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Heterosis, Breed Maternal, and Breed Direct Effects in Red Poll and Hereford Cattle

Keith E. Gregory, Delwyn D. Dearborn, Donald D. Lunstra, Larry V. Cundiff, and Robert M. Koch^{1,2}

Introduction

Breed differences, heterosis, and reciprocal cross differences from beef cattle crossbreeding experiments have been summarized in prior reports from MARC and reports from other research stations.

However, there have been only limited reports to characterize the Red Poll breed relative to other breeds. This report summarizes results from an experiment where reciprocal crosses and straightbreds were produced to estimate heterosis, breed maternal effects, and breed effects for growth rate of the Red Poll and Hereford breeds.

Procedure

This study was conducted in 1978 and 1979 at MARC. Numbers of animals classified by sex, breed of sire, and breed of dam subclass are presented in Table 1. Ten Red Poll and eleven Hereford sires were used. Most sires were used by both artificial insemination and natural service, and most produced both straightbred and crossbred progeny. Sires and dams of each breed were sampled from the same population of purebreds maintained at MARC. Age of dam distribution was similar in both breeds. Dams of each breed were randomly assigned to breed of sire and to sires within breed, except matings that would result in more than modest levels of inbreeding (> 6%) were avoided.

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Table 1—Number born, weaned, and completing postweaning growth period classified by sex, breed of sire, and breed of dam

Breed of dam	Sex of calf	Breed of sire					
		Red Poll			Hereford		
		B ^a	W ^b	P ^c	B	W	P
Red Poll	Male	19	19	19	40	34	33
	Female	32	26	23	46	45	45
Hereford	Male	114	106	104	74	61	60
	Female	124	118	117	90	75	73

^aB = no. born.

^bW = no. weaned.

^cP = no. completing postweaning growth period.

Table 2—Estimates of breed group means for economic traits

Item ^a	Calving ^b difficulty, %	Survival to 72 hr, %	Survival to weaning, %	Birth wt, lb	200-day wt, lb	Heifers		Bulls		
						368-day wt, lb	Height, ^c in	368-day wt, lb	Height, ^c in	SC, ^{cd} cm
Breed group means										
RR	16.8	89.1	85.0	74	430	621	45.3	820	47.0	30.2
HH	19.8	86.4	79.8	74	378	589	43.5	818	44.9	30.4
RH	16.6	93.8	88.9	78	420	650	45.6	880	47.0	33.3
HR	23.3	86.7	83.6	83	452	705	45.9	865	47.0	33.2

^aR = Red Poll, H = Hereford; sire breed listed first.

^b% requiring assistance.

^cEstimates of height and scrotal circumference are based on measures at the end of the 168-day postweaning feeding period at an average age of 349 days.

^dSC = scrotal circumference.

Dams were maintained on improved pasture (April to November) and fed a mixture of grass and legume hay on pasture during the winter. Calves were born during a calving season of approximately 65 days extending from mid-March to mid-May; the avg calving date was April 13. All calves were identified and weighed within 24 hr of birth. Male calves were left intact. Calves were raised by their dams on pasture without creep. They were weaned at an avg age of 181 days.

During the 168-day postweaning period, female calves received a diet of corn silage and alfalfa haylage averaging 11.8% crude protein (CP) and 2.18 Mcal of metabolizable energy (ME)/kg of dry matter (DM). The diet for male calves for the 168-day postweaning period included corn silage, rolled corn, and soybean oil meal and was 12.9% CP and 2.69 Mcal of ME/kg of DM. Weight at 368 days of age was estimated by adding 168-day postweaning gain to adjusted 200-day wt.

Bulls and heifers were measured for height, and bulls were measured for scrotal circumference at an avg age of 349 days.

Results

Individual heterosis, differences between breeds in maternal ability, and growth rate were estimated (Table 2). Important heterosis effects, expressed as a percent of the straightbred mean, were 8.0% for birth wt and 7.9% for both preweaning avg daily gain and 200-day wt. Heterosis effects on postweaning growth traits of females were 15.7% for 168-day gain, 12.0% for 368-day wt, and 2.9% for 368-day height. Heterosis effects on postweaning growth traits of intact males were 9.1% for 168-day gain, 6.5% for 368-day wt, 2.3% for 368-day height, and 9.6% for scrotal circumference.

Based on comparison of reciprocal crosses, breed maternal effects were significantly greater for calves with Red Poll dams for birth wt, preweaning avg daily gain, 200-day wt, and for postweaning gain of female calves receiving a high silage diet. However, bull calves from Hereford dams grew more rapidly postweaning than bull calves from Red Poll dams; bull calves received a diet of higher energy density than the heifer calves. Estimates of Red Poll breed effects exceeded Hereford breed effects for survival, preweaning avg daily gain, 200-day wt, and 368-day height. However, Hereford breed effects exceeded Red Poll breed effects for calving difficulty, birth wt, and 168-day postweaning gain in both heifers and bulls. Breed maternal effects were higher for the Red Poll, while breed effects for traits of the individual (e.g., growth rate) were higher for the Hereford.