BY THE NUMBERS

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Putting Our Best Foot Forward

The quality and quantity of data, along with the pedigree relationships that exist between herds, form the basis of accurate genetic evaluation.

Beef cattle breeding is a complex undertaking, consisting of simultaneous selection for several economically important traits, some of which are antagonistically related.

In 2018, the American Angus Association and Angus Genetics Inc. (AGI) commissioned a survey, a portion of which was dedicated to understanding producer preferences for the various traits that contribute to their overall success. Responses to this portion of the survey were received from 2,542 seedstock and commercial cow-calf producers from 49 states and eight countries, with 64% of respondents being seedstock breeders, 29% being commercial cow-calf producers who sell their calves at weaning, and 7% being cow-calf producers who retain ownership through the finishing phase.

Importance of foot structure

The consolidated results from this survey are displayed in Table 1. For the purposes of the survey, producers were given trade-off definitions and asked to continually select between two traits at a time in an either/or format until a final ranking of all traits was achieved. A lower median value indicates greater importance.

Given the population being surveyed, it should come as no surprise that cow traits ranked quite high. However, it may come as a surprise that foot score ranked third, above traits that may more readily come to mind. Results of this survey have shaped AGI initiatives, including the introduction of claw set and foot angle as production expected progeny differences (EPDs) in 2019, followed by their incorporation in the maternal weaned calf value ($M) and combined value ($C) dollar value indexes ($Values).

Though the results of the survey indicate a high perceived importance for foot structure, the Association is still in its relative infancy when it comes to the collection of phenotypes for claw set and foot angle. To bolster foot score EPDs with a significant amount of high-

Table 1: ***Trait preference survey of 2,542 seedstock and commercial cow-calf producers***

Trait	Trade-off definition	Median value
Cow survival	6 more cows per 100 live past 5 calvings	4.5
Docility	8 more heifers per 100 suitable as replacements because of good temperament	5.2
Foot score	8 more heifers per 100 suitable as replacements because of good feet	5.5
Heifer pregnancy	4 more heifers calve per 100 mated per year	5.6
Weaning wt.	15 lb. more weaning weight because of growth potential	6.6
Calving ease	3 fewer assisted calvings per 100 heifers	6.6
Body condition score	1 more unit of cow condition score under nutritional stress	7.5
Marbling grade	30 more carcasses per 100 exceeding mid-Choice (*Certified Angus Beef*® minimum) grade or better for marbling	7.7
Feedlot efficiency	0.5 lb. less feed per lb. of live weight gain	7.8
Milk	15 lb. more weaning weight because of cow milking ability	7.9
Feedlot gain	14 fewer days to commercial end point due to feedlot growth performance	9.1
Cow mature wt.	60 lb. less cow mature weight	9.8
Cow frame score	1 less unit (2 inches) of frame score	10.6
Yield grade	5 fewer carcasses per 100 grading Yield Grade 4+	10.7

quality data, the Board of Directors of the American Angus Association approved the inclusion of Australian foot score data and genotypes in the weekly Angus genetic evaluation beginning with the Friday, Nov. 27 EPD release.

Quality, quantity and connectedness

Accurate genetic evaluation relies upon several factors, namely the quality of the data, quantity of data and extent of pedigree relationships across herds. A review of the Australian foot score data prior to their inclusion revealed all three of these factors had been met.

Quality

Data quality pertains to the accuracy and repeatability of measurements, as well as correctly segregating animals into contemporary groups to account for the environmental effects common to a group. Utilizing the same scoring system adopted by the American Angus Association, Angus Australia began certifying foot scorers in 2002 and published its first research estimated breeding values (EBV = EPD x 2) in 2004. EBVs for foot scores have been included in the routine Angus Australia genetic evaluation since 2016.

Quantity

To account for the uncontrollable randomness of breeding, the subject of the November 2020 "By the Numbers" article, large numbers of progeny phenotypes are required to achieve highly accurate genetic estimates for any quantitative trait. At the time of this writing, there were 48,647 animals with foot score records in the American Angus Association weekly genetic evaluation. Of these, 47,937 had been submitted by Association members and 710 by members of the Canadian Angus Association, which is just beginning to capture these traits. Entering the latest joint test run were 62,799 Australian animals with foot score phenotypes, more than doubling the amount of foot score data used in the weekly evaluation.

In addition to volume, the Australian data set provides the benefit of containing progeny records on older American sires that have a limited number of foot score phenotypes within the American database. Among these are 35 American Angus sires born between 1988 and 2014 that have a minimum of 25 Australian progeny with foot scores. Though these 35 sires have no foot score records whatsoever in the American database, they have 3,114 records in the Australian data set.

Connectedness

For the phenotypic differences within a contemporary group to be meaningfully compared to those differences observed in other contemporary groups within a population, the groups must be connected through pedigree relationship. By allowing the progeny of popular sires to compete within the same contemporary groups as the progeny of natural service sires, artificial insemination (AI) has created these connections around the globe. Case in point, of the 62,799 Australian animals with foot scores, 20% have a sire registered with the American Angus Association and another 33% have a grandsire registered with the American Angus Association.

Effect on weekly evaluation

Because the same traits are being measured on the same scale, high

Fig. 1: ***Relationship between American Angus Association expected progeny difference (EPD) and the joint American Angus Association/Angus Australia (AAA/AA) test EPD for claw set for sires with 25 or more progeny records in the test evaluation***

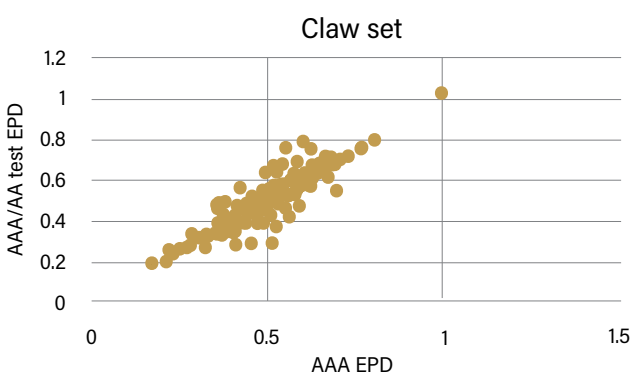
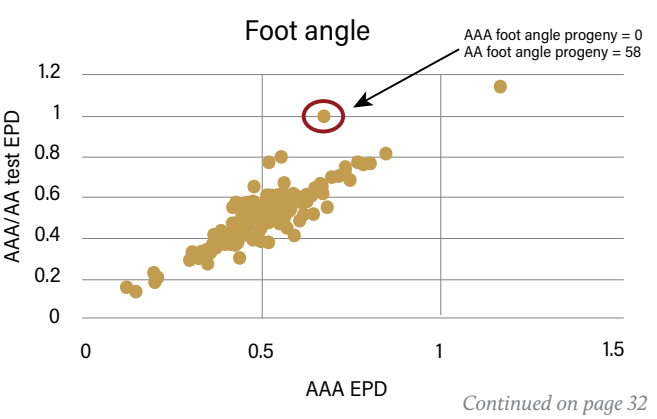


Fig. 2: ***Relationship between AAA EPD and AAA/AA test EPD for foot angle for sires with 25 or more progeny records in the test evaluation***



Continued on page 32

By the Numbers *continued from page 31*

correlations exist between current American Angus Association EPDs and those generated through a test run using American and Australian data (0.88 and 0.87 for claw set and foot angle, respectively). Figs. 1 and 2 plot American EPDs (horizontal axis) against the EPDs generated through the joint test run (vertical axis) for animals with 25 or more progeny in the joint evaluation.

Though relationships between the two estimates are visibly high, some re-ranking of sires does exist, primarily for sires with little or no data in the American database and a significant amount of data in the Australian data set. Highlighted in Fig. 2, the most significant change is a sire with no foot angle progeny records in the American database and 58 progeny phenotypes in Australia.

Due to the immediate influx of data, members may have noticed changes in the EPDs for claw set and foot angle within their herds, which could affect $M and $C. Because of the quality of the data being introduced, these changes should be viewed as improvements to our predictions of these traits and indexes.

Growing the toolbox

Achieving genetic gain and profitability in the complex world of animal breeding requires continual improvement in the quantity and quality of tools at the disposal of Angus breeders. The inclusion of Australian foot score data, when combined with the continued submission of foot score phenotypes by both Canadian and American Angus Association members, will allow Angus breeders around the globe to put their best foot forward. AJ

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Editor's note: If you have questions, please contact the AGI team at 816-383-5100.