Predicting Fertility with Days to Calving EBVs

The Importance of Selecting for Fertility

As producers in the business of beef cattle breeding, maintaining profitability is paramount to business success. There are many factors that affect profit, however, it is widely documented that fertility and successful reproduction are possibly the most important factors determining the profitability of a breeding operation.

The job of a female in a beef producing herd is to conceive, carry a foetus during gestation, deliver a live calf and raise it until weaning, within every 12 month period of her breeding life. A female that does not produce a live weaner every year is failing to do her job and eroding herd profitability. The most productive and profitable females wean the most kilogram’s of calf, most frequently, with minimal inputs. Achieving this outcome relies on fertility and optimal management.

Like other production traits, fertility is influenced by both genetic and environmental factors. Genetic variation for fertility traits within a cattle population provides the opportunity to identify and select the most fertile animals for breeding and thus, make genetic improvement. It is important to note that most fertility traits are lowly heritable, which means that more effort and time is required to make genetic improvement. One exception to this rule is the male fertility trait, scrotal size. Irrespective of heritability, the right selection decisions based on objective measurements will ensure permanent and cumulative progress over time. For a list of heritabilities and a more detailed explanation of the factors which drive genetic improvement, see the document titled “The Importance of Genetics and Objective Selection” on this CD.

Overall fertility in a breeding herd depends on both male and female fertility. Genetic improvement through female selection only is slow, and most gains are achieved if sires are also selected for fertility. Not only does fertility have ramifications in the current herd (ie. how many calves weaned this year), the sires selected for breeding now can affect the future herd for many years to come via the fertility of retained daughters.
There are a number of measures available to producers to assist them in their fertility selection decisions. For example, raw data (for females) such as calving history, calving interval and age at first calving are useful statistics but may be limited by patchy recording and environmental effects within and across years.

BREEDPLAN solves the problem with EBVs by adjusting for, or removing, those environmental effects which impact on fertility. There are currently two EBVs available for the fertility traits – the male trait Scrotal Size and female trait Days to Calving. This document will specifically concentrate on Days to Calving as it is emerging as a very important trait in the northern cattle industry.

**Days to Calving EBVs**

Days to Calving EBVs are estimates of the genetic differences between animals in time from the start of the joining period (ie. when the female is introduced to a bull) until subsequent calving. They are expressed in days. The Days to Calving EBV promotes those cows that calve earlier in the season compared to those that calve later, while penalising those cows that do not calve at all. Variation in days to calving is mainly due to differences in the time taken for females to conceive after the commencement of the joining period, as illustrated in Figure 1.

![Figure 1. Time Between First Mating and Calf Being Born.](image)

Days to Calving EBVs are calculated from the joining records submitted for females. At this stage only natural/paddock joinings are used in the calculation of EBVs, however AI joinings may be included at a later date. It is very important that once joined, all cows need to either have a calf recorded or a fate code and date entered that suitably describes why the cow does not have a calf recorded.

Of the tropical breeds, Days to Calving EBVs are only currently available in Brahman and Santa Gertrudis (as at July 2007). The development of this EBV in other breeds relies on the submission of quality joining records from a number of performance recording herds.


Example EBV Calculation

In the calculation of EBVs, the BREEDPLAN analysis takes into account all available pedigree and performance information for each animal. This includes the animal’s own performance, the performance of its parents and progeny. As joining records are only submitted for females, Days to Calving EBVs for males can only be calculated using the information available on their parents, progeny or relatives. The EBVs will generally have low accuracies until a sire has a large number of daughters with days to calving records.

In the case of a 2 year old bull, which is a typical age at purchase, there will have been no joining records submitted for his daughters yet. Therefore, his Days to Calving EBV will be a product of his parental information.

To describe this more clearly, let’s take a look at how a Days to Calving EBV is calculated for an example 2 year old Brahman bull. In this example, actual 2006 GROUP BREEDPLAN EBVs and EBV accuracies have been used, however animal names have been substituted. Figure 2 displays the Days to Calving EBVs and accuracies for “Bob” and his sire and dam. If we were predicting the outcome of a mating of Bob’s sire and dam, we could calculate the resultant Days to Calving EBV of the offspring by adding their EBVs together and dividing by two (ie. (Sire EBV + Dam EBV)/2). Therefore, in this example, the calculation would be (-0.3 + (-9.0)/2) = 4.65. When rounded, this is equivalent to Bob’s Days to Calving EBV of -4.7. This is what we would expect as Bob’s EBV is being purely driven by his parental information at this stage.

![Bob’s EBVs](image)

So what information is contributing to the EBV of Bob’s dam, which, at -9.0, is in the top 1% of the Brahman breed?

Firstly, based on the EBVs of her parents, the mid-parent EBV of Bob’s dam is -3.3. In order for her EBV to change from the mid-parent value of -3.3 to her final EBV of -9.0, there must be other information contributing to the EBV calculation. In her case it is her 3 joining records being evaluated by BREEDPLAN that are having this effect. In the BREEDPLAN analysis, Bob’s dam is compared with other cows in each of her joining groups in regards to the number of days from the day they were introduced to the bull and their subsequent calving. The details are summarised in Table 1.
Table 1. Summary of Bob’s Dam’s Joining Groups.

<table>
<thead>
<tr>
<th>Joining Group</th>
<th>Number in Joining Group</th>
<th>Average of Group (days)</th>
<th>Bob’s Dam (days)</th>
<th>Difference (Bob’s Dam vs Average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>36</td>
<td>440</td>
<td>286</td>
<td>-154</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>390</td>
<td>355</td>
<td>-35</td>
</tr>
<tr>
<td>3</td>
<td>19</td>
<td>383</td>
<td>377</td>
<td>-6</td>
</tr>
</tbody>
</table>

Table 1 reveals that Bob’s dam has performed better than the average of her joining groups on each occasion. For instance, in joining group 2, Bob’s dam’s days to calving was 35 days shorter than the average of her joining group. Her above-average performance is playing a major role in pushing her Days to Calving EBV in the negative direction.

What Does the EBV Mean?

Lower, or more negative, Days to Calving EBVs are generally more favourable. Shorter days to calving is associated with earlier puberty in heifers, earlier return to oestrus after calving and earlier conception in the joining period. This has advantages relating to management, marketing of progeny and the ability of a cow to conceive and calve within every 12 month period.

Let’s say we were considering purchasing Bob as a 2 year old bull with an EBV of -4.7 and were comparing him to a bull with a Days to Calving EBV of +4.7. When mated over similar cows, we would expect Bob to produce daughters that conceive on average 4.7 days (4.7 - (-4.7)/2) earlier in the joining period than the other bull. This effect will be cumulative over the life of these daughters.

It is interesting to note the relationship between the two fertility traits, days to calving and scrotal size. Increased scrotal circumference has a small favourable relationship with days to calving, such that bulls with larger scrotal circumference tend to have daughters with shorter days to calving.