MATERNAL HETEROSIS OF BEEF DAMS AT DIFFERENT AGES

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SUMMARY

Maternal heterosis was estimated from Hereford, 25% Simmental -75% Hereford, 50% Simmental - 50% Hereford and 75% Simmental - 25% Hereford dams. Sample halves of these dam breed groups were bred to Charolais and Tarentaise sires to produce calves at 3 to 8 yr of age. Cows were managed consistent with practices for western range environments. Maternal heterosis was estimated by regression techniques for 22 traits. Maternal heterosis was not significant for day of conception, number of services, gestation length or calving difficulty. Estimates of maternal heterosis for calf growth traits ranged from .7% for weaning height to 5.2% for weaning weight and 7.5% for weaning condition score. Calf weight per unit of cow weight at weaning showed significant maternal heterosis (7.1%). Higher levels of maternal heterosis were exhibited for milk production (18.0 to 24.4%), proportion of dams that calved and that weaned calves (11.5 and 10.4%) and calf weaning weight per cow exposed to breeding (17.9%). There was a decrease in percentage maternal heterosis for most traits as dam age increased.

INTRODUCTION

Several studies have evaluated the maternal productivity of different breed groups of beef cows, but fewer studies have been designed to estimate maternal heterosis. These present results represent part of a long term experiment to evaluate productivity of different biological types of beef cattle. Results from earlier aspects of the experiment have been reported (Kress et al., 1984; Lawlor et al., 1984; Steffan et al., 1985; Lathrop et al., 1988; Kress et al., 1990a,b). The objective of the present study was to estimate maternal heterosis from Hereford (HH), 25% Simmental - 75% Hereford (1S3H), 50% Simmental - 50% Hereford (1S1H) and 75% Simmental - 25% Hereford (3S1H) 3- to 8-yr-old cows.

MATERIALS AND METHODS

The experimental cattle were located at the Northern Agricultural Research Center near Havre, Montana. Cows within each breed group (HH, 1S3H, 1S1H and 3S1H) were sired by nine or ten different bulls. Random halves of each cow breed group were mated with Charolais and Tarentaise sires to produce calves at 3 to 8 yr of age. Cows were bred by artificial insemination for 45 d during June and July. Cows were culled if they were open 2 yr in a row up to production of the third calf crop. During the fourth and later calf crops all open cows were culled.

Cows were maintained on native range with sufficient supplemental feed during the winter (January through April) to maintain weight. The summer range was at an altitude of 1200 m and averaged 48 cm annual precipitation. The stocking rate was 1.2 ha per cow-calf unit per month.

Traits that were studied are listed in Table 1. Calving difficulty was a score from 1 (no assistance) to 4 (Caesarean). Calf weights at prebreeding, postbreeding and weaning were at 2, 3.5 and 6 mo of age, respectively. Early and late milk production estimates were at 40 and 130 d into lactation, respectively, and were converted to a 24-h basis. The visual condition score ranged from 1 (thin) to 9 (fat).

Estimates of maternal heterosis were based upon the genetic model as described in detail by Robison et al. (1981). Estimation procedures for the present study were the same as those outlined by Kress et al. (1990a).

RESULTS AND DISCUSSION

Table 1 shows estimates of maternal heterosis for the various traits in units of measurement and as a percentage. Maternal heterosis was not significant for day of conception, number of services, gestation length, calving difficulty or proportion of cows experiencing calving difficulty. Calf weights exhibited maternal heterosis of 3.6 to 5.2%. Estimates of maternal heterosis were significant for measures of calf condition (weight/height and condition score) but not for calf height. When calf weaning weight was expressed relative to cow weight, maternal heterosis ranged from 6.4 to 7.1%. Estimates of maternal heterosis were relatively higher for measures of milk production. The negative estimate for early minus late milk production, though not significant, suggested that crossbred cows maintained milk production at a higher level into later lactation. The reproductive traits (proportion of cows calving and proportion of cows weaning a calf) exhibited greater maternal heterosis than the calf growth traits, but the greatest maternal heterosis was shown by a characteristic that combined calf growth and cow reproduction (calf weaning weight per cow exposed to breeding).

Estimates of maternal heterosis for each age of dam are shown in Figure 1. Estimates for 2-yr-old dams are from Kress et al. (1990a). Values for calf growth traits are shown in the upper part of the figure and all trends were negative except for condition score. Regressions of percentage maternal heterosis on age of dam were -1.0, -3.4, -2.1 and -.9%/yr for calf weights at birth, prebreeding, postbreeding and weaning, respectively, -.3%/yr for weaning height, -.5%/yr for weaning weight/height and .9%/yr for weaning condition score. Reproductive traits are shown in the lower part of Figure 1 and the regressions for percentage maternal heterosis on age of dam were -10.8, -6.1 and -8.0%/yr, respectively, for proportion calved, proportion weaned and calf weaning weight per cow exposed.

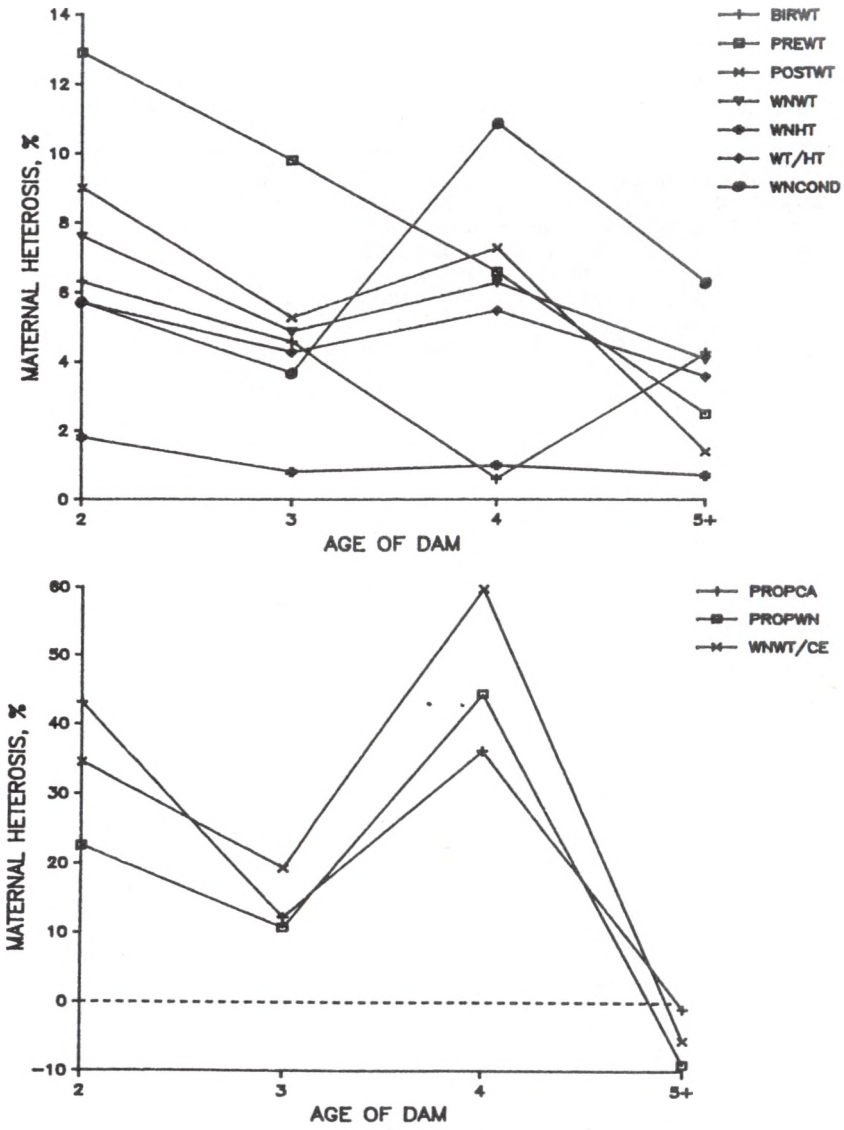

Figure 1. Percentage maternal heterosis for each age of dam, where 5+ includes 5-, 6-, 7- and 8-yr-old dams. The upper part shows results for calf growth traits (weights at birth, prebreeding, postbreeding and weaning, weaning height, weaning weight/height and weaning condition score). The lower part shows the reproductive traits (proportion that calved and that weaned a calf and calf weaning weight per cow exposed).

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Table 1. Estimates of Maternal Heterosis

Trait	Maternal heterosis Amount	Percentage
Day of conception, d	.61±.76	.4
Number of services	.05±.06	4.1
Gestation length, d	-.61±.76	-.2
Calving difficulty, score	.03±.15	2.4
Proportion calving difficulty	.05±.06	38.5[a]
Calf birth weight, kg	1.61±.72	3.6
Calf prebreeding weight, kg	4.8±1.8	4.8
Calf postbreeding weight, kg	5.6±2.3	3.6
Calf weaning weight (ww), kg	12.1±3.1	5.2
Calf weaning height, cm	.84±.54	.7
Calf weaning weight/height, kg/cm	.097±.023	4.7
Calf weaning condition, score	.43±.11	7.5
Calf ww ÷ cow prebreeding weight	.030±.007	7.0
Calf ww ÷ cow weight at weaning	.029±.007	7.1
Calf ww ÷ (cow prebreeding weight)$^{.75}$	.134±.031	6.4
Calf ww ÷ (cow weight at weaning)$^{.75}$	.130±.031	6.4
Early milk production of 4-yr-old dams, kg	2.34±2.85	18.0
Late milk production of 4-yr-old dams, kg	2.29±2.92	24.4
Early minus late milk production, kg	-1.96±4.06	-43.6[a]
Proportion calved	.082±.051	11.5
Proportion weaned	.073±.056	10.4
Calf weaning weight per cow exposed, kg	28.5±12.9	17.9

[a]Percentages may be misleading because means were small.