Final report

Northern Beef Information Nucleus - Spyglass P.PSH.0743

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 and Droughtmaster steer progeny from Spyglass Research Station, Charters Towers and collecting data on additional traits.

Additional weight, carcase, 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 including genomics into BREEDPLAN in the Brahman breed and the Droughtmaster BREEDPLAN Single Step genetic evaluation is under development.

More data is needed in both breeds to improve the accuracy and crease the genetic diversity of the Reference *P*opulations.

Executive summary

Background

The project has continued to build capacity and broaden the genetic diversity of phenotypic carcase and meat quality traits in the Brahman and Droughtmaster breed to contribute to the Reference Population data sets. Whilst the project has collected numerous records, the data sets are not yet at an optimum level for Single Step genetic evaluations for the participating breeds. Another phase of this project has been approved to collect data through to Jun 2025.

The project will allow stud and commercial Brahman and Droughtmaster breeders not able to manage BREEDPLAN data collection the opportunity to utilise genomic selection.

Objectives

- Collect carcase 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 carcase data on Brahman and Droughtmaster cattle by adding both to the number of records and diversity of sires.
- Contribute valuable data to the AGBU Multi-breed Database.
- The project will allow stud and commercial brahman and Droughtmaster breeders not able to manage BREEDPLAN data collection the opportunity to utilise genomic selection.

Methodology

The Brahman and Droughtmaster steers bred at Spyglass Research Station, Charters Towers and owned by the QLD Department of Agriculture and Fisheries are purchased by the Australian Brahman Breeders Assoc. (ABBA) and Droughtmaster Stud Breeders (DSBS) respectively after weaning.
Each draft of steers was backgrounded on various properties in central and southern Queensland and turned off before the oldest steers are about 32 months of age. The number No 15, 16, 18 and 20 calf drops were finished in feedlots and the No 17, and 19 drops were finished on pasture.
Additional weight, carcase scan, direct carcase, meat quality and structural soundness data was collected, transferred to the Animal Genetics and Breeding Unit (AGBU) multi-breed database, and analysed in BREEDPLAN.

Results/key findings

During the period this project ran, data on 729 Brahman, 691 Droughtmaster and 10 Beefmaster cross was collected.

- 400-day weight
- 600-day weight
- EMA scan
- P8 scan
- Rump fat scan
- Pre-slaughter weight and scans
- 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 genomically enhance estimated breeding values (gEBVs) for carcase and meat quality traits for the Brahman and Droughtmaster breed from their Single Step BREEDPLAN genetic evaluations.

Future research and recommendations

Research has indicated about 4,000 records of the traits of interest are required in a reference population to provide gEBV's with a reasonable level of accuracy. Both the Brahman and Droughtmaster Reference Populations are well short of the optimum number of records for the carcase and meat quality traits. The project has now been funded until 30 June 2025 to allow the No 21, 22 and 23 drop Spyglass steers to be followed through to slaughter with relevant data collection.

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1. Background

Brahman and Droughtmaster 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, carcase and product science and market suitability. The project aims to use the steer progeny from a research project collecting data on reproduction and weight gain on females to collect data on carcase and product quality and market suitability. The project 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 carcase and meat quality data in the participating breeds reference population data dases, 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 genomically enhance estimated breeding values (gEBVs) with a reasonable level of accuracy.

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

This proposal is closely linked to proposal "Northern Beef Information Nucleus (Brian Pastures) – P.PSH.0774", the difference being, this proposal incorporates Brahman and Droughtmaster cattle and therefore different project partners.

2. Objectives

- Collect carcase and meat quality phenotype measurements on the steer half sib male progeny of females measured in the female Repronomics project (MLA B.NBP.0759) undertaken by Dr David Johnston.
- Contribute to the BREEDPLAN carcase data on Brahman and Droughtmaster cattle by adding both to the number of records and genetic diversity.
- Contribute to the BREEDPLAN carcase 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 and Droughtmaster or a multi breed evaluation involving Brahman, Droughtmaster, 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 and Droughtmaster steers bred at Spyglass Station, Charters Towers and owned by the QLD Department of Agriculture, Fisheries and Forestry were purchased by the Australian Brahman Breeders Assoc (ABBA) and the Droughtmaster Stud Breeders Society (DSBS) respectively.
Each draft of steers was backgrounded on 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 20 calf drops were finished in feedlots and the No 17, and 19 drops were finished on pasture.

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

The original Brahman cow herd was the CSIRO Belmont stud herd, and the Beef CRC cows, and the original Droughtmaster base herd was the Swans Lagoon herd.

These cows have been joined to industry sires which have been recorded in the AGBU multi-breed database and analysed in BREEDPLAN.

Therefore, a significant amount of performance information is behind the steers being evaluated with 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 a relatively inexpensive way of adding significant value to previously collected data.

The numbers of animals for each respective breed involved in the project are listed in table 1.

Table 1: Number of Animals by Breed and Cohort

	Brahman	Droughtmaster	Beefmaster cross
No 15	98	107	
No 16	235	128	
No 17	111	105	
No 18	106	127	
No 19	133	115	7
No 20	146	109	3
Total	**729**	**691**	**10**

The phenotypic data that has been collected on each animal 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 in the laboratory. Shear force, objective meat colour, cooking loss and Intramuscular fat
- GGPLD 50K Genomic test, Bos indicus content and tenderness markers
- Structural soundness

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

4. Results

During the period this project ran, all traits were collected on 729 Brahman, 691 Droughtmaster and 10 Beefmaster cross steers. A total of 88 Brahman, 75 Droughtmaster and 37 Santa Gertrudis and 4 Beefmaster bulls were used across both the Spyglass and Brian Pastures projects. The bulls were selected by Dr David Johnston based on the influence their genetics have had on each breed and to increase the diversity of the genetics within each reference population.

The data has contributed to the implementation of a Single Step Brahman BREEDPLAN evaluation as well as improving accuracy levels and genetic diversity in the Reference Populations.

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

 A half strip loin sample was taken from each carcase from the No 20 steers and transferred to UNE Meat Science lab to be used to collect meat science data as well as MSA sensory analysis in the Global sensory project (L.GEN.2000), under the guidance of Prof, Peter McGilchrist.

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 carcase 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 729 Brahman, 691 Droughtmaster and 10 Beefmaster records contributed.

5.1 Key findings

More data collection is required to produce a reference population with more genetic diversity for the Brahman and Droughtmaster breeds that will contribute to Single Step BREEDPLAN gEBV'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 and Droughtmaster breeds for the traits being recorded in the project.

6. Future research and recommendations

The project has now been extended to Phase 4 and has received MDC funding to June 30, 2025, to finish data collection on the Spyglass No 21, 22 and 23 drop steers.

The benefits of the project will be commercialised through the Brahman and Droughtmaster 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 catalogue was 78% of 833 bulls.

7. References

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