# IMPACT OF ADDITION OF NEW HERDS ON GENETIC PARAMETER ESTIMATES IN THE AUSTRALIAN BRAHMAN POPULATION

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## SUMMARY
The impact of new herds joining BREEDPLAN in recent years was investigated by comparison of genetic parameters estimated from old and new herds over the same time period. New herds tended to be smaller than older herds, but no difference was observed in average contemporary group size between the two groups. Some difference was observed between the two groups in direct genetic and residual variances, most likely due to less information available from new herds. Despite these differences, genetic parameters for the trait of 200-day weight for the two groups were very similar, indicating the data could be successfully combined for genetic evaluation purposes.

## INTRODUCTION
Australian Brahman GROUP BREEDPLAN commenced in the late 1980s with a small number (n=28) of performance recording herds. Greater extension of performance recording in Northern Australia from the mid 1990s onwards led to an expansion in the number of herds submitting performance and pedigree records in recent years. Herds that joined BREEDPLAN later tend to be smaller in size, and there is a perception that quality of their data is lower. This perception also extends to the impact that data from these herds has on genetic parameters. The purpose of this study was to study data quality and quantity characteristics associated with old and new herds, and investigate whether any differences were observed in genetic parameters between these herds.

## MATERIALS AND METHODS
**Data.** Pedigree and performance records were obtained from the Australian Brahman database. For the purposes of this study only 200-day weight records were considered. Herds were divided into two groups; old (herds with first performance recorded animals born before 1995) and new herds (herds with first performance recorded animals born since 1995). Five datasets were created; all records available from all years (1974-2004); records from old herds in first 20 years (1974-1994); **all** records available in last 10 years (1995-2004**a**); records from **old** herds in last 10 years (1995-2004**o**); and records from **new** herds in last 10 years (1995-2004**n**). Characteristics of the datasets are summarised in Table 1.

**Data structure and quality.** Several data structure and quality indicators were investigated for two datasets (1995-2004o and 1995-2004n) to better understand the data from old and new herds. These included distribution of contemporary group size, number of single sire contemporary groups, number of records per herd per year, percentage of dams with unknown dates of birth and percentage of recorded animals with unknown pedigree.

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**Table 1. Summary of the 200-day weight data subsets**

| | 1974-2004 | 1974-1994 | 1995-2004a | 1995-2004o | 1995-2004n |
|---|---|---|---|---|---|
| Trait avg (SD) kg | 204 (40) | 190 (34) | 211 (40) | 209 (39) | 214 (42) |
| Number of records | 113,564 | 35,098 | 78,428 | 52,118 | 26,310 |
| Number of animals | 157,256 | 51,449 | 118,953 | 76,939 | 45,537 |
| Number of sires | 3,730 | 1,290 | 2,772 | 2,034 | 1,038 |
| Number of dams | 50,652 | 16,015 | 38,471 | 24,415 | 14,603 |
| Dams with record | 19,878 | 5,373 | 11,007 | 7,846 | 2,638 |
| Avg. CG size (SD) | 10 (13) | 9 (10) | 11 (14) | 11 (14) | 10 (12) |
| Number of herds | 105 | 42 | 99 | 36 | 63 |
| Avg. records/herd/year | 91 | 89 | 103 | 169 | 66 |

**Model of analysis.** Variance components were estimated using the standard BREEDPLAN model for 200-day weight (Graser et al. 2005). Records were pre-adjusted for age of calf and age of dam using Brahman specific adjustment factors (Donoghue 2006). The fixed effect of contemporary group (CG) was included in the model, and single record contemporary groups were excluded from the analysis. Random effects fitted included direct and maternal genetic effects and maternal permanent environmental effects. The additional random effect of sirexherd was not fitted due to lack of data structure in the smaller datasets. Pedigree records for all animals with records and 2 further generations back were used. Variance components were estimated using DFREML (Meyer 1998).

## RESULTS AND DISCUSSION

**Data structure.** Distribution of records per herd per year and contemporary group size for old (1995-2004o) and new (1995-2004n) herds in the last 10 years are presented in Figures 1 and 2, respectively. Figure 1 clearly illustrates that new herds (1995-2004n) tend have a smaller number of records per year than old herds (1995-2004o). For example, 35% of new herds averaged less than 20 records per year, compared to only 8% of old herds. This trend is confirmed by the average number of records per herd per year for the two datasets reported in Table 1 (169 vs. 66 records per herd per year for old and new herds, respectively). However, smaller herds did not have a greater number of small contemporary groups, as illustrated in Figure 2 and the similarity in average contemporary group size reported in Table 1. The large number of contemporary groups with between 2 and 5 records in both datasets (~50%) is an area that could be addressed by Brahman breeders to increase the value of performance recording to their genetic evaluation.

Some differences were observed between old and new herds in data quality indicators. Herds that joined BREEDPLAN later had a greater percentage of records where the dam's date of birth was unknown (4% and 7% for old and new herds, respectively). In BREEDPLAN, dams with unknown dates of birth are given the default age of dam value (5 years of age). Records for calves when dam's date of birth is unknown may add "noise" to the analysis via incorrect adjustments because true date of birth of dam is unknown, and this "noise" could be reflected in higher residual variances. There were more recorded animals with unknown pedigrees in new herds (5 % and 8% for old and new herds, respectively), and new herds (13%) had a higher number of single sire contemporary groups than old herds (8%). These statistics all indicate that the amount of information available for analysis from new herds was less than for old herds, which is not unexpected for new herds entering a genetic evaluation system.

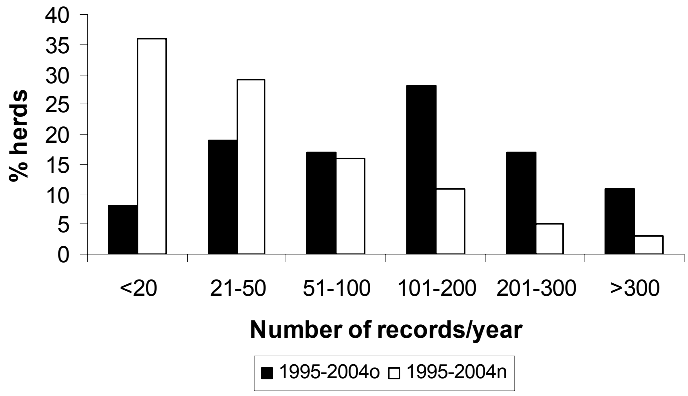


**Figure 1. Distribution of number of records/year.**

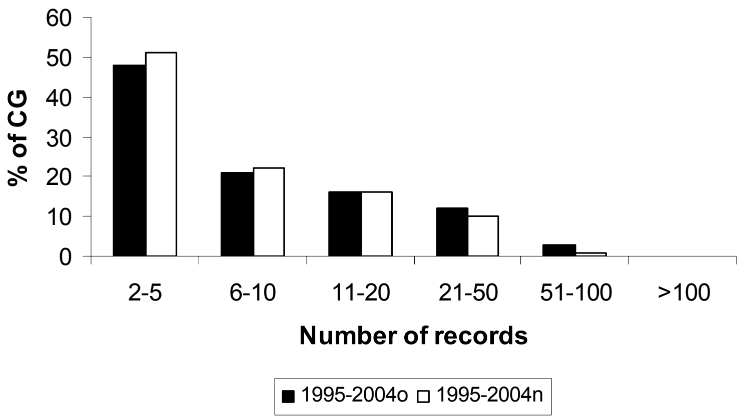


**Figure 2. Distribution of CG size.**

**Genetic parameters.** The genetic parameters estimated for the five datasets are summarised in Table 2. Parameters reported include direct ($\sigma^2_d$) and maternal ($\sigma^2_m$) genetic variances, maternal permanent environmental ($\sigma^2_c$), residual ($\sigma^2_e$) and phenotypic ($\sigma^2_p$) variances. Direct ($h^2_d$) and maternal ($h^2_m$) heritabilities and maternal permanent environmental variance as proportion of phenotypic variance ($c^2$) are also reported.

**Table 2. Genetic parameters for the 200-day weight datasets (*se*)**

| Parameter | 1974-2004 | 1974-1994 | 1995-2004a | 1995-2004o | 1995-2004n |
|---|---|---|---|---|---|
| $\sigma^2_d$ | 131 *(4.9)* | 122 *(8.1)* | 141 *(6.3)* | 148 *(7.8)* | 121 *(10)* |
| $\sigma^2_m$ | 29 *(2.5)* | 23 *(4.1)* | 24 *(3.0)* | 25 *(3.8)* | 22 *(5.0)* |
| $\sigma^2_c$ | 32 *(2.2)* | 30 *(3.8)* | 34 *(2.9)* | 34 *(3.5)* | 30 *(5.5)* |
| $\sigma^2_e$ | 279 *(3.1)* | 247 *(5.2)* | 288 *(4.1)* | 269 *(4.9)* | 331 *(7.4)* |
| $\sigma^2_p$ | 471 *(2.6)* | 422 *(4.2)* | 487 *(3.2)* | 476 *(3.9)* | 504 *(5.3)* |
| $h^2_d$ | 0.28 *(0.01)* | 0.29 *(0.02)* | 0.29 *(0.01)* | 0.31 *(0.02)* | 0.24 *(0.02)* |
| $h^2_m$ | 0.06 *(0.005)* | 0.05 *(0.01)* | 0.05 *(0.006)* | 0.05 *(0.008)* | 0.04 *(0.01)* |
| $c^2$ | 0.07 *(0.005)* | 0.07 *(0.009)* | 0.07 *(0.006)* | 0.07 *(0.007)* | 0.06 *(0.01)* |

Maternal heritabilities and $c^2$ were very similar across all datasets. Slight differences were observed for direct genetic and residual variances. In particular, new herds (1995-2004n) had reduced direct genetic variance (and, thus, direct heritability) and an inflated residual variance in comparison to old herds in the same time period (1995-2004o). These differences could be explained by some of the data quality factors mentioned before; greater percentage of records where dam's date of birth is unknown, and greater percentage of recorded animals with unknown pedigree. It should be noted that the parameter estimates for old and new herds (1995-2004o and 1995-2004n) were not statistically significantly different, despite differences in data quantity and quality for old and new herds.

There were 300 sires with progeny in old and new herds in the last 10 years, and these sires accounted for a moderate percentage of the records in both datasets (28% and 24% of records in old and new herds, respectively). This indicates that old and new herds are not two separate populations of animals. In fact, they are subsets of the same population with good genetic connections via common sires, which explains the very similar genetic parameters observed in Table 2.

## CONCLUSIONS

Expanding the gene pool of performance recorded animals is important for continued genetic progress and enhanced profitability in the commercial beef industry. It is necessary, therefore, to encourage new herds to collect and submit performance records. This study indicates that new herds in the Brahman breed have similar underlying genetic parameters to early performance recording herds, and thus data from both groups can be combined for genetic evaluation. Thus an expanded pool of performance recorded animals with BREEDPLAN Estimated Breeding Values is available for seedstock and commercial breeders.

## ACKNOWLEDGMENTS

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