AGBU ANIMAL GENETICS AND BREEDING UNIT
A joint unit of NSW DPI and UNE

Technical Information Note I/1995

Understanding CALVING EASE EBVs

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As the weight and growth rate of beef cattle increases Calving Ease becomes more and more important for the well being of dams and calves and for the subsequent production ability of the cow. Cows who experience more problems at calving will more likely lose the calf, produce less milk and get in calf later. Together with the increased cost for labour to assist a cow these effects of calving problems all contribute to the economic importance of Calving Ease.

Birth weight has long been used as an indicator for Calving Ease. But every observant beef producer knows at the same weight there is still a lot of variation in Calving Ease. Therefore some beef breed societies have encouraged their BREEDPLAN members to record Calving Ease on a 1 to 5 scale.

Table 1: BREEDPLAN Calving Ease score

Score	Definition
1	unassisted
2	easy pull
3	hard pull
4	veterinary assistance
5	malpresentation

Note that it is active recording; a blank in the column will not be interpreted as unassisted. Easy pull is defined as one person without mechanical help, while a hard pull requires two persons or one with mechanical help.

Scientists at the Animal Genetics and Breeding Unit have developed analytical software which combines in one analyses the information collected on Calving Ease, Birth Weight and Gestation Length (from AI) to estimate breeding values for Calving Ease.

What affects Calving Ease?

Calving Ease is affected by:

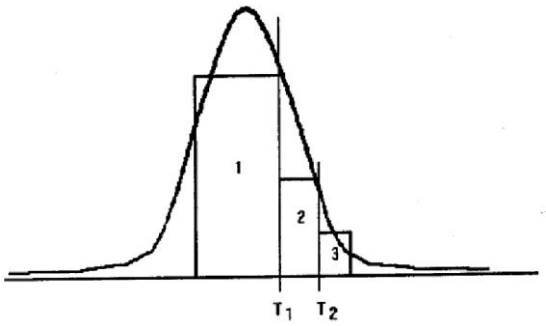
a) the calf; through sex, size, weight and shape and

b) the cow; through pelvic size, age, parity, fatness and hormonal levels.

Both cow and calf "performance" is influenced by genes but the performance is lowly heritable. The goal of the genetic analysis is to separate these different effects using the pedigree of cow and calf. We want to identify sires which produce calves that are born easy and sires which have daughters with no problems giving birth to their first calves.

Calving ease is, as described above, a trait recorded in few categories or classes and the majority of observations are scored into the first class "Unassisted" (Figure 1), even so there are considerable differences between calvings which are recorded as unassisted. Due to the inability of our observation and recording systems we can't distinguish between cows that have two hour labour or five hour labour.

Figure 1: Observed and underlying distribution of calving difficulty, a threshold model



To calculate EBVs for calving ease we need calving problems. Breeders which are quicker with assistance are an advantage for the evaluation system as it makes it easier to differentiate between animals. Groups of cows with all calves being born unassisted are of no value for a genetic evaluation of Calving Ease if this is the only information available. However birth weight and gestation length do influence Calving Ease. We know that if either of them increases the underlying calving problem will increase too (Table 2). It will be more difficult for a cow to give birth to a calf with 40 kg than to one with 35 even thought, both might be born unassisted.

To estimate the breeding values a threshold model is used that translates the records from the observed scale 1-3 to a normal distribution on an underlying scale (Fig 1). Scores 3 and 4 are currently combined and malpresentations are not included.

The assumption is made that the sum of the different effects on calving ease (genetic and non genetic) is normally distributed on this underlying scale. When the sum becomes larger than threshold T1 or T2 we observe Calving Ease as an easy pull or hard pull, respectively. A population has overall thresholds or average thresholds. The effect of management (breeders readiness to assist), age of cow and sex of calf all have a major influence on the frequency of calving difficulty and therefore modify the values of the threshold s for a particular group of animals. In young cows calving problems are more frequent and the thresholds in Figure 1 move to the left. Female calves are born on average easier than male calves; their thresholds are further to the right. Analysing data from three breeds we found that the differences between the sexes and the cow age groups are very consistent across the three breeds (Table 2) although the overall calving difficulty differ between the breeds. Very similar observations are made for birth weight and gestation length. We find that male calves have a longer gestation and are heavier at birth (Table 2).

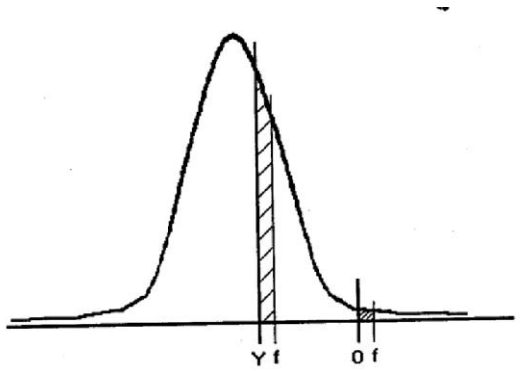
Table 2: Sex and age of cow effects on Calving Ease, Birth Weight and Gestation Length

		Calving Ease SD	**Birth Weight kg**	**Gestation Length days**
Phenotypic SD		1	44.6	5.2
Sex	F	+0.28	-1.1	-1
	M	-0.28	+1.1	+1
Dam age:	2	-0.70	-2.8	-2
	3	+0.11	-1.6	-1
	5	+0.67	0	0

From the normal distribution in Figure 2 we can see that the difference eg. between male and female calves of 0.56 SD will result in a bigger difference in calving problems in two year old cows between the two sexes compared with the same difference in mature cows. The mature cow threshold for unassisted birth is about 1.4 SD to the right of the threshold of two year old cows. Any deviation from the two thresholds eg. by difference in sex, will have a far greater effect on the left threshold for two year old cows as is demonstrated in Fig 2 by the area, under the curve.

EBVs on underlying scale

Direct and maternal Estimated Breeding Values are also calculated on the underlying



scale in units of standard deviations. Calving Figure 2: Female calf effect in young (Y) and old (O) cow for Calving Ease

EBVs on the observed scale

The EBVs on the underlying scale do not mean much to most producers and breeders. Therefore the EBVs are expressed on an observed scale as plus or minus % additional animals born unassisted. The threshold used for the transformation is the one for two year old cows, which gives the largest differences between sires.

One EBV is for the direct effect, the second one is for the maternal effect. The direct effect is important for a sire of calves, as it indicates how many more or less % calves from this bull are expected to require assistance at birth out of two year old cows. As with all EBVs a sire contributes only 50% to the total genes of a calf and therefore the difference between two sires' EBVs has to be halved to compare progeny performance. A sire with an EBV of +8% for Calving Ease is therefore expected to have 4% more calves being born unassisted out of two year old cows than a sire with an EBV of 0%.

The second EBV called Daughter's Calving Ease is an indicator for the daughters of a sire to give birth unassisted as a two year old. It consists of the maternal component and half the direct component. Again it is an EBV. A difference of 8% between two bulls means we can expect that 4% more daughters of the sire with the higher EBV will calf unassisted at two years of age.

These EBVs are based on a breed average threshold for two year olds. This threshold can vary from year to year and from herd to herd and with it the expected difference between progeny performance either as calf or as daughter. Regardless of all that the progeny of a bull with the higher EBVs are always expected to have less problems being born or giving birth.

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