

SIRE AND DAM BREED EFFECTS ON REPRODUCTION AND SURVIVAL IN PUREBRED  
AND FIRST-CROSS COWS

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INTRODUCTION

The Ministry of Agriculture and Fisheries in New Zealand began a major Beef Breed Evaluation (BBE) as from the mating year of 1971. Widely sampled Angus (A) and Hereford (H) cows have been used to generate test progeny for carcass evaluation (steers) and reproductive comparisons (heifers : 4 calvings and 5 mating years each). The work is spread over three stations, the majority of cows being in the most difficult environment, Goudies Research Station, about 50 km south-east of Rotorua in the central North Island. The present summary is for Goudies-bred heifers born in 1973 to 1977, out of nearly 200 artificial insemination (AI) bulls of eleven breeds. Four breeds are local, Angus, Hereford, Friesian and Jersey and seven imported, Blond d'Aquitaine, Charolais, Chianina, Limousin, Maine Anjou, Simmental and South Devon. Bulls were chosen as being the best available from each breed, based on growth performance or progeny test data.

MATERIALS AND METHODS

The reproductive data on a total of 1491 heifers were analysed from the five years of birth. Data were pooled over years here, because of small subclass numbers. Also 4345 matings at second to fifth parities were added, with approximately two-thirds of the data coming from females out of Angus dams and the remainder Hereford dams.

Semen was not available from Chianina sires until the third year, so all data from Chianinas should be considered with reservations. Females of all twenty breed-crosses plus Angus and Hereford purebreds were mated to a third breed of bull, by AI in early years and natural mating later, to avoid confounding heifer genotype and mating sire breed. Mating sires were however not of the same breed each year.

Conception rates by pregnancy diagnosis (PD) following mating at approximately 15 months were calculated, and also PD results from second to fifth matings. The final data on the 1976- and 1977-born cows have not been collected yet. Cows were only culled for being open in two seasons, as assessed by PD.

Calving difficulty (CD) per 100 cows calving was recorded for all calvings up to the fourth, and an all-or-none score is presented here. Results are summarised separately for first vs later calvings.

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Preliminary results for cow survival (CS) up to 4½ years of age are also presented for females born in 1973 to 1976, expressed per 100 heifers joined at 15 months. The 1977-born heifers had only reached 3½ years by the time of PD in 1981. Although the Chianina-cross data are included here, more of their joinings have been to natural bulls rather than AI; the higher PD rates achieved with natural matings have resulted in fewer of their cows being culled as open.

Data have been summarised separately for females out of Angus vs Hereford dams. Correlations between sire breed effects estimated on females out of the two dam breeds were calculated, with nine degrees of freedom (eight when Chianina-crosses were ignored). The intercept and slope of the regression line are given here, with A and H in the equations representing the two dam breeds (in units of %).

Heterosis was calculated from the performance of HA and AH crosses less the mean performance of Angus and Hereford purebreds, and expressed as a percentage of the mean performance of the purebreds.

#### RESULTS

PD and CD results for all 22 breed of sire x dam combinations are shown for first parity females in Table 1. There was a wide range of PD means, 44% to 88%, around the overall mean of 70%, with Friesian- and Jersey-crosses performing best from either Angus or Hereford dams. The poorest sire breeds were Chianina- and Limousin-crosses, closely reflecting data on age at puberty. The correlation between sire breed effects evaluated on heifers from Angus or Hereford dams was 0.77, with prediction equation  $H = 0.89A + 8.7$ .

Apart from Chianina-crosses, the range of CD results from first calving heifers was 3 to 24%. The correlation between sire breed effects was quite small however, 0.28, although based on an average of only 34 calvings per Hereford-dam subclass.

Heterosis was 21% for PD and -35% for CD.

Equivalent results for second to fifth PD results, and second to fourth CD results are given in Table 2. Friesian- and Jersey-crosses in this tough environment out of Angus dams still ranked first and second for PD, although they ranked third and fourth respectively when out of Hereford dams. Of note also were the high performances of AH and Charolais-Hereford cows. Calving difficulties were small (5%) for older cows of all breed crosses, with a small range.

As expected, heterosis for PD results (13%) was smaller in cows than in heifers, and surprisingly the heterosis for CD was positive (10%) though probably not significant.

Over all five parities, sire breed effects for PD based on Angus vs Hereford dams had a correlation of only 0.45, with prediction equation  $H = 0.47A + 38$ . Over all four parities, sire breed effects for CD had a correlation of 0.31.

Plotting 22 points of PD results for parity 1 vs parity 2, the correlation was 0.64, with prediction equation  $PD_2 = 0.37 PD_1 + 40$ .

Preliminary cow survival data are summarised in Table 3. Mean CS up to 4½ years of age was 59%. Apart from Chianina-crosses, the breed-crosses more than 4% units above the mean were Maine Anjou-Angus, South Devon-Angus,

Friesian-Angus, AH and both Jersey-crosses. The productive Friesian-crosses had higher survival than straight Angus but about the same as straight Hereford. Heterosis was 17%.

#### DISCUSSION

Large sire breed differences exist in first parity PD results, which seem to be reasonably reproducible in heifers out of Angus or Hereford dams. The correlation of first and second PD result (20 df) was smaller and the correlation of sire breed effects (9 df) over all five parities based on heifers from Angus vs Hereford dams was only 0.45, indicating (at this stage) presumably many factors affecting lifetime PD result. Quite large differences (Tables 2 and 3) between HA and AH crosses indicate possible maternal effects for PD and CS.

Friesian- and Jersey-crosses were the best beef producing crosses available over five parities of evaluation, with an 82% and 81% PD result out of Angus dams, compared with 78% for HA and 70% for straight Angus. Out of Hereford dams they were 4% and 6% below AH, with the straight Herefords being 13% below AH. With a record like this, why should Friesian- and Jersey-crosses be called dairy crosses? Calf weaning weights from Friesian- and Jersey-cross dams have also ranked these dams well in all BBE data, being respectively 16 and 8% above straight Angus. Of the 'exotic' crosses, based only on the PD criterion, Maine Anjou-Angus and Charolais-Hereford cows showed high potential, but not above HA or AH performances.

Further detailed analyses are required, but preliminary data show the merits of the Friesian- and Jersey-crosses. These are now being evaluated, amongst others, in a further Phase of the research.

Table 1. Conception rates by pregnancy diagnosis (PD) following mating at approximately fifteen months of age, and two-year-old calving difficulty (CD) frequencies, in crossbred and purebred females born in 1973 to 1977

Sire breed of heifer	Dam breed of heifer					
	Angus			Hereford		
	No. of matings	% PD in calf	% CD, of heifers calved	No. of matings	% PD in calf	% CD, of heifers calved
Overall	971	69	12	520	71	12
Blond d'Aquitaine	74	66	7	41	59	14
Charolais	67	60	24	22	73	18
Chianina (no 1973, 1974 data) <sup>†</sup>	63	48	11	27	44	0
Limousin	70	50	3	47	49	11
Maine Anjou	77	71	7	40	85	13
Simmental	181	68	11	97	64	16
South Devon	64	77	18	33	67	5
Friesian	72	88	13	34	88	13
Jersey	71	85	9	47	87	5
Angus	145	64	11	76	83	5
Hereford	87	81	17	56	71	23
(% heterosis*): PD in calf		(21)				
CD			(-35)			

\* AH and HA versus AA and HH

<sup>†</sup> Chianina semen was not available before the third year of the trial.

Table 2. Conception rates by pregnancy diagnosis (PD) following matings of cows in their second to fifth seasons, and calving difficulty (CD) frequencies at 3 to 5 years of age, in crossbred and purebred females born in 1973 to 1977 (data inclusive of 1980/81 season).

Sire breed of cow	Dam breed of cow					
	Angus			Hereford		
	No. of matings	% PD in calf	% CD, of cows calved	No. of matings	% PD in calf	% CD, of cows calved
Overall	2808	73	5	1537	72	5
Blond d'Aquitaine <sup>+</sup>	194	66	5	121	71	11
Charolais	171	71	7	59	80	2
Chianina (no 1973, 1974 data)	163	79	4	78	71	2
Limousin <sup>+</sup>	199	69	2	137	70	6
Maine Anjou <sup>+</sup>	231	77	6	113	67	3
Simmental	537	69	7	279	65	9
South Devon	191	70	3	86	71	7
Friesian <sup>+</sup>	231	80	4	111	75	5
Jersey <sup>+</sup>	228	80	1	138	73	0
Angus	406	72	7	243	82	5
Hereford	257	77	6	172	69	3
(% heterosis <sup>+</sup> ):	PD in calf	(13)				
	CD		(10)			

\* AH and HA versus AA and HH

+ No 1977-born heifers of these crosses were generated.

Table 3. Cow survival (CS) summaries\* up to 4½ years of age per 100 15-month females in crossbreds and purebreds born in 1973 to 1976 : preliminary data

Sire breed of heifer	Dam breed of heifer			
	Angus		Hereford	
	No. of 15 month heifers	% CS	No. of 15 month heifers	% CS
Overall	905	59	488	58
Blond d'Aquitaine	74	43	41	56
Charolais	56	61	19	58
Chianina (no 1973, 1974 data)	45	76	21	62
Limousin	70	59	47	60
Maine Anjou	69	65	34	50
Simmental	181	56	97	47
South Devon	53	68	26	50
Friesian	72	64	34	59
Jersey	71	65	47	66
Angus	136	52	70	69
Hereford	78	62	52	60
(% heterosis <sup>+</sup> )		(17)		

\* Cows culled after being diagnosed open in two years

+ AH and HA versus AA and HH.

#### SUMMARY

Reproductive data have been analysed from 1491 heifers generated over five calf drops out of widely sampled Angus and Hereford dams in N.Z. Heifers were sired by nearly 200 AI bulls of 11 breeds, Angus, Hereford, Friesian and Jersey and imported Blond d'Aquitaine, Charolais, Chianina, Limousin, Maine Anjou, Simmental and South Devon. Heifers were mated to a third breed of bull. The mean conception rate by pregnancy diagnosis (PD) following mating at approximately 15 months was 70%, range 44 to 88%. The correlation among sire breed effects for heifers out of Angus vs Hereford dams was 0.77, with 21% heterosis among Hereford-Angus and its reciprocal. Adding PD data from 4345 matings of second to fifth parities, Friesian- and Jersey-cross females ranked first and second out of Angus dams, and second and fourth out of Hereford dams, under difficult farming conditions. Calving difficulty results ranged from 3 to 24% among two-year-old calvers (excluding Chianina crosses) with negative heterosis, and from 0 to 11% among older cows but with positive heterosis. Survival data for cows up to 4.5 years of age are also summarised.

#### R E S U M E N

Se han analizado los datos de reproducción de 1.491 terneras producidas de madres Angus y Hereford en Nueva Zelanda. Las novillas se cruzaron con unos 200 toros de inseminación artificial de 11 razas, Angus, Hereford, Friesian y Jersey, y las importadas Rubia de Aquitania, Charolesa, Chianina, Limosina, Maine Anjou, Simmental y South Devon. Las novillas se cruzaron con una tercera raza de toros. El tipo medio de concepción por gestación diagnosticada (PD) consecutivamente a las montas y aproximadamente a los 15 meses de edad fué del 70%, con oscilación de 44 al 88%. La correlación entre los efectos de la raza del padre para novillas Angus frente a Hereford fué de 0,77, con 21% de heterosis entre Hereford-Angus y recíprocamente. Los datos adicionales PD de 4.345 montas del segundo al quinto parto, de hembras Frisonas y Jersey cruzadas se situaron en primer y segundo lugar sobre las Angus y en segundo y cuarto frente a las Hereford bajo condiciones difíciles de granja. Los resultados difíciles de producción de terneros oscilaron de 3 a 24% entre las parturientas de dos años de edad (excluyendo los cruces con Chianina) con heterosis negativa y de 0 a 8% entre las vacas de más edad, pero con heterosis positiva. Se resúmen también los datos de supervivencia de vacas hasta 4,5 años de edad.