final report

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Development and extension of a comprehensive BREEDPLAN "proof of concept" package using research and industry data

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Executive summary

This project was undertaken to increase awareness of the benefits of genetic technologies in the Australian Beef Industry. Its aim was to utilise information collected within Angus Australia's Progeny Test and Information Nucleus to generate compelling 'proof of concept' messages that clearly demonstrate the value of performance recording, genetic evaluation and selection based on BREEDPLAN Estimated Breeding Values (EBV's) and Selection Indexes.

The project showed that there is a significant amount of genetic variation that exists within the Angus Breed and therefore an opportunity to improve both the productivity and profitability of beef breeding enterprises through the use of superior genetics. The project found that EBVs are a good predictor of an animal's genetic merit and are a reliable selection tool that should be used with confidence by beef producers to identify genetics most aligned with their breeding objective. Any increased adoption of EBVs and Selection Indexes has the potential to drive genetic improvement in the Australian Beef Industry and increase the rate of genetic gain.

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1 Background

This project was undertaken to increase awareness of the benefits of genetic technologies in the Australian Beef Industry. Its aim was to utilise information collected within Angus Australias Progeny Test and Information Nucleus to generate extension messages that clearly demonstrate the value of genetic technologies such as BREEDPLAN Estimated Breeding Values (EBV's) and Selection Indexes.

Dissemination of key messages to the wider beef industry aimed to provide beef producers with proof that the genetic technologies work, and arm other organisations within the beef extension network with a template to use when generating further proof of concept messages.

The project ultimately aimed to increase the uptake of genetic technologies thereby increasing the rate of genetic improvement in the Australian Beef Industry.

2 Project objectives

1. Utilise the information collected within the P.PSH.0528 project (Angus Australia Progeny Test and Information Nucleus) to generate compelling 'proof of concept' messages that clearly demonstrate the value of performance recording, genetic evaluation and selection based on BREEDPLAN Estimated Breeding Values (EBV's) and Indexes.
2. Investigate the potential to utilise data from industry herds that demonstrate the benefits of selection based on the use of EBVs and Indexes.
3. Disseminate the 'proof of concept' messages through the development of a comprehensive range of extension materials such as fact sheets, video clips, newsletter articles, press releases and presentation templates in order to increase awareness of the benefits of genetic technology.
4. Provide a template for the development of further proof of concept messages by other organisations within the beef genetics extension network (e.g. ABRI, other breed societies).

3 Methodology

3.1 Compilation of information

The initial phase of the project involved compilation of the required information to enable the project to be completed. This information included:

- Performance information collected within the P.PSH.0528 project (Angus Australia Progeny Test and Information Nucleus).
- "Initial" EBVs for bulls entered in cohorts 1 – 3 of the P.PSH.0528 project. Due to analytical changes to Angus BREEDPLAN, these EBVs were generated through the conduct of additional BREEDPLAN analyses by ABRI (as per Milestone 1)
- "Final" EBVs for bulls entered in cohorts 1 – 3 of the P.PSH.0528 project (as per July 2016 Angus BREEDPLAN analysis)
- Genomic breeding values of bulls entered in cohorts 1 – 3 of the P.PSH.0528 project

3.2 Data analysis

The second phase of the project involved analysis of the compiled information to generate relevant proof of concept messages that demonstrate the value of genetics and genetic evaluation using BREEDPLAN.

Analysis 1 : Calculation of Average Progeny Performance

The average performance of each sire's progeny for each sire in Cohorts 1 – 3 of the P.PSH.0528 project was calculated.

Individual progeny performance data was collected for all major traits and the standard BREEDPLAN adjustments and groupings applied. The performance data was then analysed through the Statistical Analysis System (SAS) to generate least squares means (LSMs), being each sire's average progeny performance for each trait.

Analysis 2 : Quantifying the Genetic Variation Between Animals

Using the sire LSMs, the average progeny performance for the highest five and lowest five performing sires in each cohort were calculated for each respective trait, followed by the conduct of a T-test to quantify whether the difference in progeny performance between the highest and lowest performing sires was statistically significant or not.

Analysis 3 : Quantifying Whether EBVs Accurately Predicted Progeny Performance

The "initial" EBVs of sires in each cohort were ranked from highest to lowest for each trait, and the average EBV of the highest 10 and lowest 10 sires were used to calculate how much difference in performance was predicted between the progeny sired by bulls in each of the two groups.

The predicted difference in performance was then compared to the actual difference that was observed in progeny performance within the ASBP (as assessed by sire LSMs) to ascertain how well the EBVs predicted the breeding value of the sires.

Analysis 4 : Quantifying the degree of EBV change in a group basis, between low and high accuracy EBVs.

The 'initial' EBVs of sires in each cohort were ranked from highest to lowest for each trait and the average 'initial' EBV and EBV accuracy of the highest and lowest 10 sires for each trait was calculated. This was then compared to the corresponding average 'final' EBV and EBV accuracy for these sires, to evaluate how much change in EBVs and EBV accuracies had occurred.

Analysis 5 : Quantifying the degree of EBV change on an individual sire basis between low and high accuracy EBVs.

The possible change in the initial EBV of each sire was quantified by assessing the standard error of the EBV, with the standard error differing based on the accuracy of the sire's initial EBV. The predicted degree of EBV change was compared to the actual degree of EBV change for each sire.

4 Results

4.1 Extension materials

A range of extension materials have been created and disseminated. These materials include website material, brochures, videos, and presentations.

4.1.1 Website

A specific area has been established in the Angus Sire Benchmarking Program area on the Angus Australia website. Under the banner of "Lessons from the ASBP", the web area facilitates the presentation of all extension material from the project.

4.1.2 Brochures

Brochures were created encompassing the four key "Lessons from the Angus Sire Benchmarking Program"

- An 8 page brochure titled: Capitalising on the Genetic Variation Between Angus Animals.
  https://www.angusaustralia.com.au/content/uploads/2016/11/Ash_POC_Genetic_Variation_A4_8page.pdf
- A 12 page brochure titled: EBVs Are No Bull.
  https://www.angusaustralia.com.au/content/uploads/2017/02/Ash_POC_EBVs-No-Bull_web2.pdf
- An 8 page brochure titled: Starting Vs Finishing EBVs – Did They Change?
  https://www.angusaustralia.com.au/content/uploads/2017/07/Ash_POC_Did_EBVs_Change_web.pdf
- An 8 page brochure titled: Starting Vs Finishing EBVs – Individual Sire Changes
  https://www.angusaustralia.com.au/content/uploads/2017/07/Ash_POC_Individual_Sire_EBV_Changes_web.pdf

4.1.3 Video series

A Video Series called "Lessons From The Angus Sire Benchmarking Program" was created to provide an overview of the project and outline the four key messages.

- Video 1: Lessons from the ASBP - Project Overview
  https://www.youtube.com/watch?v=EotVyN08SGs
- Video 2: Lessons from the ASBP - Genetic Variation
  https://www.youtube.com/watch?v=UpYnvFH3wsY&feature=youtu.be
- Video 3: Lessons from the ASBP - EBVs Are No Bull
  https://www.youtube.com/watch?v=_JxcTELevoc&feature=youtu.be
- Video 4: Lessons from the ASBP – Did EBVs Change?
  https://www.youtube.com/watch?v=R_GQOskgWUI&feature=youtu.be
- Video 5: Lessons from the ASBP – Individual Sire EBV Changes?
  https://www.youtube.com/watch?v=nv8JFkT6N7M

4.1.4 Presentation templates

Powerpoint presentation templates were created on each of the four key messages.

- **Template 1:** Genetic Variation Between Angus Animals in the ASBP.

https://www.angusaustralia.com.au/content/uploads/2016/12/Lessons-from-the-ASBP-Genetic-Variation.pdf

- **Template 2:** EBVs Are No Bull
  https://www.angusaustralia.com.au/content/uploads/2017/01/Lessons-from-the-ASBP-EBVs-are-No-Bull.pdf
- **Template 3:** Starting Vs Finishing EBVs – Did They Change?
  https://www.angusaustralia.com.au/content/uploads/2017/07/Lessons-from-the-ASBP-Starting-Vs-Finishing-EBVs.pdf
- **Template 4:** Starting Vs Finishing EBVs – Individual Sire Changes
  https://www.angusaustralia.com.au/content/uploads/2017/07/Lessons-from-the-ASBP-Individual-Sire-EBV-Changes.pdf

4.2 Material dissemination

The extension materials generated were disseminated via an extension and communication strategy that utilised Angus Australia's comprehensive communication network, and the wider beef genetics extension network, with materials disseminated via:

- the Angus Australia website (www.angusaustralia.com.au)
- Angus Australia's weekly electronic newsletter – titled "Angus Enews"
- Angus Australia's social media accounts – Facebook, Twitter and Instagram.
- an email blast to all Angus Australia members.
- an email blast to Angus Australia's industry contacts within the beef extension network.
- Beef Central and Rural Press.

5 Discussion

5.1 General overview and future research

This project generated compelling 'proof of concept' messages that clearly demonstrate the value of performance recording, genetic evaluation and selection based on BREEDPLAN Estimated Breeding Values (EBV's) and Selection Indexes.

While many of these 'proof of concept' messages were similar to those generated in previous research projects, the project confirmed the need to regularly update and disseminate evidence regarding the value of genetic improvement technologies by way of maintaining confidence in the genetic technologies that are available.

It would be beneficial for future proof of concept projects to identify the value of genomics and demonstrate the potential for genetic improvement in the Australia Beef Industry using genomic technology. This could be completed using a similar framework to the current proof of concept project.

5.2 Project objectives

5.2.1 Objective 1

Utilise the information collected within the P.PSH.0528 project (Angus Australia Progeny Test and Information Nucleus) to generate compelling 'proof of concept' messages that clearly demonstrate the value of performance recording, genetic evaluation and selection based on BREEDPLAN Estimated Breeding Values (EBV's) and Indexes.

Summary: Progeny performance data was collected on the first three cohorts of sires tested in the Angus Australia Progeny Test and Information Nucleus. This information was used to generate proof of concept messages underpinning and demonstrating the value of BREEDPLAN Estimated Breeding Values and Selection Indexes. Encompassing approximately 122 sires and 3100 progeny, this information has provided a solid basis to establish proof that performance recording, genetic evaluation and selection using the available selection tools can improve the productivity and profitability of Australian beef breeding enterprises.

5.2.2 Objective 2

Investigate the potential to utilise data from industry herds that demonstrate the benefits of selection based on the use of EBVs and Indexes.

Summary: The potential to gather data from industry herds was explored and identified considerable challenges with the ability to use industry herd data for the compilation of 'proof of concept' messages. The collection of industry data is achievable provided the herds from which data is utilised are a) joining a large number of sires, with considerable genetic variation between the sires' genetics for each trait of interest , b) have a sufficient number of progeny per sire (e.g. 15 effective progeny sire), and c) are comprehensively and accurately performance recording all animals for each trait of interest.

5.2.3 Objective 3

Disseminate the 'proof of concept' messages through the development of a comprehensive range of extension materials such as fact sheets, video clips, newsletter articles, press releases and presentation templates in order to increase awareness of the benefits of genetic technology.

Summary: A comprehensive range of extension materials were developed and disseminated across the Angus Australia membership and through the wider beef extension network. Extension materials included articles, videos, press releases and powerpoint presentations. The extension materials demonstrated four key messages:

- There is genetic variation in the Angus population and therefore opportunity to caplitalise on this genetic variation.
- EBVs provide a good indication of the genetic merit of each animal.
- EBVs can change as more information becomes available. However on average, EBVs generated when there is limited performance data available, allign closely with EBVs generated when sires are comprehensively performance recorded.
- While EBVs for some individual sires do change as more information becomes available, limited sire re-ranking occurs and the changes experienced are within expected ranges based on each sire's EBV accuracy.

5.2.4 Objective 4

Provide a template for the development of further proof of concept messages by other organisations within the beef genetics extension network (e.g. ABRI, other breed societies).

Summary: This project identified and articulated a methodology that can be followed by other organisations, particularly those conducting progeny test programs that are similar to the Angus Australia Progeny Test and Information Nucleus. This methodology demonstrates how proof of concept messages can be compiled and presented from performance information, to generate proof of concept messages regarding the value of genetics and genetic improvement technologies. The project also provided presentation templates that can be utilised by the wider beef extension network to demonstrate the value of Estimated Breeding Values and Selection Indexes.

6 Conclusions/recommendations

This project has demonstrated that EBVs and Selection Indexes are a reliable selection tool and beef producers should use EBVs with confidence to obtain long term sustainable genetic improvement.

Research is required on an ongoing basis to re-inforce the 'proof of concept' messages developed in this project, with any further research also encompassing the value of genomic selection.

The wider beef extension network should utilise the information and extension messages generated in this project to help increase the rate of genetic improvement through the adoption of genetic technologies such as Estimated Breeding Valiues and Selection Indexes.

7 Key messages

As a result of the research completed in this project, Australian beef producers should use EBVs and Selection Indexes with confidence to identify genetics that are most aligned with their breeding objectives. Harnessing the significant amount of genetic variation that exists in the Australia beef population provides a considerable opportunity to improve the productivity and profitability of the Australian Beef Industry.