u>									
Limousin	(15)	1.99	0.30	23.1	9.5	32.4	1.48	283.9	2.32
Charolais	(13)	3.31	0.32	48.3	10.2	40.3	1.59	282.6	2.49
Maine-Anjou	(13)	4.16	0.32	79.1	10.2	43.5	1.59	282.4	2.49
Hereford	(11)	2.62	0.35	31.6	11.1	29.6	1.73	282.1	2.71

TABLE 2 Estimates of maternal and direct genetic components of breed differences for calving difficulties, birth weight and gestation length

	Calving difficulty score (1-5)		Very difficult calvings (%)		Birth weight (kg)		Gestation length (d)	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
<u>ALL CALVINGS</u>								
Mean of French breeds	2.153	.101	22.7	3.17	42.0	.49	286.8	.77
Maternal Effects								
Limousin	-.420	.117	-11.38	3.68	-2.83	.58	-2.92	.90
Charolais	.045	.122	3.02	3.84	-.26	.60	-.70	.94
Maine-Anjou	.375	.123	8.36	3.86	3.09	.60	3.62	.94
Direct Effects								
Limousin	-.413	.187	-6.06	5.90	-2.43	.92	5.89	1.44
Charolais	.104	.186	-3.17	5.84	0	.91	-.43	1.43
Maine-Anjou	.309	.187	9.23	5.90	2.44	.92	-5.46	1.44
<u>CALVING AT 2 YEARS</u>								
Mean of French breeds	3.152	.183	50.2	5.76	38.7	.90	283.0	1.41
Maternal Effects								
Limousin	-.400	.208	-12.85	6.56	-2.79	1.02	-4.01	1.60
Charolais	.346	.232	17.27	7.29	.38	1.14	-.99	1.78
Maine-Anjou	.054	.225	-4.42	7.09	2.41	1.11	5.00	1.73
Direct Effects								
Limousin	-.767	.327	-14.20	10.29	-3.55	1.61	4.97	2.51
Charolais	-.185	.349	-19.13	10.99	1.21	1.72	.59	2.68
Maine-Anjou	.952	.345	33.33	10.86	2.34	1.70	-5.55	2.65

Dam weights after calving did not follow the trends in calving difficulties or birth weights. Over all calvings these weights were: Maine-Anjou  $599 \pm 7.7$  kg; Charolais  $617 \pm 7.4$  kg; Hereford  $441 \pm 7.5$  kg and Limousin  $458 \pm 8.2$  kg. All of the breed differences were significant.

Estimates of breed maternal and direct genetic effects on calving difficulties, birth weight and gestation length for the French breeds are given in Table 2. For the average of all calvings and for first calving at 2 years, the maternal effect of the Limousin dams was to reduce calving difficulties, lower birth weight and reduce gestation length relative to the other breeds. In contrast, Maine-Anjou dams increased calving difficulties and the other traits over all calvings. At first calving however, the maternal effect of the Charolais increased calving difficulties relative to the Maine-Anjou. With direct genetic effects the Limousin breed reduced calving difficulties and birth weights while the Maine-Anjou increased these traits. The pattern of direct effects on gestation length was the opposite of that for maternal effects.

#### DISCUSSION

In this experiment large between-breed differences in calving difficulties were recorded. As a pure breed the Maine-Anjou gave the most difficulties while Charolais were also worse than Herefords and Limousins. No experiments with these breeds have been reported in other countries so a direct comparison of results is not possible. However, the order of results agrees generally with those obtained in several crossbreeding experiments although it has usually been reported that calving difficulties were lower from matings with Hereford than those from matings with Limousin bulls, the latter tending to be closer to Charolais (e.g. Smith *et al.* 1976). In this experiment there were no significant differences between the two breeds and the Limousins actually had fewer calving difficulties. The differences between these results and those from crossbreeding work may be due to the maternal advantage of the Limousin dams.

As expected, calving difficulties were greatest for first calving at 2 years of age. Breed differences were also greater, although rankings were the same. The high frequencies of extreme calving difficulties within the Maine-Anjou and Charolais cattle for first calving at 2 years, despite the special selection of bulls for this mating, indicate the problems faced by breeders and support their practice of delaying first calving until three years of age.

In general, maternal effects were as important as direct genetic effects on breed differences. However at 2 years of age, direct effects on calving difficulties were more important for Maine-Anjou but were considerably less important than maternal effects for Charolais. Clearly, attention should be given to both maternal performance and direct genetic effects in plans to use these breeds.

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