

Variation in Age and Weight of Puberty in Tropical Cattle



A major research project within the Cooperative Research Centre for Beef Genetic Technologies (Beef CRC) has provided a very useful insight into the variation that exists in the age and weight at which tropical cattle reach puberty in Northern Australia.

Previous to the Beef CRC, very little research had been done in this area, with one of the primary objectives of the Beef CRC project being to investigate what effect genetics had on the age of puberty and consequently what opportunities may exist to improve fertility rates in Northern Australia through genetic improvement.

PROJECT DESIGN

A total of 2115 heifers were involved in the project (1007 Brahman and 1108 Tropical Composites (TC)). The heifers were born in Northern Australia on 7 co-operator properties (4 Brahman and 3 TC) and at "Belmont Research Station" which breed both Brahman and TC. Genetic linkage, across properties of origin and year within genotypes was generated by the use of AI. The heifers were generated over 4 and 3 years for Brahman and TC respectively.

The heifers were allocated according to genotype, property of origin and sire to one of the following four properties "Toorak" Julia Creek, "Belmont" Rockhampton, "Swans Lagoon" Ayr and "Brian Pastures" Gayndah at weaning.

Belmont and Toorak ran both Brahman and TC while Brian Pastures only had TC and Swans Lagoon with the harsher environment only had Brahman. At each location all heifers from the same year of birth were managed as a single cohort (group).

The heifers were ovarian scanned by the use of real time ultrasound by an experienced scanner to determine when the first Corpus Luteum (CL) was observed on an ovary. When a heifer had recorded a CL she was deemed to be pubertal. The heifers were scanned every 4-6 weeks after they had reached 200 kg or at the first

scanning opportunity if they were over 200 kg at their entry into the project. At each ovarian scan the heifers were weighed, P8 fat measurement was recorded and a condition score was given. All heifers were kept in the project until they had a recorded CL, which in some cases was after 2 mating opportunities.

RESULTS

Analysis of the Beef CRC results across all four properties shows that there was a large range in both the weight and age at which the heifers reach puberty in both Brahman and TC. There was a difference of 29 months from when the youngest heifer till the oldest heifer reached puberty, whereas a difference of 289 kg was recorded between the lightest and heaviest animals when the first CL was recorded as shown in Table 1.

Table 1. Mean & Range for All Heifers at Age of Puberty

| Trait | Mean | Range |
|------------------------|------|-----------|
| Age at 1st CL (Months) | 23 | 11-40 |
| Weight at 1st CL (kg) | 332 | 196 - 485 |

When looking at the distribution in age at when the heifers reached puberty, the effect the environment and production system has on when the heifers cycle was can be observed. Figure 1 shows there is a small number of Brahman heifers reaching puberty in the first wet season after weaning, followed by only low numbers until the next wet season when the majority of heifers reached puberty at two years of age and are going into mating. The last heifers did not reach puberty until the next wet season at nearly 3 years of age. Figure 2 shows the TC heifers had a similar pattern to the Brahman heifers except there were more heifers reaching puberty in the first wet season and only a few animals had not reached puberty at the end of the second wet season.

LOCATION DIFFERENCE

The location of the property on which the heifers were run had a large effect on the puberty traits in both breeds. In TC, the heifers at Toorak and Brian Pastures had a similar age and weight at first CL, whereas the heifers at Belmont were significantly older and heavier.

In Brahman, the heifers at Belmont and Toorak were significantly younger than those at Swans Lagoon at the age of puberty, even though the heifers at Swans were significantly lighter when they reached puberty. At Belmont, where the Brahmans and TC were run in the same cohort, there were no differences in age or weight at puberty between the breeds.

BIRTH-MONTH DIFFERENCES

Birth month had a significant effect on the puberty traits. As the heifer's birth month became later in the calving season (i.e. from August to April) there was a trend for age at first CL to increase. On average, early born heifers (i.e. August to September) reached puberty by approx. 20 months of age, coinciding with the end of their first post-weaning wet season (i.e. May).

For late-born heifers (i.e. February to March), the average age at puberty was delayed until the following May, at approx. 26 months of age, suggesting that heifers that did not achieve puberty before the start of their second post-weaning dry season were significantly delayed in reaching puberty. This can have a dramatic impact on the number of heifers that have reached puberty going into mating.



GENETIC EFFECTS

One of the key outcomes of the Beef CRC research was that both age at first CL and weight at first CL were shown to be under significant genetic control in both Brahmans and TC. Heritability estimates for age at first CL were 0.57 for Brahmans and 0.52 for TC while the heritability estimates for weight at first CL were 0.56 for Brahmans and 0.46 for TC.

Further analysis revealed that there was a difference due to genetics of 5.6 months in age of puberty between the top and bottom Brahman sire included in the research trial. Although not as high, there was a 3.1 month difference in age of puberty between the top and bottom sire in the TC.

Table 2. Mean of Heifer Puberty Traits by Location and Breed

| Tropical Composite | Toorak | Brian Pastures | Belmont |
|-------------------------|--------|----------------|------------------------|
| Age at 1st CL (Days) | 643 | 652 | 706 |
| Weight at 1st CL (Days) | 314 | 334 | 353 |
| Brahman | Toorak | Swans Lagoon | Percent Abnormal Sperm |
| Age at 1st CL (Days) | 750 | 805 | 724 |
| Weight at 1st CL (Days) | 339 | 323 | 357 |

CONCLUSIONS

There is a large variation in the both the age and weight that heifers reach puberty in tropical cattle, with both genetic and environmental influences having an effect. Age of puberty can be significantly delayed in late born calves and also in environments that limit growth rates particularly during the dry season.

Therefore, management can be used to reduce the age of puberty by controlling month of birth, duration

of mating period and supplementary feeding pre-pubertal heifers prior to mating. However, significant improvement can also be made by including selection for improved reproduction into a breeding program.

This can be best achieved by recording female reproductive performance information with BREEDPLAN for the calculation of Days to Calving EBVs (particularly reproductive information for maiden heifers), and careful consideration of Days to Calving EBVs when selecting both sires and dams for use within a breeding program.

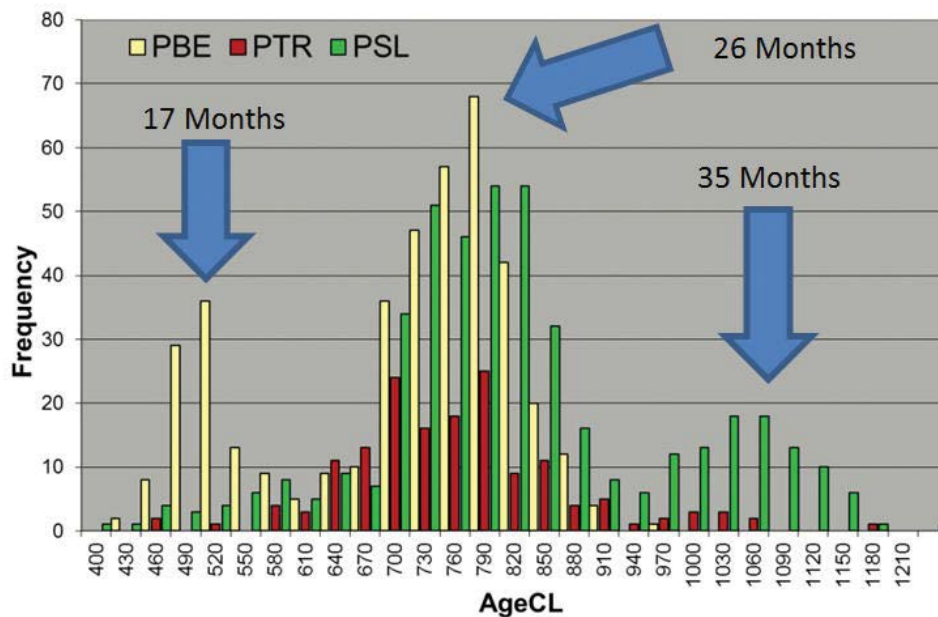


Figure 1. Distribution of Age of Puberty for Brahman on Belmont (PBL), Toorak (PTR) and Swans Lagoon (PSL) research stations.

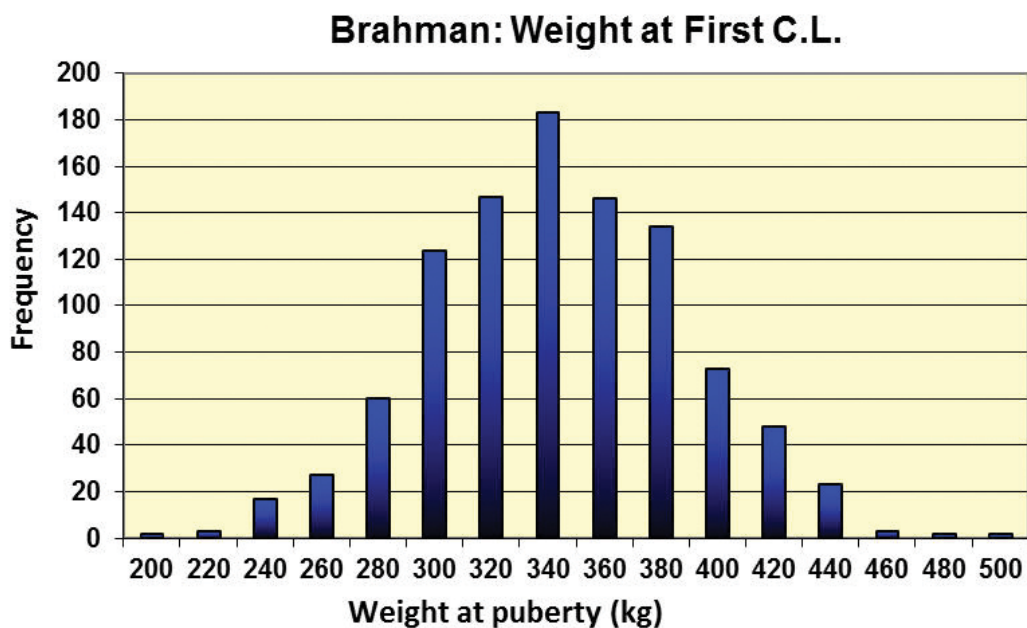


Figure 2. Distribution of Weight of Puberty for Brahman.