BY THE NUMBERS

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Can we stop collecting data?

The road ahead with carcass and ultrasound in Angus cattle.

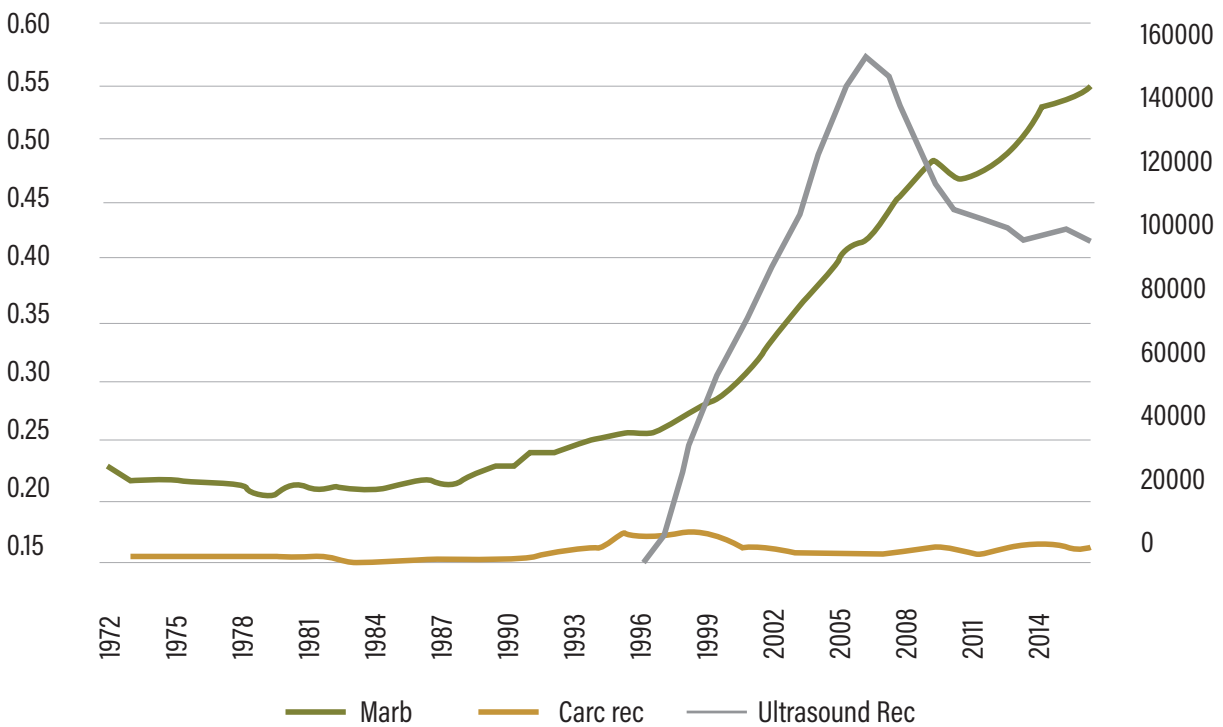
The Angus breed has many accomplishments to celebrate. One success story that I don't think gets enough attention is the genetic trend for carcass quality and the role ultrasound scanning has played.

This relationship is obvious when one lines up our marbling genetic trend with our adoption of ultrasound scanning (Figure 1). Considering a lag between scanning bulls and subsequent gains in progeny, it is clear that ultrasound has played a large role in this genetic progress. It is also a testament to the cattle breeders' ability to take a measurement on a live animal that is heritable and turn it into genetic gain.

This progress is facilitated through the American Angus Association's National Cattle Evaluation using scan records and carcass data in a joint model, with ultrasound providing indicator traits that are highly correlated to carcass records. Cattle breeders have been fortunate to have had access to such technology and should not take this advantage for granted.

With genomically enhanced expected progeny differences (GE-EPDs) now available, should breeders keep up efforts to ultrasound their cattle for carcass traits? After all, they can obtain a decent level of accuracy with genomics alone, why keep ultrasounding? If Angus's breeders were to cease ultrasounding today, they would begin the process of degrading the accuracy of their carcass evaluation and ultimately slow their genetic trend.

Figure 1. Angus genetic trend for marbling and recording of carcass and ultrasound.



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When considering if genomics should replace ultrasound, let's first consider how genomic predictions obtain their accuracy. Genomic predictions for traits are based entirely on the performance data in the genetic evaluation, along with genotypes. If a breed has no ultrasound or carcass data, they will not be able to generate genomically enhanced carcass EPDs (GEPDs), no matter how many animals they genotype. Simply put, the phenotypes are the "fuel" that make the genomic engine run.

Power in a dataset

So, given genomically enhanced EPDs need performance measures to be accurate, when it comes to carcass traits, what is required, actual carcass measures or live animal ultrasound measures? How do each of these weigh-up in terms of importance? One way to consider this question is to look to basic fundamentals as to where "genomic predictions" gain their power from, and how this can be weighted.

The best way to measure the amount of "power" in a dataset for generating genomic predictions is to evaluate the product of the number of animals with phenotypes and genotypes and the accuracy of the "phenotype." Simply put, one genotyped animal with a 90% accuracy for the trait is equivalent to two animals genotyped, each with a 45% accuracy.

This formula indicates that fewer animals with more accurate phenotypes is not always better than more animals with less accurate phenotypes. When applied to the Angus carcass evaluation, the information from the ultrasound data is much larger using this metric than the data coming from carcass data directly.

There are 966 genotyped sires with five or more carcass progeny (averaging 40) in the carcass evaluation, whereas there are just over 200,000 genotyped animals with individual ultrasound scan records. Considering the value of a scan record, as a correlated trait, the ultrasound data is close to 99% of the data when measured in this way. Actual carcass data is important and should be continuously pursued. However, albeit a rough estimate, it is clear the ultrasound data in the Angus evaluation has a very large impact on the accuracy of the genomic predictions, as it represents the majority of the data connected directly to genotyped animals.

Maintain phenotyping

So now that Angus has "arrived" with accurate genomic evaluations, can data collection stop? You guessed it — no. If data collection were to cease in the Angus evaluation, the predictability of the genomic information would suffer from decay. As generations progress, the genome evolves; and the predictions based on more distant generations no longer reflect the current animals. For this reason, the breed needs to maintain phenotyping to keep this evaluation "fresh" and current.

With a population as large as Angus, it may be tempting to think, "Well, as long as lots of other people are recording traits, I won't have to." This shortcut has pitfalls as well.

The Angus genomic prediction is based on a method known as GBLUP. In short, it is just like the cattle evaluation before genomics, but instead of fitting the average expected pedigree relationship between animals, it includes the genomic relationship, which is more accurate.

With this GBLUP approach, the more exact relationship with ancestors is what drives the difference in the EPDs. If these ancestors have little data behind them, the GBLUP approach has little to go on. As indicated earlier, the genomic predictions are based on data. The more data in your immediate pedigree, combined with genotypes, the more accurate genomic predictions will be for your cattle in the long run.

The Angus breed has outpaced all others in improving carcass merit. This has been the result of a long road filled with a lot of hard work, including carcass measures; but with ultrasound playing a significant role. It would be a perilous decision for a breeder to turn away from ultrasound scanning when it has been the technology that has carried them thus far.

Genomics will carry the breed further still, but this technology needs data to be accurate. Often "hard roads" ahead are described as being full of blood and toil. For carcass genetic improvement in Angus cattle, this road into the future will be about "blood (DNA and carcass) and oil (ultrasound)" for some time to come.

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