

ABSTRACT

The American Angus Association (AAA) uses the Angus Herd Improvement Records (AHIR) system as a way of determining the genetic merit of breeding animals. New advances in genotyping have created a way to more accurately determine a breeding animal's EPDs (Estimated Progeny Differences), which will help the producer improve production traits through selection. We examined the rate of improvement in accuracy of EPDs from Angus GS genomic testing vs. performance data submitted to the AAA. After utilizing the Angus GS test, accuracy of EPD values were found to be significant whereas EPD values themselves were not significant. In addition, researchers contributed to the advancement of the Angus breed by scoring 39 of MTSU's Angus cows for foot angle and claw set.

INTRODUCTION

The American Angus Association (AAA) has for several years used the AHIR (Angus Herd Improvement Records) system as a way of determining the genetic merit of Angus breeding animals. This is achieved by compiling millions of individual data points from breeders such as weights, measurements, and carcass data from Angus cattle into the Association's database. New advances in genotyping have created a way to more accurately determine a breeding animal's performance. The Angus GS genomic selection tool utilizes a core set of 40,000 single-nucleotide polymorphisms (SNPs) that are genotyped directly as opposed to relying on data imputed by individual producers.

Recently, the AAA has begun collecting new performance data from breeders for foot score and claw set. This is evaluated on a scale of 1-9 for both foot score and claw set (American Angus Association). Lameness in cattle can have significant negative impacts on cattle production, health, and welfare resulting in economic losses (Davis-Unger et al., 2017). In a study published in 2017, moderate heritability was found for foot angle (.34), which warrants future genetic evaluation (Wang et al., 2017). With the advancements in gene-mapping technology for the Angus breed, hopefully performance data for foot score and claw set will be able to be determined more accurately through genomic testing. For now, Angus breeders must rely on newly compiled foot score and claw set data from other members of the Angus Association to determine performance data for their breeding animals.

OBJECTIVE

The objective of this project was to examine the rate of improvement of accuracy for performance data in Angus cows using Angus GS genomic testing vs. performance data submitted to the AAA. Additionally, researchers contributed to the advancement of Angus breed improvement through claw set and foot score submissions.



Figure 3: Dr. Carter preparing to draw blood from one of MTSU's Angus cows

Methodology

We selected 16 cows from the herd for the comparison of regular EPDs versus genomic-enhanced EPDs on March 4, 2020. For the comparison of control cows (n = 8) and genomic cows (n = 8) we selected four animals from the following birth years: 2013, 2015, 2016, and 2017. We skipped 2014 because there were not enough females in the herd from that year. We randomly assigned these cows to either the control or genomic group. Eight Angus GS tests were ordered through AAA for the animals being genetically tested. Blood was collected from each cow and transferred to blood cards. This was done by wiping the animal's ear clean and then pricking the ear vein with a sterile needle. Then we touched the circle on the DNA card to the blood site on the ear and filled the circle with blood. Cards were dried away from direct sunlight for at least 24 hours prior to mailing. The blood cards were sent to Angus Genetics Inc. Upon return of the samples, the accuracy of the performance data for the 8 genetically tested cows was compared to the accuracy of the AHIR submission data for those 8 cows who did not receive the GS tests.

All animals in the Angus herd (39) were foot scored on a scale of 1-9 and scored for claw set 1-9 (5 being ideal for both) and the data was submitted to the AAA through the AHIR. Visual chart for foot scores are included in Figure 1 and 2. Cows were scored in the holding pen where they were on a flat, solid surface. Two people collected foot scores and the scores were averaged.



Figure 1. Guidelines for foot scores.

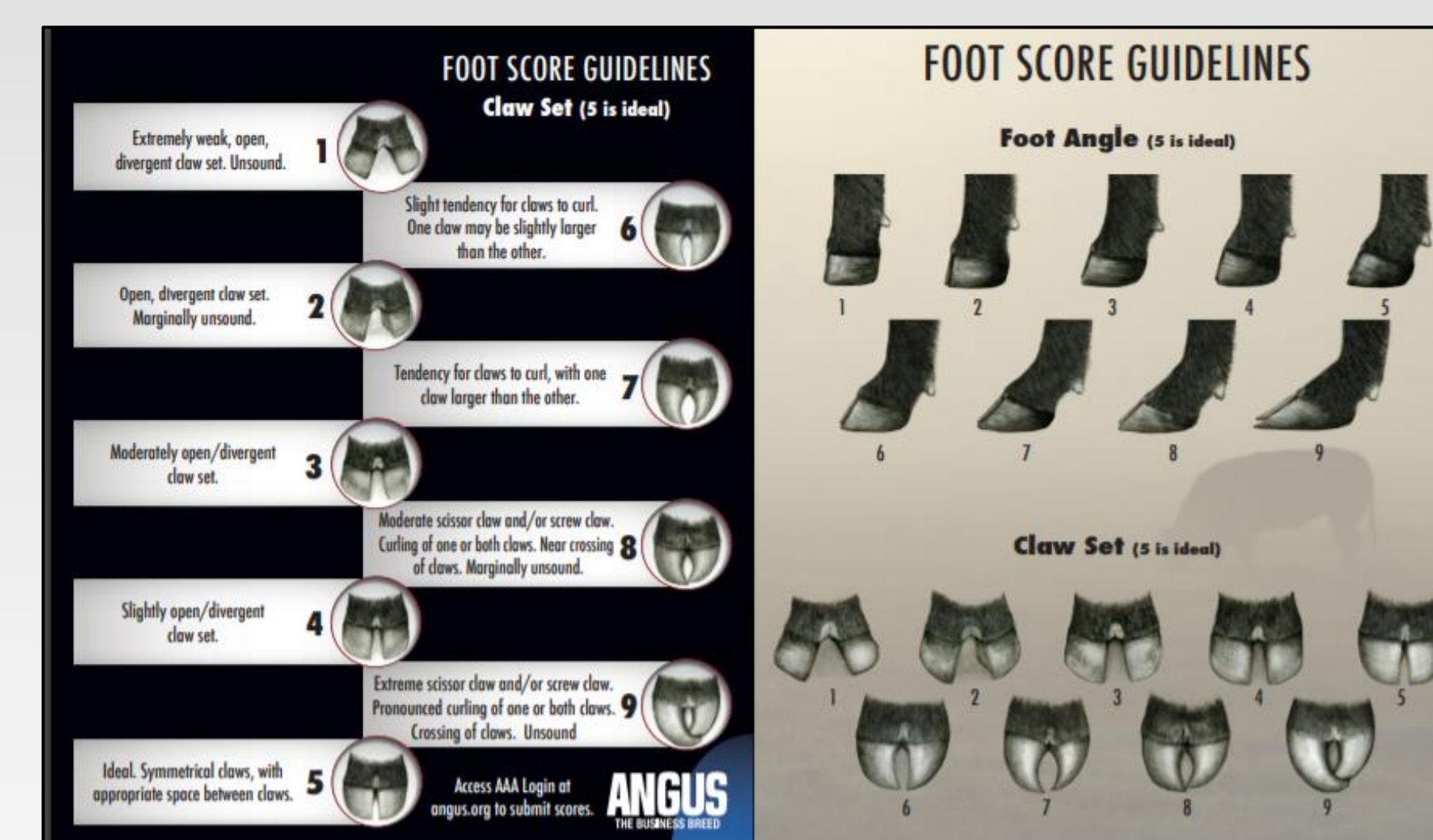


Figure 2. Score card for claw set and foot angle scores.

RESULTS

Of the 39 cows who were scored for claw set, 23% were scored ideal, 5, with symmetrical claws and appropriate space between claws (Figure 3). Fifty-four percent of the cows were scored a 6 in claw set, with a slight tendency for claws to curl, and one claw potentially being slightly longer than the other. Of the 39 cows who were scored for foot angle, only 13% were scored ideal, 5, with an approximate 45-degree angle at the pastern joint and appropriate length of toe and depth of heel (Figure 4). Sixty-seven percent of the cows were scored a 6 for foot angle, possessing a slightly shallow heel and long toe. This data will be submitted to the American Angus Association for the calculation of EPDs in these two categories. We will now be able to use this information and select for improved foot scores through sire selection and regular monitoring of foot scores in the herd.

Results, cont.

We focused our attention on the following EPDs for comparison: production traits Calving Ease Direct (CED), Birth Weight (BW), Weaning Weight (WW), Yearling Weight (YW) and Docility (DOC) as well as the maternal trait of Maternal Milk (Milk). Average EPDs for the control and genomic groups are included in Table 1. There were no significant differences in EPDs ($P > 0.05$) although the milk EPD showed a trend ($P = 0.09$) with cows in the control group have a higher milk EPD than cows in the genomic group. We used a small sample size due to budget limits for this project. With a larger sample size we would expect to see more significant differences in EPDs. Using the Angus GS genomic testing, there was a significant increase in accuracy (Table 2) for all EPDs evaluated. CED, BW and WW accuracy improvement were most significant ($p < 0.001$). Using the Angus GS genomic test, the accuracy for YW increased by 58% and the accuracy for DOC increased by 72%.

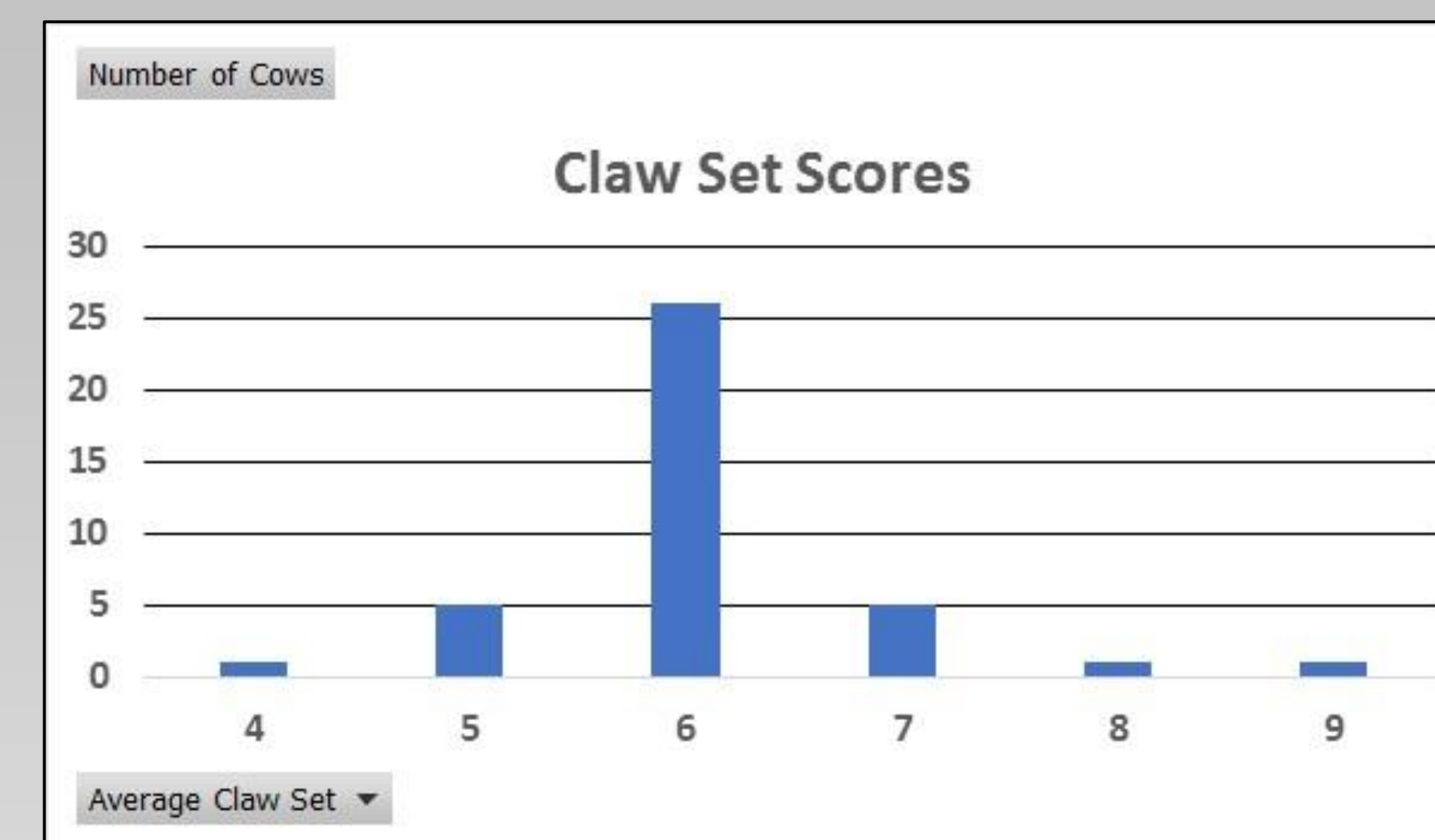


Figure 3. Average claw set scores for the MTSU Angus herd.

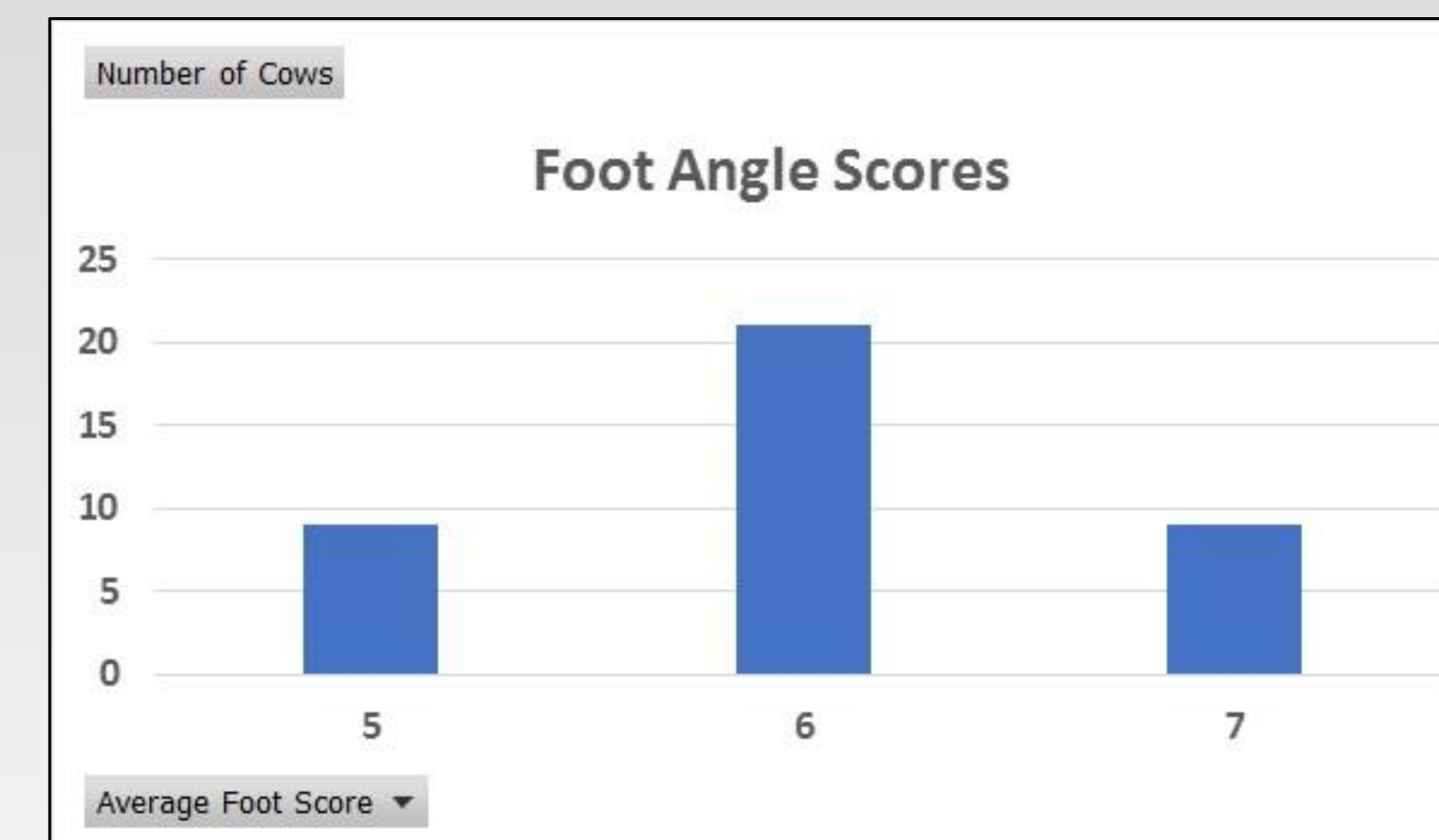


Figure 4. Average foot angle scores for the MTSU Angus herd.

EPDs	Control	Genomic	St. Error	P-value
CED	4.6	1.9	3.8	0.182
BW	2	2.7	1.5	0.389
WW	44.5	54.1	10.7	0.140
YW	78.3	90.5	6.7	0.283
DOC	8.7	7.5	4.1	0.708
Milk	23.6	18.9	2.9	0.099

Table 1. EPDs for commonly measured production and maternal traits. * Significant difference at $P < 0.05$

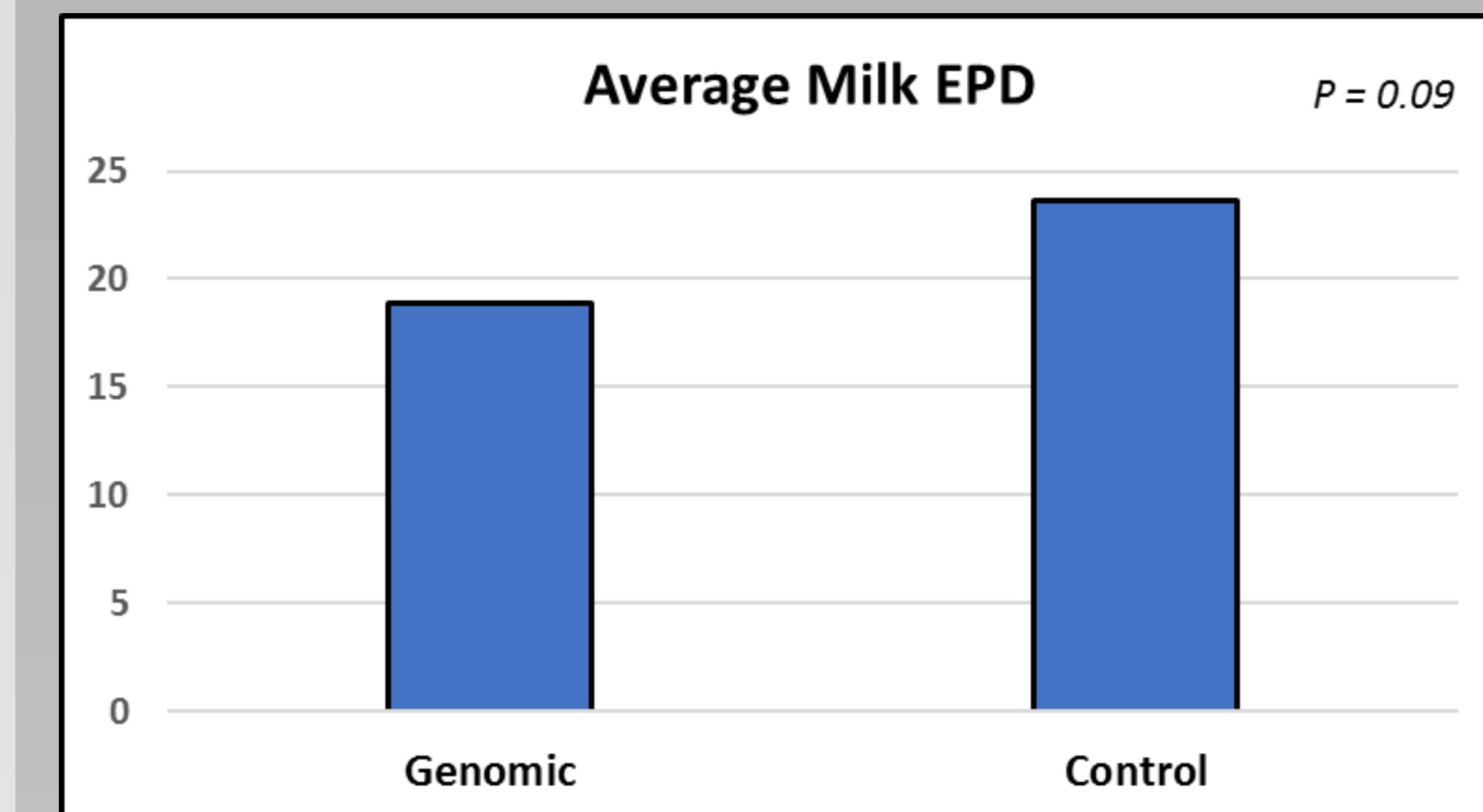


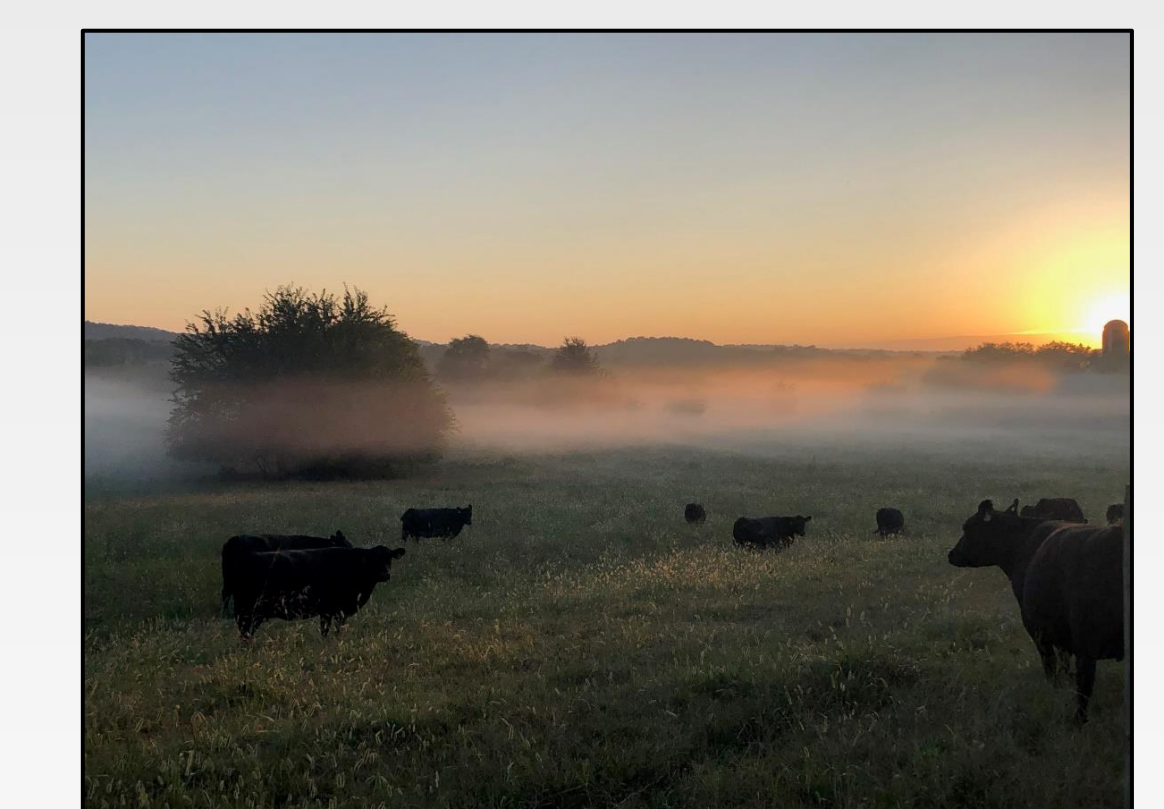
Figure 5. Average Milk EPDs for Genomic & Control groups.

Trait	Control	Genomic	St. Error	P value
Calving Ease	0.211	0.328	0.015	<0.0001*
Birth wt., lb	0.376	0.525	0.012	<0.0001*
Weaning wt., lb	0.326	0.455	0.012	<0.0001*
Yearling wt., lb	0.240	0.380	0.020	<0.0001*
Docility	0.220	0.388	0.032	0.002*
Milk	0.235	0.235	0.047	0.003*

Table 2. Accuracy values (range from 0 – 0.99) for EPDs measured. * Significant difference at $p < 0.05$

CONCLUSIONS

As expected, the Angus GS genomic test significantly improved accuracy of EPD values for the genomic group when compared to the control group. This is especially true for that of CED, BW and WW. This increased accuracy will help the producer decide which offspring to keep for replacement heifers for improvement of the herd. MTSU can now more accurately select for heifers who have a high calving ease, produce calves with more ideal birth weights, and that have increased milk production. We also expect to improve weaning weights and yearling weights and produce calves that are more docile. Finally, the newly acquired foot score and claw set data provides new criteria to make informed culling decisions within the herd.



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ACKNOWLEDGEMENTS

- Undergraduate Research Experience on Campus (URECA)
- Middle Tennessee State University School of Agriculture
- Dr. Jessica Carter