WEANING WEIGHT OF CALVES SIRED BY THREE RED ANGUS BULLS FROM DEVON, HEREFORD AND RECIPROCAL CROSS HEIFERS

D.J. JOHNSTON*, J.M. THOMPSON#, W.H. UPTON* and K. HAMMOND*

Animal Genetics and Breeding Unit*, Department of
Animal Science#, University of New England,
ARMIDALE, N.S.W. 2351.

INTRODUCTION

Crossbreeding can increase beef production by simultaneously making use of additive and non-additive (heterotic) genetic differences between breeds. The second cross, which is often made using a third breed of sire mated to first cross females, can exhibit maternal and direct heterosis via the crossbred combinations of the dam and its calf, respectively. The expected advantage in weaning weight from such a system depends on the specific breeds used. Based on crosses between Bos taurus breeds Gregory and Cundiff (1980) estimated the cumulative effect of heterosis from a three-breed cross to be 23.3% for weight of calf weaned per cow exposed to breeding, compared to the average of the straightbreds.

Benyshek (1979) examined the importance of sire *x* breed of dam interactions on the prediction of a sire's breeding value from progeny tests. He concluded that the interaction may have a significant affect on weaning weight and hence had the potential to distort the sire evaluations. Work by Cunningham and Magee (1986) on Simmental sires also suggests the existence of a sire *x* dam type interaction for preweaning traits.

A crossbreeding experiment was undertaken to estimate maternal heterosis for weaning weight in Devon-Hereford reciprocal cross heifers, as expressed by the weaning weight of their Red Angus sired calves. The design allowed testing of a sire *x* breed of dam interaction for calf weaning weight and the results are reported here.

MATERIALS AND METHODS

Animals and Design

The four heifer genotypes were generated from a base herd of 141 Devon and

* AGBU is a joint unit of the NSW Department of Agriculture and Fisheries and the University

153 Hereford cows inseminated with semen from either 15 Devon or 14 Hereford sires (Gyles et al. 1986). Straightbred Devon (DD), straightbred Hereford (HH), Devon (sire) *x* Hereford (DH) and Hereford *x* Devon (HD) heifers were born in December 1984/January 1985 and weaned at an average age of six months. After weaning the heifers were grown out on high quality pasture and at 15-16 months of age the four genotypes were equally divided into three single sire mating groups and mated to three Red Angus sires.

The 60 calves used in this study were born in February/March 1987. Calves were weighed and tagged within 12 hours of birth. Weaning weight was recorded at an average age of nine months.

Statistical Analysis

Preweaning weight gain (PWG) from birth to weaning was calculated by subtracting birth weight from weaning weight. A least-squares model was fitted to the PWG records, including terms for dam genotype, calf sex, calf age within dam breed and sex, sire and all first order interactions. Non-significant ($P>0.05$) interactions were sequentially removed from the model. As female calves were born earlier, especially in the DH group, calf age was adjusted within dam breed and sex.

RESULTS

The final model for PWG included terms for dam genotype, calf sex, calf age within dam genotype and sex, sire and sire *x* genotype of dam interaction ($P<0.05$). The least-squares means for PWG of calves from the four heifer genotypes and the three sires are presented in Table 1.

Table 1: Preweaning weight gain (kg) (standard errors) and numbers of calves sired by three Red Angus bulls from Devon, Hereford and reciprocal cross heifers.

Dam genotype (sire breed first)	Calf numbers			Preweaning weight gain		
	Sire 1	Sire 2	Sire 3	Sire 1	Sire 2	Sire 3
DD	4	8	1	222 ^{a} (13.9)	190 ^{b} (11.9)	207 ^{a} (26.9)
DH	4	10	4	193 ^{ab} (13.3)	225 ^{a} (9.4)	209 ^{a} (12.4)
HD	7	5	3	223 ^{a} (10.5)	212 ^{ab} (12.3)	208 ^{a} (14.6)
HH	3	7	4	169 ^{b} (15.2)	204 ^{ab} (13.3)	196 ^{a} (13.6)

a b: Means in the same column without a common superscript differ ($P<0.05$).

PWG means for the calves from Sire 1 showed that the straightbred Devon heifers and the Hereford *x* Devon weaned significantly heavier calves than the straightbred Hereford heifers. However calves from Sire 2 showed no difference between the straightbreds although there was a significant difference in

preweaning weight gain in calves from the Devon *x* Herefords and the straightbred Devon heifers. No significant differences existed for PWG for Sire 3, however the number of calves per dam genotype were lower for that sire.

DISCUSSION

The ranking of the three Red Angus sires for preweaning weight gain of their progeny differed between the four heifer genotypes. Although numbers in each sire/dam genotype sub-class were very low, this interaction suggests that the performance of the calves may vary with sire and dam genotype. Benyshek (1979) postulated that the significant Limousin sire by breed of dam interaction he observed for weaning weight may have arisen from a genotype *x* genotype interaction as a result of differences in allelic or non-allelic interactions when individuals from genetically different populations were combined. In addition the interaction could have involved a genotype *x* maternal environment interaction with the different dam breeds providing different maternal environments.

The difference in the performance of calves from the straightbred dams by Sire 1 suggests there are genetic differences for PWG between the Devons and Herefords. These may be additive or non-additive gene action. As the calves from the straightbred dams by Sire 2 showed no significant difference, the non-additive interpretation is favoured. When the performance of the crossbred dams is considered it also suggests that Sire 1 and 2 were performing differently with respect to dam genotype. The overall affect may be related to a sire *x* grandmaternal genotype interaction. Sire 1 produced heavier calves from Devon granddams compared to the straightbred Hereford (HH), whereas Sire 2 tended to produce heavier calves from Hereford granddams compared to the straightbred Devon (DD).

This small study demonstrated the existence of a significant sire *x* genotype of dam interaction for preweaning weight gain. The biological basis for the interaction is unclear. However, the interaction suggests the effect is due to non-additive gene action and therefore the potential affect on estimates of heterosis should be recognised. Further work is required to quantify the magnitude of this interaction across a greater number of sires and dams and to investigate the benifits of testing sires prior to their use in a crossbreeding program.

REFERENCES

Benyshek, L.L. (1979). J.Anim.Sci. 49:63.

Cunningham, B.E. and Magee, W.T. (1986). Proc. Beef Improv. Fed. Ann. Conv., Lexington. p.203

Gregory, K.E. and Cundiff, L.V. (1980). J.Anim.Sci. 51:1224.

Gyles, A.L., Upton, W.H., Hammond, K., Thompson, J.M. and Tier, B. (1986). Proc. 3rd. Wld. Cong. Genet. Appld. Livest. Prod. 9:365.