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The Influence of Genetic Information in the Selection and Valuation of Angus Bulls 2: Key Informant Analysis

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Abstract

Genetic information for beef cattle in Australia has been provided through BREEDPLAN since 1972. The BREEDPLAN model estimates the genetic potential of livestock using Estimated Breeding Values. There is substantial evidence proving the accuracy of Estimated Breeding Values, yet there is a substantial variation in the breeding programs of individual seedstock producers and ongoing industry-wide debate between phenotypic and genotypic approaches to assessing an animal's breeding value. The Angus breed is the most widely used in commercial beef breeding programs in Australia. In a companion paper, data for 49 bull sales during 2019 from 42 different Angus studs (a total of 3,070 bulls) were taken from publicly available web sites and subjected to statistical analysis. Indexes of breeding values were found to be highly significant variables in explaining the prices paid for Angus bulls, but there was still a majority of the variation that was unexplained by either measured genetic or phenotypic variables. The purpose of this follow-up analysis was to interview some of the bull breeders and bull buyers involved in these sales and attempt to ascertain what other factors were thought to be in play when a bull is selected for purchase and valued in the market.

Keywords: bull sales, genetics, phenotype, Angus, interviews

Introduction

Genetic information for beef cattle in Australia has been provided through BREEDPLAN² since 1972. The BREEDPLAN genetic evaluation system uses Best Linear Unbiased Prediction technology to produce Estimated Breeding Values (EBVs) for a range of economically important production traits (Angus Australia, 2019b). BREEDPLAN (2021) notes that it is the most widely used genetic evaluation service for beef cattle internationally, representing almost 40 beef cattle breeds and at least 100 breed associations distributed across 14 countries. EBVs are available for a large number of traits. For example, for the Angus breed, BREEDPLAN now includes pedigree, performance and genomic

¹ The authors express their appreciation to the Angus seedstock producers who provided data from their sales.

² The BREEDPLAN software is owned by Meat and Livestock Australia (MLA), the University of New England (UNE) and the NSW Department of Primary Industries (NSWDPI). Research and development is undertaken by the Animal Genetics and Breeding Unit (AGBU) while the Agricultural Business Research Institute (ABRI) is the BREEDPLAN licensee (MLA, 2018).

information to calculate EBV's for calving ease, growth, fertility, carcass, feed efficiency, temperament and structural soundness traits. BREEDPLAN also provides a range of breeding indexes tailored to individual production systems and markets, offering bull breeders the potential to accelerate genetic progress in their herds, and to provide objective information on stock they sell to commercial breeders. These indexes weight the importance of individual EBVs to maximise value from the particular market of interest. Thus, there are indexes for the domestic market, the grainfed market and the grassfed market. Of interest in this study is the Angus Breeding Index (ABI), the Angus breed's best single figure representation of an animal's genetic merit. It "estimates the genetic differences between animals in net profitability per cow joined in a typical commercial self-replacing herd using Angus bulls" (Angus Australia, 2019a). So a typical ABI value might be \$120.

Use of performance recording through BREEDPLAN amongst Australian beef breeders was estimated at 58 per cent in 1990 compared to just 4 per cent in 1978 (Woolaston, 2014). Over all breeds using the BREEDPLAN system, Barnett (2017, p. 6) reports "Using weaning weight records submitted to BREEDPLAN as a proxy for adoption of BREEDPLAN, it is estimated that an average of approximately 65 per cent of registered calves submit weaning weight data to BREEDPLAN, and that this level of penetration across the industry has been reasonably consistent for the past 15 years". Phillips (2016a) reports that some 95 per cent of all Angus bulls are performance recorded through BREEDPLAN. At the other extreme, in 2015 just on 45 per cent of the total registered cattle in the five major tropical breeds (Brahman, Santa Gertrudis, Droughtmaster, Brangus and Braford) had 200-day weights recorded, up from less than 30 per cent in 2011 (Phillips, 2016b).

To reiterate the point made in the companion paper (Thomson et al., 2021), given the now almost 50-year history of BREEDPLAN in Australia and the significant investments that are made into collecting, analysing and providing genetic information on individual beef breeding stock, it would be expected that genetic information would have a significant influence in the process of selecting bulls to purchase. This should certainly be the case for the Angus breed, the most measured and most used breed for commercial beef production. However, it is evident that many producers in the industry focus strongly on the traditional values of phenotype, such as live weight and average daily gain (ADG). For example, there have been cases of top priced bulls at a sale having a poor ABI value but being highly sought after for their phenotype. For example, in 2016 a record price was paid for a particular Angus bull that had an ABI of \$101 – only in the 77th percentile for current EBV's. One of the new owners was quoted as saying "The bull had wonderful phenotype and something that we feel is missing in the breeding in the Angus society." (Woolrich, 2016). This has created a divide in the industry where some producers argue against the use of EBV's despite development and extension programs by Angus Australia and Meat and Livestock Australia. As well, there are producers that will select a bull purely on figures without seeing the bull itself or judging its structure and phenotype. Both scenarios lead to problems within the industry.

The overall aim of this research was to determine the extent to which genetic information as represented by the ABI influences sale price. In the companion paper to this (Thomson et al., 2021), data for 49 bull sales during 2019 from 42 different Angus studs (a total of 3,070 bulls) were taken from publicly available web sites and analysed statistically. That analysis found that there was a clear positive relationship between the ABI and the price that producers will pay for an Angus bull. The inference is therefore that producers are using genetic information and selecting on genetic merit. ABI had a consistently statistically significant relationship to sale price in all four estimated models - the 2018-born, 2017-born, Southern 2017-born and Northern 2017-born. ABI had the greatest influence on sale price in the 2018-born and 2017-born bulls as well as the Southern analysis.

Live weight and ADG had more varied effects and were statistically insignificant in some regression outputs. Live weight had the greatest influence on sale price in the Northern analysis. The analyses

found that live weight generally had a stronger influence on sale price than ADG. This means that contrary to what most breeders and producers say, they are not considering age of the bulls and are paying more for bigger, more impressive looking bulls on sale day, rather than bulls that have been measured to gain weight early.

In this paper we report on key informant interviews to complement the quantitative data analysis. These took the form of phone or Skype interviews asking selected seedstock breeders questions involving their breeding objectives and selection criteria, to provide some reasoning behind the conclusions found through the data analysis. We also wanted to understand the reasons why individual seedstock producers have their own breeding objectives and how successful they were in achieving these objectives. In particular, there was a focus on the variation in selection decisions from North and South areas. Contacting breeders and conducting these interviews was approved by the University of New England's Human Research Ethics Committee (Approval number HE19-133, valid to July 2020).

Qualitative Data Sources

Key informants were contacted via email which was publicly available from stud websites. Key informants were chosen based on variations in previously shared views and opinions regarding genetic information in the wider industry and on influence in the seedstock sector. The authors were able to interview three breeders from NSW and one from Victoria. They were sent an information sheet, consent form and copy of interview questions as per the Human Research Ethics Committee requirements. Interviews were conducted in person or over the phone or by Skype and took approximately one hour. A copy of the interview questions is provided in the Appendix.

Key Informant Interviews

The key informant interviews provide an insight into the views and opinions of a selected few breeders. This does not represent the entire breeder population or even the sample of studs used for the quantitative research. However, this small insight is valuable for discussing possible explanations for the results found in the companion empirical paper as well as wider issues in the industry and possible solutions. All key informants are incredibly passionate about the industry, their own breeding programs and the advancement of Australian Angus cattle. Two informants are focussed on phenotype and the other two are focussed on genotype.

The first key informant is heavily focussed on phenotype and matches the phenotype of his cows with the phenotype of the bull he chooses to join them with. He visually assesses every bull he uses including AI sires from Australia or overseas. "I select the bulls I'm going to use, basically on phenotype, they've got to stack up. Then I go, OK well you're just too bad on EBV's, I can't use you. Or OK, you've got this set of EBV's and I can accommodate them." He is a big supporter of BREEDPLAN EBV's but believes they have not been used in the way they were initially intended. "BREEDPLAN, great tool, meant to give you information on an animal, not meant to make you a decision." He is particularly not in favour of how indexes have become a focus for Angus breeders at the expense of visual appraisal saying "The indexes are not worth a penny, to my clients they are not worth the paper they are printed on."

He believes the breed has moved away from the great all-round type of cattle that made Angus so dominant. "The breed's unrecognisable, and that's why we're getting such popularity because we're breeding a unique type (phenotype) of animal." He says he is one of the last breeders that haven't heavily focussed on EBVs saying "you can't find the type of Angus we're breeding".

He thought the indexes heavily favoured the feedlot and processor sector rather than commercial producers. “The bloke at the farm gate, what makes him his money, is animals that get heavy early, that hold condition in a drought, that re-breed in a drought and calve easily, that is where the profit is.” This was the focus of his breeding program further stating, “we’re actually genuinely breeding with a balanced approach. BREEDPLAN figures are good in our herd. They’re just not exceptional”.

When asked what their clients were looking for at their sale he said “They want phenotypic traits above all, so they want length, depth and breadth, they want sound structure, they want good weight, they want good thick top cattle, they want strong heads, they look at the figures”. This is consistent with the quantitative results for this stud which showed their sale had a stronger than average relationship with live weight and ADG. It also showed a weaker than average relationship between sale price and ABI.

The second key informant is predominantly focussed on phenotype and carcass quality but are driven by a balanced approach which includes relatively high EBV’s. They place high emphasis on performance data and have been well recognised in carcass competitions. They say that “phenotype is king, it’s no use having fantastic figures if they haven’t got the phenotype”. They make joining decisions based on visual appraisal of the phenotype of their cows and potential sires as opposed to using computer software such as Total Genetic Resource Management (TGRM) or MateSel. When asked about their breeding objective they said they breed for efficiency and profitability. They record extensively with the intent on increasing the accuracy of their EBV’s as much as possible. They say they breed larger than average cattle and their clients are looking for proven performance. “They’re believing in our program more than just going on EBV’s”. They said clients continue to buy bulls from them because of the consistency of the bulls even through to the later lots in the sale.

When asked about their view on indexes they said that there was a number of issues around indexes that meant they didn’t use them and when asked specifically about the ABI they said “we do look at it but we don’t place much emphasis on it.” This statement is supported by the quantitative results as this stud’s sale had an average ABI very close to the average of all sales in the analysis. The correlations of ABI, ADG and live weight to sale price for their sale were all below average but followed the pattern of live weight higher than ABI, and ADG lower again. These are unsurprising as the stud is located in Northern NSW, where ABI is expected to have a lower correlation. The stud is also well known for offering large, high performing cattle in terms of weight, phenotype and carcass. Therefore, clients are less worried about selecting for these traits as they are confident any bull in the sale would reach high standards in this area.

This informant also made the following comment, “I’d bet you that you’d find the biggest bulls are usually the ones that make the most money.” This supports the common opinion that live weight has the biggest individual influence on sale price, particularly in the Northern region.

The third key informant is particularly driven by data and genetics stating “we use objectivity first” when asked how they select animals for breeding. He described that they use their own custom index and the TGRM software to select bulls to join to their 1,500 stud cows. This custom index takes all EBV’s into account and considers the value of those breeding decisions along the entire supply chain to the consumers. This informant said “we’re breeding the most valuable carcass we can” when asked about their breeding objective. They have seen the value of this through receiving carcass feedback from the abattoir. This data is entered back into BREEDPLAN to improve the accuracy of carcass EBV’s.

When asked what his clients were looking for at their sale he replied with “how big they are, ... it’s a bit disappointing on sale day.” Although this is quite surprising from a stud that is so focussed on genetics, it is consistent with their quantitative results. This stud’s sale had a stronger than average

relationship between live weight and sale price as well as ADG and sale price. It also had a weaker than average relationship between ABI and sale price. A possible explanation for this is that producers attending this stud's sale know that all the sale bulls are genetically superior and have significant data backing their EBV's. Therefore, they have less need to select for genetics and instead select on phenotype.

However, he also went on to say that "there's a massive lack of education in the Australian beef industry" with regard to the use of technology and information when making selection or breeding decisions. He also had a lot to say about how much producers should really be paying for commercial bulls and how the awareness of producers on farm gross margins varies.

"A fair portion at the sale come because they know we've got lots of good data. They tend to pay less because they're more in tune with their farm costs and they know how much they can justify spending on a bull. Whereas if you don't use technology and you attract people that are just phenotype orientated, they're generally less modernised farmers and they haven't got such a good idea of the gross margins that they're running on farm and don't really have a clue of what an upper limit of spending money on genetics would be. I also think that they think that there's only one bull there for them. Whereas someone who's got stats knows that there's heaps of bulls that fit their requirements and they might vary a bit phenotypically but genetically they're very similar. So, they know that if one gets a bit expensive, they can wait and buy another one. Whereas the phenotype people that select on phenotype tend to just pick a bull or two. Then they bid up on those bulls and pay ridiculous sorts of money which they could never recoup the value of. Or they might be able to recoup the value of it, but they could have bought its brother or its full brother in the next pen for a tenth of the price and had the same result."

The fourth key informant places minimal emphasis on the visual appearance of their cattle when compared to key informants one and two. They are also highly genetics driven and have some of the highest indexing bulls in the country. However, they are very strict on structure and independently assess their cows as well as their bulls and enter these structural scores into BREEDPLAN. When asked how they select animals to purchase or use for breeding they said "always EBV's first... then tick off, make sure they're sound in the feet, square legs, nice shape." This breeder is very similar to key informant three as they both use computer software to choose their joining's. That is, which bull they will join to which cow. The software matches the animals which are estimated to breed the best progeny based on a custom index. The software can also be used to enforce certain rules such as restricting how much an individual bull is used or the level of inbreeding in the progeny population.

Both genetics-driven breeders gave very minimal value to raw data due to the environmental influence present. They both said that they weren't worth anything and couldn't be compared across different herds. They put the raw data into the BREEDPLAN model and compare EBV's as this takes the environmental factors into account.

With regard to their bull buying clients, they said that "the majority of our clients are index focused". This is consistent with the quantitative results as the correlation of ABI and sale price of the 2018-born bulls from this sale was equal to the average across all sales. In the 2017 bulls, this correlation was above average. The correlations for ADG and live weight in the 2018 bulls were actually very weakly negative while the correlations in the 2017 bulls were well above average. The accuracy of these results however, is jeopardised by the small number of bulls sold, which was partly caused by severe drought conditions in the surrounding area. This partially explains the high variation in the correlation results.

These four interviews showed a great deal of variation in their views and opinions which is also evident in the quantitative results reported in the companion paper (Thomson et al., 2021). These views were consistent with the correlation analysis results and consequently have provided some valuable reasoning to those results.

Influence of Individual Studs

As inferred above, one of the major factors influencing selection decisions and therefore factors affecting sale price is the reputation of the stud itself. There is a high level of loyalty in the industry where bull buyers will only look at one or two studs for their bulls. This is due to high priority associated with breeding programs where a buyer likes how the whole stud herd is managed and is confident that the bulls are the right 'type' and will suit their own breeding program and environment. Sometimes this means that buyers are happier to buy the worst bulls in a sale from a particular stud than the best bull from another stud that has a poorly regarded breeding program, even if that bull is clearly better across all traits. This means that buyers are only selecting within one or two sales generally in their local region and not across the industry. Therefore, the stud is one of the most significant factors in determining sale price.

This explains why in the quantitative analysis (Thomson et al., 2021) there was no significant correlations between average ABI, average live weight, average ADG and the measures of sale performance across all sales compared to correlations for individual studs. To take account of this effect, the individual sales were included in the regression analysis as dummy variables.

It might be expected that studs that are heavily genetics-focussed would have a stronger relationship between genetics and sale price and that studs that are focussed on phenotype would have stronger relationships between phenotypic traits and sale price. However, the statistical analysis found the opposite to be true in a small number of individual studs who are particularly focused on either genotype or phenotype. This is consistent with the variation in views and opinions evident in the key informant interviews noted above. A possible explanation for this is that producers attending those sales are confident they can buy a bull that is high quality for the area that the stud focusses on. Therefore, the buyers do not need to select for those traits and instead selects on the traits that the stud is lacking in. Hence, sometimes studs driven for genetic progress actually have high correlations to live weight and ADG. For example, sale 2 in the quantitative analysis (Thomson et al., 2021, Table 3) has one of the highest average ABI's but also has above average correlations for live weight and ADG and below average correlation for ABI.

In the statistical analysis, when comparing sales that are particularly high or low in ABI or liveweight we observe that there is minimal difference in the correlations of ABI and liveweight to sale price. The 2017-born bull sales with the lowest average ABI have an ABI of \$101, \$103, \$104, \$108 and \$111. These sales had a correlation for ABI to sale price of 0.345, 0.503, 0.495, 0.349 and 0.369 respectively. Compare these to the five highest average ABI's at \$148, \$144, \$143, \$142 and \$141 which had correlations of 0.290, 0.441, 0.516, 0.410 and 0.497. This demonstrates that even breeders who are the least focussed on breeding for genetics still have buyers who are selecting on it. To reinforce this point, the correlation of sale average ABI to the correlation between individual ABI and sale price was calculated and the result was a very weak correlation of 0.084.

Sale 38 (Thomson et al., 2021, Table 3) has particularly interesting results. This stud is well known for their focus on phenotype and are heavily involved in local and regional shows. Their sale bulls had an average ABI of \$103 which is below the industry average ABI for 2019 BREEDPLAN figures of \$112. It is also the second lowest in the sales of 2017-born bulls. However, it had a relatively high correlation between ABI and sale price of 0.503 and was one of only a few sales where ABI had a higher correlation

than live weight. This is quite surprising given the focus of their breeding program from their website is bulls that are “more powerful, thicker, longer, stronger boned and grow quicker”. A potential explanation for this is that buyers attending this sale are sure they will be able to buy a bull with high quality phenotype. Therefore, they have less need to select for this. Whereas, a bull with high quality genetics would be particularly hard to find in this sale and so buyers need to actively select on genetics if that is what they are looking for. This higher correlation between ABI and sale price compared to live weight and sale price (Thomson et al., 2021, Table 3) is also likely to be influenced by the fact that this sale is located in the Southern region where it has been found that producers have greater preference to genetics than phenotype.

Conclusion

There is significant variation in the breeding programs of Angus seedstock breeders and the relative importance they place on genetic and phenotypic traits. This paper explores those differing opinions and provides some explanation behind them. The results from this qualitative analysis closely match the quantitative results in the companion paper (Thomson et al., 2021). Individual studs play a major role in determining the sale price of bulls due to the loyalty in the beef industry where producers will only look to buy from one or two breeders in their local region rather than shopping abroad. Bull buyers will often select on genetic information at a sale that is renowned for phenotype and vice versa, achieving a balance of genetics and phenotype. This behaviour explains some of the surprising results where breeders with minimal emphasis on genetic information, and consequently a low average ABI, have a higher correlation between ABI and sale price. Genetic information has a strong influence on the sale price of Angus bulls and depends on regional location, breeding philosophy of stud masters and perceived genetic and phenotypic quality of sale bulls.

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Appendix. Key Informant Interview Questions

1. How many registered breeders do you run?
2. How many bulls do you sell each year?
3. How much do you source genetics internationally?
4. Do you use genetic or phenotypic information, or a combination of both to inform management decisions such as breeding, selection and culling?
5. Do you believe one is preferable to the other in assessing an animal's value? Explain why.
6. What is your breeding objective?
7. What traits are your clients looking for when they attend your bull sales?
8. What traits are you looking for when selecting a bull to purchase or use as an AI sire?
9. Which individual traits do you target when breeding or selecting a bull for purchase or AI?
10. What process do you go through when assessing a bull's value?
11. If you buy bulls from a sale, what process do you go through to select the bull/s you want to buy?
12. What priority do you give to the Angus Breeding Index when selecting a bull? 1 being no priority and 10 being highest priority. Please explain why.
13. What priority do you give to live weight when selecting a bull? 1 being no priority and 10 being highest priority. Please explain why.
14. Do you believe EBV's are an accurate representation of the potential performance of an animal or their progeny? Please explain why or why not.
15. Do you believe a phenotypic assessment of an animal is an accurate representation of the potential performance of an animal or their progeny? Please explain why or why not.
16. What are your thoughts regarding the use of genetic information to assess an animal's value at an industry wide level?
17. What are your thoughts regarding the use of phenotypic information to assess an animal's value at an industry wide level?
18. Please provide any other comments you might have with regard to the use of genetic or phenotypic information, including individual EBV's.