DEMONSTRATING BREEDPLAN ESTIMATED BREEDING VALUES IN NEW ZEALAND COMMERCIAL BEEF HERDS

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SUMMARY

Demonstration of BREEDPLAN Estimated Breeding Values (EBVs) is important to build confidence in the value of genetic improvement for commercial farming businesses and for user trust in genetic evaluation. Work of this kind has not been completed before in a New Zealand setting. The way that this validation is presented to users is also important in order to maintain confidence. Across the 9 BREEDPLAN traits assessed to date, the responses in calf performance ranged from 25% to 151% of predicted response based on sire EBVs – giving confidence to users that selection on EBVs is translating into gains in performance under New Zealand commercial beef cattle systems.

INTRODUCTION

The uptake of Estimated Breeding Values (EBVs) and other genetic tools has been mixed in New Zealand beef breeding to date. In sheep breeding, the uptake is relatively advanced and many rams sold are first grouped on $ Index to be valued for sale. Given a vast majority of farms run both sheep and beef on the same land – this is an interesting difference.

Beef+Lamb New Zealand Genetics established the Beef Progeny Test (BPT) with a strong focus on adoption. Typically, progeny tests are formed for the purpose of evaluating sires and providing research data primarily. While the BPT also has evaluation and research goals, a strong adoption focus is a defining aspect of the BPT. Proving that the tools work and that the investment pays off from using them is a central theme for the test – it has become a platform for adoption in NZ beef genetics. The use of significant sized commercial farms is a key factor in ensuring that NZ farmers believe and relate to the outputs of the BPT.

MATERIALS AND METHODS

The BPT is an industry and government funded project that tests the genetic merit of beef sires through the performance of their progeny. The project completed its 5th cohort of joining via artificial insemination (A.I) in 2018. Approximately 2200 cows in five large commercial herds (4 herds with Angus cows and 1 herd with Herefords) are artificially inseminated each year using fixed time oestrus synchronisation to approximately 50 sires representing Angus, Charolais, Hereford, Simmental, and Stabilizer breeds. Herds were selected on a range of criteria including number of cows, ability to execute the project, credibility with commercial farmers, geographical spread, ownership/governance/management, among other factors.

Sires are used across 5 properties; Mendip Hills Station- Cheviot, Tautane Station- Hawkes Bay, Whangara Farms- Gisborne, Caberfeidh Station- Hakataramea Valley and Rangitaiki Station- Taupo. Not every sire is used on every property, however there is sufficient genetic linkage to compare the performance of sires across these wide ranging environments with most sires (except Stabilizers) used across at least two properties and many used across four. Maternal sires were used with the intention of achieving a rate of 25 effective progeny per sire (30 in later years), and terminal sires at a rate to achieve 12.5 effective progeny (15 in later years) giving sufficient accuracy of sire evaluation for most traits - with all progeny being DNA parentage verified to sire and dam. International sires from other global progeny tests have been used to provide benchmarks for New Zealand beef sire performance and to allow future collaboration. Progeny of sires are assessed for over 30 traits- including growth, carcass quality (using live ultra-sound at approximately 18 months of age, and actual carcase assessments based on the Meat Standards Australia measurement system), structural assessments, maternal ability, fertility, cow size and body condition. Heifers from Angus, Hereford and Stabiliser sires are mated naturally to calve at 2 and 3 years of age, with the intention of retaining them into the cow herd. All steers and heifers from Simmental and Charolais sires were slaughtered and carcase measurements collected. Animals for slaughter were drafted into groups based on weight, generally several months prior to slaughter, and all animals within the pre-allocated groups were killed on the same day.

Statistical analysis. An analysis of how calf performance related to sire EBVs was undertaken to provide a demonstration of the utility of EBVs for improving performance in commercial environments. Data was restricted to calves sired by Angus, Hereford and Simmental sires with Breedplan EBVs available. Two cohorts of calves (born 2014 and 2015) were available for growth and ultra-sound scanning traits, with only one cohort available for carcase traits. For each trait a linear model was fitted using R, which included effects of sex, calf age within Herd-year (estimated from conception date scanning and dam-calf DNA match), age of dam (years) and contemporary group (Herd-sex-mob), Sire EBV and Sire Breed. This model assumes the same regression slope on Sire EBV between breeds, with different breed intercepts to allow for different breed EBV bases. A preliminary analysis found that EBV x Breed interaction was not significant, suggesting that there was no evidence within the data analysed for different slope relationships between breeds. The EBVs used in the analysis were from Angus, Simmental and Hereford Group BREEDPLAN analyses, where the BPT data was not included in the analysis (and so were independent of this data).

RESULTS AND DISCUSSION

Figure 1 is an example of the graphs which were produced to summarise the analysis in a visual way. The graph demonstrates that for every kg increase in sire W200 EBV, the progeny performance for weaning weight increased by 0.49 kg, which is 99% of the expected performance in progeny. The major goal of these graphs is to give farmers confidence that a response to the different EBVs is observed in a commercial beef production setting in New Zealand, and that EBVs created largely on data collected in seedstock herds are relevant to commercial beef systems.

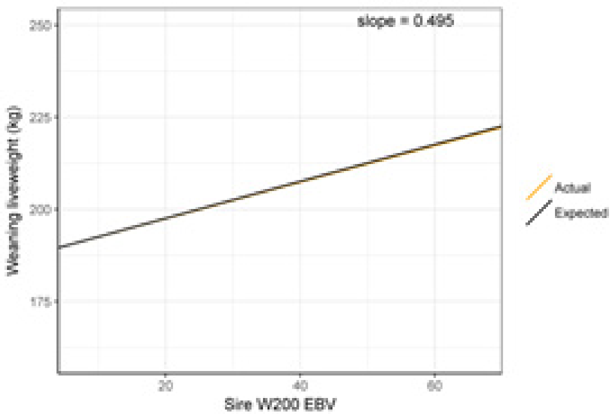

Figure 1. Demonstrating 200 Day Weight EBV

Table 1 gives the slope observed, and the percentage of this slope relative to what might be expected (generally expectation is 0.5 where the trait mirrors the EBV definition exactly). The impact of error in the EBVs on the expected slope is not accounted for in the calculation. Robinson (2005) showed that when the assumption that the independent variable is measured without error is violated, the expected slope is reduced and this can be predicted based on known errors. While accounting for this would be more appropriate from a scientific viewpoint to assess the utility of EBVs, communicating this to a lay audience is difficult, and it is also a "real world" factor which influences the realisation of commercial gains from use of EBVs. Consequently, for extension purposes the expected response was not adjusted to account for imperfect accuracy in sire EBVs.

Table 1. Demonstrating EBVs across traits

Trait	Observed slope	% of expectation
200 Day Weight EBV	0.49	99%
400 Day Weight EBV	0.41	82%
600 Day Weight EBV	0.45	90%
Days to Calving EBV*	0.50	100%
Rib Fat EBV	0.75 (abattoir)	151%
Eye Muscle Area EBV	0.33 (abattoir)	67%
Intra Muscular Fat EBV**	8.0 (abattoir)	25%
Carcass Weight EBV	0.15 (abattoir)	32%
Rib Fat EBV	0.20 (ultrasound scanning)	40%
Rump Fat EBV	0.32 (ultrasound scanning)	65%
Eye Muscle Area EBV	0.33 (ultrasound scanning)	66%
Intra Muscular Fat EBV	0.27 (ultrasound scanning)	54%
		73%

* Conception date as recorded in the BPT is calculated similarly to DTC but doesn't include Gestation length and is based off conception date information from ultra-sound scanning with foetal age called in 5 day increments.
**MSA marble score has been scaled to relate to IMF%. using values from Bindon (2001).

As a general rule, the relationships between calf performance and EBVs which were closest to expectation were for traits where EBVs are generally the most accurate (e.g. growth traits). The responses in calf performance for growth and fertility traits were generally close to expectation from Sire EBV. Responses in carcase ultra-sound measurements were generally lower than expectation (ranging from 40% to 66% of expectation) but still strongly positive.

For actual carcase measurements, the relationships between progeny performance and sire EBV for fat depth, marble score and carcase weight the relationship were positive but substantially below theoretical expectation. For these traits, the accuracy of the EBVs is affected by both the lower level of recording, and that the majority of recording is based on ultra-sound carcase predictions rather than actual carcase data. This is particularly important for marbling predictions, where ultra-sound %IMF is imperfectly correlated to actual marble scores which likely contributes to the lower than expected correlation (where the calculation of expectation does not take this into account). Responses in carcase eye muscle area were similar to those for ultra-sound scan eye muscle area, while for carcase fat depth the responses exceeded that predicted by Sire EBVs. Responses in carcase weight being much lower than expected can be explained by the impact of drafting strategy, where animals were pre-selected into groups to be killed together based on liveweight (generally several months before actual slaughter). Reverter *et al*. (2000) found measurements on the same cattle ultrasound scanned as yearlings and then again at the abattoir were moderate to strongly positive, suggesting that selection using yearling ultrasound measurements of seedstock cattle should result in predictable genetic improvement for abattoir carcass characteristics. This has been demonstrated anecdotally around the world with good levels of genetic gain in carcass traits using ultrasound scanning.

Across the 9 BREEDPLAN traits assessed 73% of sires EBVs turned into calf performance. This was further demonstrated by Angus Australia (2018) which showed an excellent relationship between expected difference between sires and actual differences in their progeny. The outcome was comparable to this work where the percentage of predicted difference and the actual difference averaged 120%. This was reinforced by Thrift and Thrift (2006) where the expected differences between high and low EBV sires were similar to the realised differences.

Our experience in showing these relationships to commercial farmers, with the aim of enhancing uptake of EBVs, is that the main focus of farmers tends to be on the fact that there is a positive relationship, rather than the proportion of the expected relationship actually achieved. Thus while the relationships for some traits might be lower than expected from a scientific perspective, the main message taken from these relationships from an extension viewpoint is that the EBVs are predictive of calf performance, and therefore selection based on EBVs will lead to gains within commercial beef production systems.

CONCLUSION

This work has demonstrated strong positive relationships of Sire EBVs with the performance of their calves. Confidence of commercial beef producers in the application of EBVs is enhanced when they can observe these relationships demonstrated in a local context and in farm systems that similar to their own.

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