

**THE EFFECT OF GENOTYPE ON BIRTH WEIGHT AND GESTATION LENGTH WHEN  
ANGUS, HEREFORD, LIMOUSIN AND SIMMENTAL SIRES ARE MATED TO ANGUS  
AND HEREFORD COWS.**

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**SUMMARY**

A project to develop multi-breed estimated breeding values (EBVs) is being conducted for the temperate environment of Southern Australia. Angus and Hereford cows were impregnated with semen from 88 Angus, Hereford, Limousin and Simmental sires in 1997 and 1998. There was no significant effect of dam breed on birthweight, but some effect on gestation length. Sire breed significantly influenced both calf birth weight and gestation length. Calving ease was not influenced by either sire or cow breed. The project is being funded by the MLA, NRE Vic. and SARDI, SA.

**Keywords:** Multi-breed EBVs, crossbreeding, purebreeding, southern Australia, beef cattle

**INTRODUCTION**

Crossbreeding in the beef industry has been recognized for some time as being a tool to increase productivity (Morgan *et al.* 1992, Morgan and Clark 1982, Barlow and O'Neil 1978), and enables beef producers to more accurately tailor cattle to market needs. As a consequence of cross breeding, birth weights can increase, with the potential of increased calving difficulty (Laster *et al.* 1973). Additionally, Koger *et al.* (1967) and Morris *et al.* (1986) found that calf survival at birth can be significantly influenced by birth weight. Calf loss could be reduced by optimizing size at birth (Gardiner and Rutley 1995).

**MATERIALS AND METHODS**

Angus, Hereford, Limousin and Simmental were joined to Angus and Hereford dams. Hereford and Angus were used because they are the two major breeds in southern Australia (based on herd registrations), followed by Limousin and Simmental (major European breeds). These four sire breeds provide a diversity of genotype, with two representing the most common British breed cattle type and two representing European type cattle. Twenty-two sires from each of the breeds were chosen. They were high accuracy group Breedplan sires, with a minimum accuracy of 75 %, covering a range of traits for which EBVs were available. For each breed, the 22 sires were chosen to represent a similar range of EBVs for their particular breed. The EBV for 400-day liveweight was chosen as a guide, and a similar number of sires of each breed represented the top 10, 25, and 50 percentile bands within each breed, and so on, so that within each breed, the sires chosen represented a similar average percentile. Sires with progeny in the top 1 percentile for birthweight were not used, to decrease the likelihood of calving difficulty. No first calving cows were used, and sires were only mated to mature Angus and Hereford dams, using a synchronized AI program, on 15 different

properties throughout the temperate areas of Victoria, SE of South Aust and southern N.S.W. (Rainfall 500-700mm). For each property, a similar number of sires from each breed were used, the sires being selected at random. Herd sizes ranged from 50 to 200 cows.

Data was analyzed using REML Variance Components Analysis, with property being used as an absorbing (random) factor. For the variate birthweight, the fixed model was: constant+gestation (covariate)+cowbreed+sirebreed+sex+cowbreed.sirebreed+cowbreed.sex+sirebreed.sex+cowbreed.sirebreed.sex. A similar model was used for the variate gestation, with birthweight being the covariate. The Wald statistic (are approximate Chi-squared tests, used when factors contain unequal numbers) was used to test fixed effects, and least significant differences were used to test the significance of differences at the maximum level. (Genstat 5 Committee 1994).

## RESULTS

There was a significant ( $P<0.05$ ) effect of both sire breed and sex on calf birthweight (Table 1). However, there was no significant effect of dam breed. Simmental sired calves were significantly heavier by 2.6, 2.0 and 1.6 kg than those sired by the Angus, Hereford or Limousin sires respectively. There were no significant differences between the latter three sire breeds. Male calves were, on average, 2.5 kg heavier than the females. Average birthweights for properties ranged from 33.8 kg to 44.5 kg.

**Table 1. The effect of sirebreed, cowbreed and sex of calf on birthweight (kg) ( $\pm$  standard deviation) with least significant differences (l.s.d.). n = number of animals**

Sire breed		Angus n=228	Hereford n=198	Limousin n=190	Simmental n=204	Average	l.s.d.
Dam Breed	Angus n=215	36.4 $\pm$ 5.5	37.6 $\pm$ 6.1	37.7 $\pm$ 6.5	39.1 $\pm$ 4.6	37.7	2.32
	Hereford n=578	37.4 $\pm$ 5.7	37.4 $\pm$ 5.4	38.2 $\pm$ 6.1	40.0 $\pm$ 6.4	38.2	
Sex	Male	37.8 $\pm$ 5.4	38.5 $\pm$ 5.4	39.6 $\pm$ 4.4	41.0 $\pm$ 5.0	39.2	0.9
	Female	35.9 $\pm$ 5.7	36.4 $\pm$ 5.4	36.3 $\pm$ 6.7	38.0 $\pm$ 6.2	36.7	
Average		36.9	37.5	37.9	39.5	37.9	1.36

There was a very low incidence (0.9 %) of cows requiring assistance at calving, with 0.4 %, 1.01 %, 1.58 % and 0.98 % for the Angus, Hereford, Limousin and Simmental sires, respectively. The average birthweight of those calves affected was 36.4, 44.5, 38.5 and 50 kg respectively. Of those cows requiring assistance, half were Angus and half were Hereford, with 5 of the 8 being male calves.

Gestation length (Table 2) was significantly affected ( $P<0.05$ ) by sire breed and sex of calf. There was a significant interaction between sirebreed and cowbreed, with the Hereford cows joined to Hereford and Limousin sires having longer gestation periods than the Angus cows, but a shorter gestation length when joined to Simmental sires. The gestation period of those cows that had male calves was one day longer (284.4 days) compared to those with female calves. Of cows requiring calving assistance, gestation averaged 1.7 days longer than those calving unassisted. Average gestation length for properties ranged from 281 days to 288 days.

**Table 2. The effect of sirebreed, cowbreed and sex of calf on gestation length (days) ( $\pm$ standard deviation) with least significant differences (l.s.d.)**

Sire breed		Angus	Hereford	Limousin	Simmental	Average	l.s.d.
Dam breed	Angus	282.0 $\pm$ 6.0	281.6 $\pm$ 5.9	286.1 $\pm$ 6.1	285.6 $\pm$ 5.6	283.8	2.04
	Hereford	281.2 $\pm$ 5.4	283.4 $\pm$ 5.0	287.1 $\pm$ 5.5	284.3 $\pm$ 5.7	284.0	
Sex	Male	281.1 $\pm$ 5.1	283.6 $\pm$ 5.0	287.3 $\pm$ 5.4	285.7 $\pm$ 5.2	284.4	0.82
	Female	282.1 $\pm$ 5.9	281.4 $\pm$ 5.3	285.9 $\pm$ 5.9	284.1 $\pm$ 5.3	283.4	
Average		281.6	282.5	286.6	284.9	283.9	1.18

## DISCUSSION

Birthweights recorded were slightly higher for the Hereford and Angus sired calves than the 35.9 and 33.7 kg respectively reported by Gregory *et al* (1988), and also higher than Hereford sired calves (31.5 kg) reported by Deland *et al* (1983). This is possibly a reflection on the strong selection for growth rate in these breeds over the last 10 years. However, the Simmental and Limousin sired calves were lighter than the 42.5 and 39.2 kg respectively reported by the same authors. The Simmental-sired calves were similar in birthweight to those reported by Newman and Deland (1991). The 2.5 kg difference between female and male calves in this study was similar to the 2.3 kg of Deland *et al* (1983). Lawlor *et al* (1984) reported that Simmental calves from Hereford dams had a heavier birth weight than Hereford and Angus-sired calves, 41.4, 37.9 and 37.2 kg respectively, with no difference between the Hereford and Angus-sired calves. These birthweights were similar to those in the present study. As with this and other studies, Smith *et al* (1976) found that Simmental sired calves were heavier than those sired by Limousin, being 38.0 and 36.2 kg, respectively.

The overall incidence of calving difficulty at 0.09 % in this study was much lower than that found by Gregory *et al* (1988), who reported 13.5 %, 7.7 %, 14.4 % and 21.8 % for the Angus, Hereford, Limousin and Simmental-sired calves, respectively. The study by Lawlor *et al* (1984) found that Simmental-sired calves had the most calving difficulty compared to the other 2 breeds, with a calving difficulty of 8.9 %, compared to 1.5 % and 0.65 % for the Angus and Hereford-sired calves, respectively. Hearnshaw *et al* (1984), found that Hereford and Simmental sires joined to Hereford dams had 2.5 % and 4.6 % dystocia, respectively.

The sire breed effect on gestation length was similar to that found by Lawlor *et al* (1984) who found that the Simmental sired calves also had the longest gestation duration at 287.5 days, compared to 284.9 and 283.2 for the Hereford and Angus-sired calves, respectively. The latter two were also significantly different from each other. As with the present study, Smith *et al* (1976) found that Limousin-sired calves had a longer gestation length of 288.1 days, compared to 286.2 days for the Simmental-sired calves and straight Angus and Hereford calves were 281.6 and 285.5 days, respectively. These sire breed differences are similar to those of this study.

The 1 day difference in gestation length due to sex of calf, was similar to the 1.2 day difference reported by Cundiff *et al* (1974).

## CONCLUSION

The birthweight and gestation length differences due to sire breed reported in this study are consistent with results of other reported work. However, differences in calving difficulty were much lower than differences found by other researchers, particularly the figures from calves sired by Simmental bulls. This may be due to the fact that sires used in this study excluded the top 1 percentile category for birthweight EBV, and no first calving heifers, only mature cows were used. The figures presented provide a good indication of differences that could be expected to occur when these four sire breeds are used in Australia. There was very little evidence of heterosis in the reciprocal cross Angus and Hereford calves in either birthweight or gestation length. This paper has not examined the relationship between the parameters reported and EBVs that are currently available for the sires used, as the final joinings for the project are just being completed. A full analysis of all the EBV relationships will commence as all progeny data becomes available.

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