



Foot and Leg Trait EPDs

New tools for selecting structurally sound cattle

Troy Rowan, The University of Tennessee Institute of Agriculture
trowan@utk.edu

Dr. Darrh Bullock

Dr. Jared Decker

Dr. Megan Rolf

Dr. Troy Rowan

Dr. Matthew Spangler

Dr. Alison Van Eenennaam



Genetic improvement of structural soundness has been a longstanding challenge for the beef industry. Until recently, selection for soundness has been exclusively phenotypic: identifying replacement females that pass the “eye test” and culling cows when foot and leg structure becomes problematic. As with other low-to-moderate heritability traits, making genetic progress on soundness through phenotypic selection is especially difficult because much of the variation in observed phenotype is controlled by management and environmental conditions. However, structural soundness is heritable, and choosing an unsound sire can create structural issues in a cow herd for generations.

Furthermore, for seedstock producers, bull returns due to structural unsoundness can negatively impact their bottom lines. This makes the accurate selection for structurally sound animals even more important. Two of the most effective measures of structural soundness, foot angle and claw set, are moderately heritable. Both have heritabilities of 0.25 in American Angus. Slightly lower heritabilities have been reported in pilot studies of Red Angus and Simmental cattle. This means that making genetic progress on structural soundness, particularly when using an EPD, is possible for both seedstock and commercial producers.

Dairy genetic evaluations have reported genetic predictions for visually scored “type traits” like foot and leg structure since 1978, but beef breeds have lagged behind. As with any trait, assembling a large set of phenotypic measurements is the first step in generating genetic predictions. Recently, researchers and breed associations have started assembling datasets of the size needed to perform genetic evaluations for foot and leg structure.

Scoring and Recommendations

Research has identified three main indicator phenotypes that can be used to capture the most important aspects of structural soundness: Foot angle, claw set, and rear leg angle. All breeds with feet and leg scoring initiatives use a 1-9 scale to classify each of these traits. Foot angle is a measurement of the pastern joint’s angle, the depth of heel, and length of the foot (Figure 1A). Here a score of 1 is overly steep (approaching a 90-degree angle), and a score of 9 is overly shallow (approaching a 0-degree angle). Claw shape measures the shape and curl of the hoof (Figure 1B). An animal with a score of 1 has splayed out open toes, whereas a 9 has overlapping scissor-like toes. Finally, rear leg angle measures the angle from the front of the hock (Figure 1C). Here, phenotypes range from completely straight, a score of 1, to completely sickle-hocked, a score of 9

For each of these traits, the ideal phenotype is a score of 5 (not too far towards either extreme). An ideal foot angle is a 45-degree angle above the ground, with enough length and heel depth. Ideal claw sets consist of hooves that are symmetrical and appropriately

spaced. Rear legs should be flexible and have an appropriate angle to the hock with mobile pasterns. Visual representations of foot angle, claw set, and rear leg scores (1-9) can be found below, courtesy of the American Simmental Association.

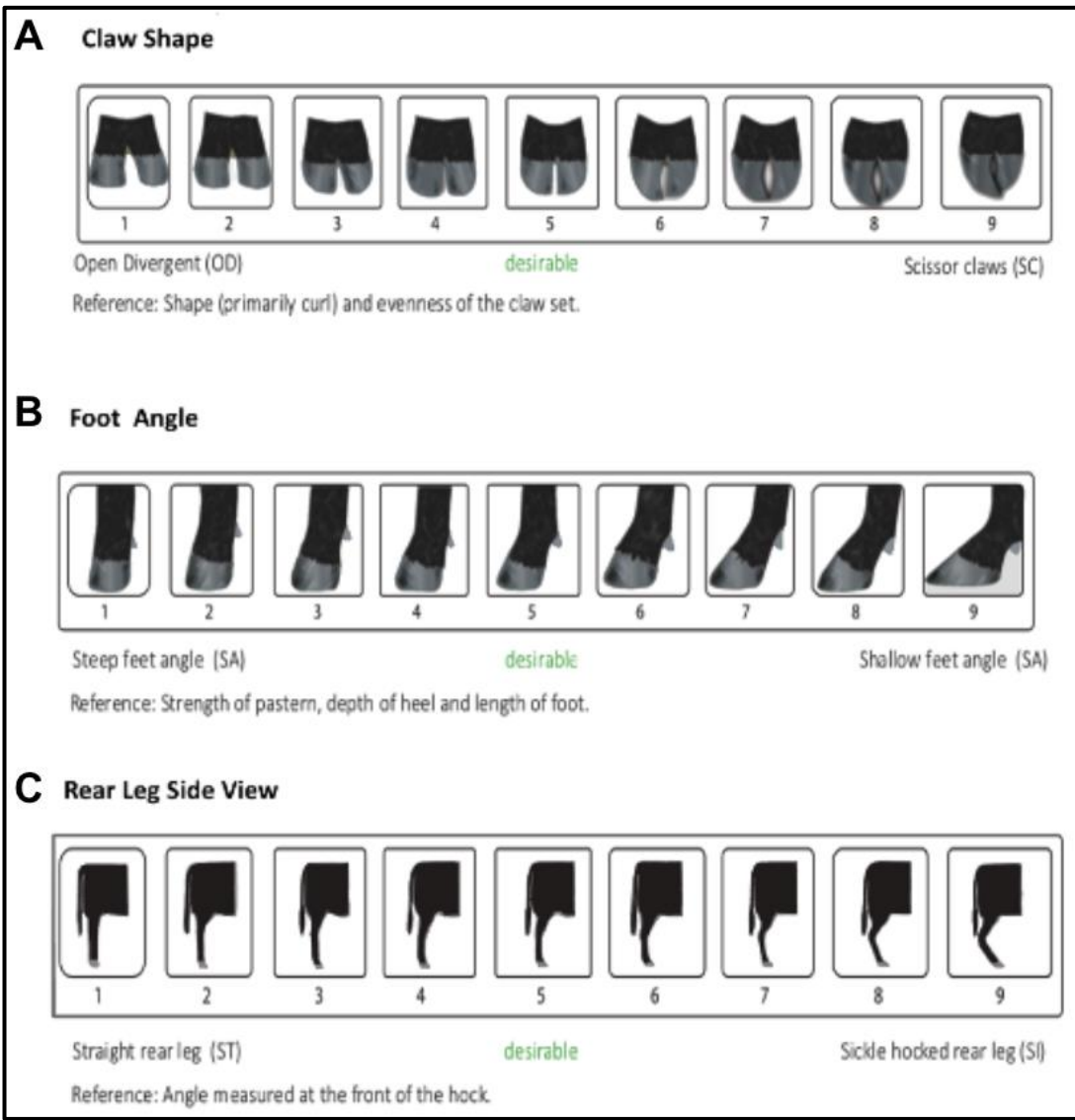


Figure 1. Scoring guides for three major structural soundness phenotypes: A) Claw shape, (B) foot angle, and (C) rear leg side view. Each trait is measured on a 1-9 scale where 5 is the optimal phenotype.



Breed associations suggest initially scoring bulls and heifers as yearlings (between 13 and 18 months of age). Foot and leg structure changes as cows age. Over time, the variation in foot scores will increase as some cows maintain their favorable structure, while others begin to regress. As a result, scoring mature cows multiple times over their years in the herd adds useful information beyond the yearling score.

Contemporary groups for both yearlings and mature animals should consist of individuals from the same herd and birth year. Due to a lack of contemporary animals, bull foot and leg scores are only of use in genetic evaluations as yearlings. All animals in a contemporary group should be scored on the same day by the same scorer for maximum consistency. Scores should be collected on a hard surface where animals can naturally stand. If there is variation between an animal's legs, the worst scoring foot should be reported.

Breed Association Initiatives and EPDs

Multiple beef breed associations, through industry and academic collaborations, have undertaken foot and/or leg scoring initiatives with the intent of creating new selection tools. The American Simmental Association, American Gelbvieh Association, and the Red Angus Association of America are actively building databases with the intent of calculating research EPDs for structural phenotypes. As of now, the American Angus Association (AAA) is the only beef breed in the U.S. reporting foot score EPDs. To date, Angus has observed a relatively small number of 1-4 scores for both foot angle and claw set, so these scores are not being included in the evaluation.

This lack of records on the low end of the scale means that an EPD is currently only being calculated for scores 5-9. As a result, the minimum possible EPD is 0 and lower values indicate more desirable EPDs. We can interpret AAA's reported EPDs as a difference in foot score units (foot angle or claw set), where numbers closer to zero indicate the more favorable intermediate phenotype. For example, if Bull A's claw set EPD = 0.5 and Bull B's = 1.5, the progeny of Bull A would on average have a claw set a full score closer to ideal than progeny from Bull B.

Future work and promise

Several breed associations are continuing to build their foot and leg score databases. As with any trait, more phenotypes will enable higher accuracy EPDs. In addition to foot and leg score EPDs, commercial producers can expect to see breed associations begin to report EPDs on other structural phenotypes.

The inclusion of structural soundness phenotypes in maternally focused selection indexes will further enhance our ability to identify bulls likely to create more profitable and long-lasting daughters. The American Angus Association has begun including foot angle and claw set EPDs in the \$Maternal and \$Composite indexes, and other breed associations will likely do the same in the future.

As we strive to improve our cowherds, measuring and predicting novel and economically relevant phenotypes related to cow longevity is crucial. Foot and leg scores are the most recent efforts and provide producers with another tool for selecting sound cows that will stay in the herd longer with fewer issues.

