DATA DIVE

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Why do birth, weaning and yearling weights need to be adjusted?

There are numerous environmental factors that can influence the weight of a calf, including age of the calf and the age of the calf's dam. Ensuring the environmental contributions are accounted for allows for more accurate comparisons within a contemporary group.

The phenotypes we observe in cattle, such as weaning weights or yearling heights, are controlled by both genetics and the environment to which an individual animal is exposed. The environmental component is the combination of all factors influencing the trait outside of the genetics of the animal.

However, when making selection decisions, it is important to remember the environmental conditions an animal is exposed to cannot be passed on to progeny. This makes selection based on phenotype alone less effective because of the inability to compare phenotypes from animals raised in differing environmental conditions.

Genetic selection tools, such as expected progeny differences (EPDs), combine multiple sources of data and account for known environmental effects. This provides a way for animals to be compared across environments for genetic potential in a particular trait while leveraging all available data.

When calculating EPDs, accounting for environmental factors influencing the trait of interest is crucial. There are a couple ways environmental effects can be accounted for in a genetic evaluation, including contemporary grouping and data adjustments.

Contemporary groups are groups of animals that have been managed alike and exposed to similar environmental conditions, therefore given equal opportunity to perform. Criteria for contemporary groups vary by trait but typically include sex, a defined birth window and group/management/location codes.

However, in some cases, not every environmental factor can be accounted for in the contemporary group. In these instances, including additional terms in the statistical model or pre-adjusting the phenotypes ensures those factors are accounted for.

Two examples of environmental factors not accounted for in contemporary groups are calf age and age of dam. These are factors known to influence certain traits.

Next, we will describe how the age of the dam and the age of the calf affect phenotypes of economically relevant traits and why we need to take them into account.

Age of dam

Age-of-dam adjustments are used to account for the differences that the age of the calf's dam can have on the calf's performance.

First-calf heifers are not as physiologically developed as mature cows. This means a portion of the nutrients they consume will be partitioned towards their own growth, rather than simple bodily maintenance and milk production for their calf. Similarly, calves born to dams who are older and have passed their years of peak production may receive less nutrition.

Thus, the age of its dam is a part of that calf's environment that affects its phenotype. Because of this, calves born when their dams are younger or older are likely to have, on average, lighter weights both at birth and weaning than the calves born from dams in their peak years of production. By calculating adjusted weights, we have the ability to account for the effect the dam's age can have on calf performance, and more accurately estimate the EPDs for those traits.

Age of calf

The weight of a group of calves at weaning time varies due to age differences among calves even within the same contemporary group.

Age-of-calf adjustments are made to standardize a phenotypic measure to one specific age for all the calves in the group. Age affects measurements such as weaning and yearling weights, with older calves typically having an advantage over younger calves. Adjusting for age removes the non-genetic advantage or disadvantage an individual calf may have due to when they were born in the calving season.

Application

Let's look at an application of the age adjustment in practice, taking the yearling weight as an example. The acceptable window for collecting yearling weights is 320–440 days of age. Therefore, there will be variation in the ages when breeders measure their yearlings within that window. To account for that variation, yearling weights are adjusted to 365 days. See Fig. 1 for the formula to calculate the adjusted yearling weight.

Notice the adjusted yearling weight formula takes into account the 205-day adjusted weaning weight, and it models the additional weight gain from weaning to yearling, 205 to 365 days of age (that is where the 160 days comes from). Although not covered in this example, the adjusted weaning weight included in this formula considers the age of the calf and the age-of-dam adjustments for that record.

To make it easier to understand it in practice, let us apply the yearling weight adjustment formula to a real example. In this example, we'll look at an animal for which we already know the 205-day adjusted weaning weight [731 pounds (lb.)]. This particular animal had an actual yearling weight of 1,085 lb. and was weighed at 363 days of age. The calf weighed 660 lb. at weaning when weighed at 209 days of age, and has a 205-day adjusted weaning weight of 731 lb.

Now that we have all the pieces, let's plug them into our formula. See Fig. 2.

After some number crunching, the adjusted 365-day yearling weight for our example is 1,173 lb.

Accounting for environmental effects is of utmost importance in genetic evaluations to generate accurate EPD predictions. Every trait is affected by different environmental components, such as age of calf and age of dam, that need to be considered.

In the case of weight traits, adjusting the weights for age of calf and age of dams has been a routine practice within the Angus Herd Improvement Records (AHIR®) since the fall of 1959.

Additionally, as breeders collect more and more phenotypes, the American Angus Association and Angus Genetics Inc. (AGI) continue to invest in research and development to ensure that weight adjustments are current and aligned with the distribution of the phenotypes in the Angus population, ensuring an accurate prediction of EPDs. AJ

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FIG. 1: Formula to calculate adjusted yearling weight

$$365\ day\ adj.YW = \frac{(actual\ yearling\ wt - actual\ weaning\ wt)}{No.days\ between\ measure\ ages}\ X\ 160\ days + 205\ day\ adj.WW$$

FIG. 2: Calculating adjusted yearling weight example

$$365\ day\ adj.YW = \frac{(1085\ lbs - 660\ lbs)}{363\ d - 209\ d}\ X\ 160\ d + 731\ lbs = 1{,}173\ lbs$$