



Final report

Northern Beef Information Nucleus- Brian Pastures P.PSH.0774

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Abstract

Genomic selection provides the potential to increase the accuracy of selection and genetic gain in beef cattle. To achieve this outcome a Reference Population of genotyped animals with phenotype data on the traits of interest is required.

This project adds value to the “Repronomics- Building and delivering effective genomic selection for northern Australian cattle” project by taking the Brahman, Droughtmaster and Santa Gertrudis steer progeny from Brian Pastures Research Station, Gayndah and collecting data on additional traits. Additional weight, carcass, meat quality and structural soundness data is collected to expand and balance the traits available for selection with the female reproduction traits from the Repronomics project in the Reference Population of the participating breeds and contribute valuable data towards enabling the northern multi-breed project.

The project has enabled the introduction of the Single Step method of blending genomics into BREEDPLAN in the Brahman and Santa Gertrudis breeds and the Droughtmaster BREEDPLAN Single Step genetic evaluation is under development.

More data is needed in all three breeds to improve the accuracy and increase the genetic diversity of the Reference Populations.

Executive summary

Background

The project has continued to build capacity and broaden the genetic diversity of phenotypic carcass and meat quality traits in the Brahman, Droughtmaster and Santa Gertrudis breed Reference Population databases which are not yet at an optimum level for Single Step genetic evaluations. It is part of a longer running project for which a funding proposal until 30 June 2025 has been approved.

Objectives

- Broaden the application of genomic selection among stud and commercial Brahman, Droughtmaster, and Santa Gertrudis breeders not able to manage BREEDPLAN data collection, particularly for hard to measure traits.
- Collect carcass and meat quality phenotypic measurements on the steer half sib male progeny of females measured in the female reproduction project (MLA B.NBP.0759) undertaken by Dr David Johnston.
- Contribute to the BREEDPLAN carcass data on Brahman, Droughtmaster, and Santa Gertrudis cattle by adding both to the number of records and diversity of sires.

Methodology

The Brahman, Droughtmaster and Santa Gertrudis steers bred at Brian Pastures Research Station, Gayndah and owned by the QLD Department of Agriculture and Fisheries were purchased by the Australian Brahman Breeders Assoc. (ABBA), Droughtmaster Stud Breeders (DSBS) and the Santa Gertrudis Research Herds group respectively after weaning.

Each draft of steers has been backgrounded at various properties in central and southern Queensland and turned off before the oldest steers are about 32 months of age. The No 15,16,18 and 19 steers were finished in a feedlot and the No 17, and No 20 steers were finished on pasture. Additional weight, carcass scan, direct carcass, meat quality and structural soundness data is collected, transferred to the Animal Genetics and Breeding Unit (AGBU) multi-breed database, and analysed in BREEDPLAN.

Results/key findings

The following data was collected on 344 Brahman, 284 Droughtmaster and 377 Santa Gertrudis steers in the No 15,16,17,18,19 and 20 drops of calves.

- 400-day weight
- 600-day weight
- EMA scan
- P8 scan
- Rib fat scan
- Pre-slaughter weight and carcass scan
- Structural soundness scores
- Full MSA grading data
- Meat science data- shear force, extracted fat, cooking loss, objective meat colour

Benefits to industry

The benefits to industry are higher accuracy gEBV's for carcass and meat quality traits for the Brahman, Droughtmaster, and Santa Gertrudis breeds from their Single Step BREEDPLAN genetic evaluations.

Future research and recommendations

Research as indicated about 4,000 records of the traits of interest are required in a Reference Population to provide GBV's with a reasonable level of accuracy. The Brahman, Droughtmaster and Santa Gertrudis Reference Populations are well short of the optimum number of records for the carcass and meat quality traits. A funding proposal to continue the project until 30 June 2025 to allow the No 21, 22 and 23 drop Brian Pastures steers to be followed through to slaughter with relevant data collection has been approved.

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1. Background

Brahman, Droughtmaster, and Santa Gertrudis cattle represent a significant proportion of the Australian beef industry particularly in northern Australia. The key economic drivers for the northern industry are survival, reproduction, weight gain, carcass and product quality and market suitability. The project aims to use the steer progeny from a research project collecting data on reproduction and weight gain to collect data on carcass and product quality and market suitability and will provide data to balance the suite of traits relevant to the beef industry in northern Australia.

The project will continue to build capacity and broaden the genetic diversity of phenotypic carcass and meat quality data in participating breeds which are not yet at an optimum level for Single Step genetic evaluations.

Research has indicated about 4000 genotyped animals with a phenotype record for each trait are required to give Genomic Breeding Values (GBV's) with a reasonable level of accuracy.

The current level of recording for the participating breeds with genotype and phenotype records particularly for carcass meat science traits are still well below the numbers required.

This project is closely linked to the "Northern Beef Information Nucleus (Spyglass) – P.PSH.0743", the difference being, this proposal incorporates Brahman, Droughtmaster and Santa Gertrudis cattle and therefore different project partners.

2. Objectives

- Collect carcass and meat quality phenotype measurements on the steer half sib male progeny of females measured in the female reproduction project (MLA B.NBP.0759) undertaken by Dr David Johnston.
- Contribute to the BREEDPLAN carcass data on Brahman, Droughtmaster, and Santa Gertrudis cattle by adding both to the number of records and diversity of sires.
- Contribute to the BREEDPLAN carcass data resources for the validation of Beef CRC prediction equations and the Single Step method of incorporating genomics directly into BREEDPLAN.
- Contribute to the data necessary to undertake an across breed genetic evaluation with Brahman, Droughtmaster, and Santa Gertrudis cattle or a multi breed evaluation involving Brahman, Droughtmaster, Santa Gertrudis and other breeds.
- Collect genomic data on *Bos indicus* content and tenderness markers that can be used to look at correlations between hump height and shear force with the genomic data
- Benchmark variations in *Bos indicus* content within the Droughtmaster breed
- Evaluate the relationship between *Bos indicus* content, hump height and shear force within the Droughtmaster breed.

3. Methodology

The Brahman, Droughtmaster and Santa Gertrudis steers bred at Brian Pastures Research Station, Gayndah and owned by the QLD Department of Agriculture and Fisheries were purchased by the Australian Brahman Breeders Assoc (ABBA), the Droughtmaster Stud Breeders Society (DSBS) and the Santa Gertrudis Research Herds group respectively.

Each draft of steer was backgrounder at various properties in central and southern Queensland and turned off before the oldest steers are about 32 months of age.

The No 15,16,18 and 19 calf drops were finished in a feedlot and the No 17, and 20 drops were finished on pasture.

The Brahman steers are by registered Brahman bulls, the Droughtmaster steers by registered Droughtmaster bulls and the Santa Gertrudis steers are by registered Santa Gertrudis bulls selected by Dr David Johnston, Principal Research Scientist, Animal Genetics and Breeding Unit (AGBU) to broaden the database of genotyped and phenotyped animals in the respective breeds.

The original Brahman cow herd was the CSIRO Belmont stud herd, and the Beef CRC cows, the original Droughtmaster base herd was the Swans Lagoon herd, and the original Santa Gertrudis bases herd was the CRC composite cows plus additional BREEDPLAN recorded stud Santa Gertrudis cow purchases. These cows have been joined to industry sires which have been recorded in the AGBU multi-breed database and analysed in BREEDPLAN.

There is therefore a significant amount of performance information behind the steers being evaluated and good linkage to the Beef CRC data.

The selection of influential sires with high accuracy phenotypic data will significantly improve the Single Step method of incorporating genomics into BREEDPLAN. The steers are therefore of high value to the project. The project is therefore a relatively inexpensive way of adding significant value to previously collected data. The numbers of each respective breed involved in the project are listed in Table 1.

Table 1: Number of animals by breed and cohort year

	Brahman	Droughtmaster	Santa Gertrudis
No 15	55	37	63
No16	45	53	65
No 17	50	42	54
No 18	61	58	51
No 19	73	54	81
No20	60	40	63
Total	344	284	377

Data collection includes

- 400 Day weight
- 600 Day weight
- Scan EMA
- Scan P8 fat
- Scan red fat
- Scan IMF

- Direct carcase, EMA, Rump, and Rib Fat, MSA grading
- Meat science. Shear force, objective meat colour, cooking loss and Intramuscular fat
- GGPLD Genomic profiling, Bos indicus content and tenderness markers
- Structural soundness scores

All data which can be analysed in BREEDPLAN will be submitted for analysis. Other traits that were recorded that are currently not analysed in BREEDPLAN can be analysed using least squares. All raw data has been stored on ILR2 databases of both Brahman, Droughtmaster, and Santa Gertrudis breeds, and or the AGBU Multi breed database for future analysis.

4. Results

During the period this project ran, the data described previously was collected on 344 Brahman, 284 Droughtmaster and 377 Santa Gertrudis steers. A total of 88 Brahman, 75 Droughtmaster and 37 Santa Gertrudis bulls were used to produce the steers across both the Brian pastures and Spyglass projects.

The data has contributed to the implementation of Single Step BREEDPLAN evaluations in the Brahman and Santa Gertrudis breeds as well as improving accuracy and genetic diversity in the Reference Populations.

Work conducted by AGBU as part of BIN project L.GEN2007, including cohorts to 2020 from both Brian Pastures and Spyglass projects demonstrate the number of carcase records in the Reference Populations to be approximately 1100, 1100 and 350 for Brahman, Droughtmaster and Santa Gertrudis respectively.

This set of carcase records is very important to the Reference Populations required for Single Step genetic evaluations. For Santa Gertrudis there is still a requirement for more carcase data to adequately represent the breed and for Droughtmasters to progress to genomic selection. Without the data already collected and to be collected as part of this project the EBV's from genomic selection may be adversely affected.

Change in accuracy

BLUP evaluations show that recording carcase traits lifted the average accuracy by between 0.26 and 0.47 (average across traits = 0.40) for Brahman and by 0.23 and 0.39 (average across traits = 0.33) for Santa Gertrudis. This is a considerable increase observed for reference animals, but the traits are difficult to record and not practical for wider recording, indicating the importance of the reference population model.

Predicted accuracy from genomics for target animal (born 2019+ that are not part of the reference data) increased average accuracy by between 0.06 and 0.21 (average across traits + 0.16) for Brahman and between 0.11 and 0.16 (average across traits = 0.14) for Santa Gertrudis. For animals currently related to reference animals an extra 15% in accuracy can be obtained given the current Reference Populations, of which the Northern BIN's are key contributors to data. Increasing reference size will increase the accuracy further. Animals that are not well related may not benefit as much and therefore it is important to continue collecting carcase data to ensure that the reference animals are linked to the wider breed, especially for Santa Gertrudis and Droughtmaster.

A Droughtmaster Single Step BREEDPLAN evaluation is under development, having achieved the required data threshold.

Breed content impact on Eating Quality

The relationship between Brahman content and carcass trait phenotypes undertaken as part of the BIN co-ordinating project (L.GEN.1904) included 1,533 BIN animals from the No 15,16,17 and 18 Spyglass and Brian Pastures cohorts.

The Brahman content identified by the genotype breed composition analysis in the Single Step evaluation for the three breeds is as follows.

Table x. Breed content of Northern Bin projects

	Average	Range
Brahman	98.9%	87.6% - 100%
Droughtmaster	57.2%	34.7% -79.1%
Santa Gertrudis	38.9%	27.8% - 50.9%

There was a quadratic relationship with Brahman content and MSA hump height and MSA index, with the relationship varying for different cohorts. Animals with higher Brahman content had higher hump heights, with the impact being greatest for higher content animals. MSA index decreased with increasing Brahman content. For other traits a linear relationship was observed with Brahman content, but again the relationship varied for different cohorts. However, on average it was observed that increasing Brahman content showed a decrease for Hot Total Weight, Hot P8 fat depth, MSA EMA, MSA rib fat depth, Intramuscular fat, MSA USDA ossification, Longissimus dorsi a* colour, Longissimus dorsi b* colour, MSA Loin temperature and MSA Aust. Marble score. For Shear force, Longissimus dorsi L* colour and Longissimus dorsi cooking loss an increase was observed with increasing Brahman content.

5. Conclusion

The project has achieved its objectives by contributing to the building of reference populations for the participating breeds to facilitate genomic selection technology, with 344 Brahman, 284 Droughtmaster and 377 Santa Gertrudis records collected and contributing to BREEDPLAN.

5.1 Key findings

More data collection is required to produce a reference population for the Brahman, Droughtmaster and Santa Gertrudis breeds that will produce Single Step BREEDPLAN EBV's of an optimum accuracy.

5.2 Benefits to industry

Facilitate the use of genomic selection and an increased rate of genetic gain in the Brahman, Droughtmaster, and Santa Gertrudis breeds for the traits being recorded in the project.

6. Future research and recommendations

The project funding proposal to extend to Phase 4 has received MDC funding to June 30, 2025, to finish data collection on the Spyglass No 21, 22 and 23 drop steers has been approved as an MLA Donor Company project.

The benefits of the project will be commercialised through the Brahman, Droughtmaster, and Santa Gertrudis Single Step BREEDPLAN genetic evaluations.

Even with less-than-optimal accuracy levels, in the Brahman breed the percentage of bulls with reported EBV's in the 2022 Rockhampton Brahman Week Sale catalogue has increased to 78%.

7. References

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