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CALVING RATES IN A HEREFORD COW HERD FOLLOWING SYNCHRONISED ARTIFICIAL INSEMINATION PROGRAMS

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SUMMARY
Hereford cows were mated to semen (total 2438 doses) from seven sire breeds (Angus, Belgian Blue, Hereford, Jersey, Limousin, South Devon and Wagyu). A total of 97 sires were represented over four matings from 1993-1996 with an overall calving rate of 62%. Only 19% received a repeat dose of semen. Year of mating and cow age significantly affected calving rates and gestation lengths. Sire breed differences were not significant. However, a wide range of success rates were noted for individual sires.
Keywords: Cattle, semen, oestrus synchronisation, calving rates, gestation length.

INTRODUCTION
In many countries, cattle are intensively farmed, observed daily and artificial insemination (AI) is relatively commonplace, whereas artificial insemination of beef cows in Australia represents the exception because cattle are extensively managed and heat detection is both difficult and expensive. This trial was designed to study the genetics of meat quality traits (Rutley *et al*. 1995, Ewers *et al*. 1999 and Siebert *et al*. 1999) and hence required the use of a relatively large number of sires which precluded the use of paddock mating with bulls. At the time of planning the trial, reliable results of artificial insemination programs to calculate the numbers of doses of semen necessary to achieve the number of calves required for accurate comparisons were difficult to obtain. Publication of trial results with various methods of synchronisation may help others faced with similar circumstances.

MATERIALS AND METHODS
The programs were conducted at Struan Research Centre and at Wandilo, near Mt Gambier, South Australia. Straight-bred Hereford cows (fat score approx 2) which had calved in March-April (autumn calving) were mated in June-July each of the years 1993-96.

The 1993 synchronisation program consisted of a Prostaglandin(PG) program using PG on days 1 and 11 followed by insemination after observed oestrus using Ka-Mar® heat detectors on days 14 or 15. In subsequent years, a combination of drugs based on a modified EZI-BREED CIDR® program was used. The 1994 synchronisation program was as follows: Day0; insertion of the CIDR® plus Oestradiol Benzoate capsule into all cows which had calved at least 55 days prior: Day 6 PG injection to all cows: Day10 removal of the CIDR®, wash and dry used CIDRs® for re-use; Days12 and 13 inseminate cows with positive Ka-Mar heat detection devices (approximately 48-72 hours after the removal of the CIDR®); keep non-submitters calves in yards for 48 hours. Day15 reunite cows and calves: Day 20-22 late calving cows (those which had less than 55 days since calving at the start of the program) separated from calves for 48 hours; Day 22 insert new CIDRs® and capsules into non-submitters and "late calvers": Day 27 insert washed CIDRs® (no capsules) into all inseminated cows to pick up natural

returns; Day 28 inject PG into late calvers; Day 32 withdraw all CIDRs® and apply Ka-Mars, PMSG all non-submitters; Days 34, 35 and 36, AI cows with positive heat detection devices. In 1995 and 1996 the above program was used, except that calf withdrawal and PMSG were omitted.

Semen was obtained from a total of 97 bulls selected to represent the variety of bloodlines available within each breed and sources included custom collected and licensed AI centre derived semen from Australia and overseas. Breeds were selected to represent a wide range of biological types and included Angus, Hereford, South Devon, Limousin, Belgian Blue, Jersey and Wagyu. Cows were weighed prior to mating each year. Cows were only culled prior to calving if they had serious faults such as developing eye cancer or lameness. Calves born at Struan were weighed, ear-tagged and tattooed on the day of birth. However, at Wandilo, calving rounds were carried out only three times per week .

Results were analysed using Proc. Mixed (SAS 1989) with year of mating, cow age and breed of sire as fixed effects. In addition, sire nested within breed, and cow were fitted as random effects. Age and location were almost completely confounded with young cows (1-5) at Struan and older cows (5-11) located at Wandilo so location was not included. Significance was defined as $P<0.05$. Heritability and repeatability were calculated from the sire, cow and residual variances.

RESULTS AND DISCUSSION

The proportion of calves per cow programmed was higher in this study than that of Graham *et al.* (2000) who obtained 43% (range 33-66%) calving to cows programmed over the two years 1997-98. However their programs resulted in a tighter synchronisation (2 days) than this study (3 days for first AI followed by 6 days for returns in 1993; 2 days followed by 3 days for returns in 1994-96) and almost 100% of cows programmed being inseminated in their CIDR+PG+ODB program with more than 90% on the first day of insemination. The procedure of calf withdrawal from first calvers and late calvers was discontinued because of the effects of concentration of cows around yards and the labour involved.

Table 1. Insemination and calving summary

Year	1993	1994	1995	1996	Total
Total herd	526	630	637	669	2462
Doses used	535	683	703	517	2438
Cows recycled	68	127	122	72	389
Cows inseminated	467	556	554	445	2022
Cows not cycled	59	74	83	224	440
Calves born	343	361	350	285	1339
Calves alive	321	328	337	278	1264

Age of cow at mating and year of mating were significant for all traits (Table 2). There was a rapid reduction in calving rates of cows mated at 9 years of age or older. This is possibly due to a combination of a natural decline in fertility with age and the culling of older cows for eye cancer, lameness etc. which may have included pregnant cows. The peak of calf production was in cows mated at 7 years of

age (calve at 8). This is consistent with the early report of Rutley *et al*. 1995), who noted that 7 year old cows had the heaviest and fattest calves.

Table 2. Least squares means (±SE) and significance of calving and insemination data

	Mating weight (kg)	Calves born to first insemination (%)	Repeat insemination (%)	Calves born to cows progr'd (%)	Gestation length (days)
Year of mating	***	***	***	***	***
1993	489±4.3	68±3	12±2	67±3	283±0.7
1994	487±2.6	66±3	21±2	62±3	285±0.6
1995	503±2.5	56±3	27±2	53±3	283±0.6
1996	514±2.7	57±3	16±2	56±3	286±0.6
Age of cow at mating	***	***	NS	***	***
2	399±2.6	67±2	21±2	66±2	281±0.5
3	445±2.6	74±3	23±2	68±2	283±0.5
4	489±3.2	70±3	20±2	66±3	284±0.6
5	516±3.7	69±3	17±3	64±3	284±0.6
6	507±4.5	74±4	14±3	70±4	284±0.7
7	512±5.4	67±4	23±3	67±4	285±0.8
8	534±5.4	66±5	19±4	62±5	285±0.9
9	532±6.4	48±5	18±4	47±5	286±1.1
10	527±6.9	41±6	23±5	44±6	284±1.3
11	523±10.9	40±11	13±9	41±10	287±2.6
Breed of sire		NS	NS	NS	***
South Devon		59±3	18±2	57±3	285±0.8
Limousin		59±3	20±2	57±3	288±0.8
Belgian Blue		61±3	20±2	59±3	284±0.8
Hereford		56±4	24±3	54±4	283±1.0
Angus		66±4	18±3	64±4	281±0.9
Wagyu		64±3	17±2	63±3	287±0.8
Jersey		65±3	17±3	63±4	282±0.9
Variances					
Sire(Breed)		0.0004	0.0002	0.0042	4.4
Cow		0.0315	0.0037	0.0257	9.4
Residual		0.1775	0.1560	0.1908	44.1
Heritability (%)		1	1	8	30
Repeatability (%)		16	3	19	47

*** = P<0.001; NS = not significant

Mating weight as a linear and quadratic was not significant as cow age accounted for most of the variation in mating weight. The mating weight by cow age interaction was significant for gestation length. Significant effects on gestation length were noted for year of mating, age of cow and breed of sire. The age of cow effect can be partly explained by the fact that older cows were at Wandilo where calving rounds were carried out three times per week and some calves may have been 3 days old when found. The breed range of 281 days for Angus to 288 days for Limousin is similar to that reported by Graham *et al*. (1999)

Differences in calving rates due to breed were not significant. However it was noted that none of the Angus sires had less than 52% and one had 90% calves born to doses of semen used. Individual sire values ranged from a minimum of only 7% to a maximum of 90%. The calving rate for the top 23 bulls exceeded 70% whereas 13 bulls had an average of less than 40% calving. There is large variation due to environmental or chance events noted here which should be taken into account when planning an AI program. Dependant on numbers of progeny required, extra semen / bulls should be used to make up for random failures.

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