

BREEDING FOR A BETTER FUTURE

Genetics have potential to be a game changer in the sustainability space.

by Miranda Reiman, senior associate editor

Continuous improvement is a popular phrase as organizations and companies adopt sustainability plans, but it's not a new concept in cattle country. Collectively, Angus breeders and their customers have operated under that "always getting better" mindset all along, says Kelli Retallick-Riley, president of Angus Genetics Inc.

There's proof in the weaning weight trend that has gone up since it was first measured. From 1972 to 2021, Angus breeders have selected for growth, and that shows up in the weaning weight expected progeny differences (EPDs) that have increased by 81 pounds (lb.) during that period (see Fig. 1). It's also evident in adjusted weaning weights kept in the Angus Herd Improvement Records (AHIR®) database, where bulls have gone from averaging 477 lb. at weaning to an average of 659 lb. last year.

"We're one of those countries that continue to produce more and more beef with fewer

cattle. Genetics has obviously played a role in that," she says.

Since 1976, USDA data show that, as the beef cow inventory has decreased, beef production in total tonnage has increased. CattleFax reports the average beef production per cow (including dairy cattle) was 467 lb. per head in 1976, compared to around 685 lb. per head last year (see Fig. 2, page 86).

Statistics like that are important when calculating how many pounds of beef are produced per live animal and putting that against greenhouse gas (GHG) emissions of the U.S. beef system per head. That math leads to what's commonly

called "emissions intensity," (GHG per pound of beef) a figure that has been trending down, or improving, over time.

John Crowley, consulting geneticist with AbacusBio, says cattle have been getting better, and that improves GHG emissions intensity, most notably enteric methane, which is the second-most important on the list behind carbon dioxide.

"Improving profitability and improving emissions intensity, which would be the amount of greenhouse gas per kilo of carcass produced, they're very well-correlated.

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— Sara Place

Left: “When you think about it from a welfare perspective, we’re allowing cows to lay down and have those calves by themselves and not be stressed, and I think that’s a cool story,” says Kelli Retallick-Riley, noting Angus members record a less than 6% assistance rate through AHIR.

Probably just by improving profitability through genetics at the moment, we’re doing a good job on greenhouse gases,” he notes.

In the Angus world, feed intake came online as a measurable trait in late 2014, allowing breeders to make selection decisions that include that performance measure.

“We continue to push that efficiency envelope and being able to create animals that can do more with less,” Retallick-Riley says.

Compared to other countries, the U.S. beef industry is already in a strong position.

“The U.S. makes roughly 4 to 5 billion pounds more beef per year than Brazil, but we have a cattle herd size that is less than half what Brazil’s is,” says Sara Place, animal scientist with AgNext at Colorado State University. “There’s just more maintenance requirement, more enteric methane, more manure, more feed requirements to produce the same amount of human nutrition out of their cattle herd because of that.”

The tradeoffs

If it were as easy as producing more beef from each animal on feed, cattlemen could rest easy knowing that the formula for that improvement already exists. However, there are often tradeoffs, and the whole picture is more complex, Crowley says.

“If we’re challenged with reducing gross emissions, then those productivity traits will probably take a bit of a hammering, and we’ll have to reduce

productivity,” he says. “If gross greenhouse gas reduction is the end goal, what’ll come into focus is your cost-saving traits, and saving cost is going to replace any revenue that’s lost by increased productivity.”

It will be trading maximums for optimums, he suggests.

What does that mean in practice?

“We’ve selected animals from a feedlot standpoint that are going to gain more and that are larger at the end of their life to produce

more beef per animal,” Place says. “Of course, the consequence of that is the cows have also gotten bigger.”

When considering the inputs those bigger, more productive cows require against the emissions equation, the beef industry hasn’t made the same progress.

“I think we have a lot of opportunity to really think about that in new ways to decrease those maintenance costs, energy costs, but then also the greenhouse gas emission associated with that maintenance of the total herd per unit of beef we’re producing from that herd,” Place says.

The trick is finding the balance and knowing that there will be differences in what’s best region to region and even operation to operation, she says.

Today’s tools work

There are things cattlemen can do now.

“Use more of the tools that have been around for quite a long time,” Place advises. “If we can get more folks actually using those tools and actually putting the selection pressure on the cow herd for things we already know will work, improving the overall efficiency of the herd ... I think that’s a neat opportunity for us to select for low-methane-emitting animals.”

Thinking more whole life cycle, the Angus breed’s focus on maternal and other “convenience” traits is a boon, Retallick-Riley says.

“One of the best ways to make sure your production efficiency and your sustainability continue to increase is to make sure we get animals bred,” she notes.

Heifer pregnancy measures the probability

that a virgin heifer will get bred in the first breeding season.

In addition to making fewer freeloaders, grazing without producing a calf, the American Angus Association will soon introduce a research EPD for functional longevity later this fall.

“We’re trying to find the sires that are going to leave daughters in the herd that have the genetic potential for a long productive life in the herd,” Retallick-Riley says.

The more calves spread out over that maintenance energy, the more profitable she is and the more product she can apply to offset that enteric methane that’s basically counted against her on the balance sheet.

“Maternal weaned calf value (\$M) is the closest thing to a sustainability index that we have today,” Retallick-Riley says. “It works to balance pounds of weaned calf with maintenance energy requirements, which are increased with things like mature cow size and milking ability, while trying to eliminate young females leaving the herd early for reasons like temperament or structure.”

When making progress on those types of heritable traits, producers see the benefits in their own herds, and it helps industry-wide, Crowley says.

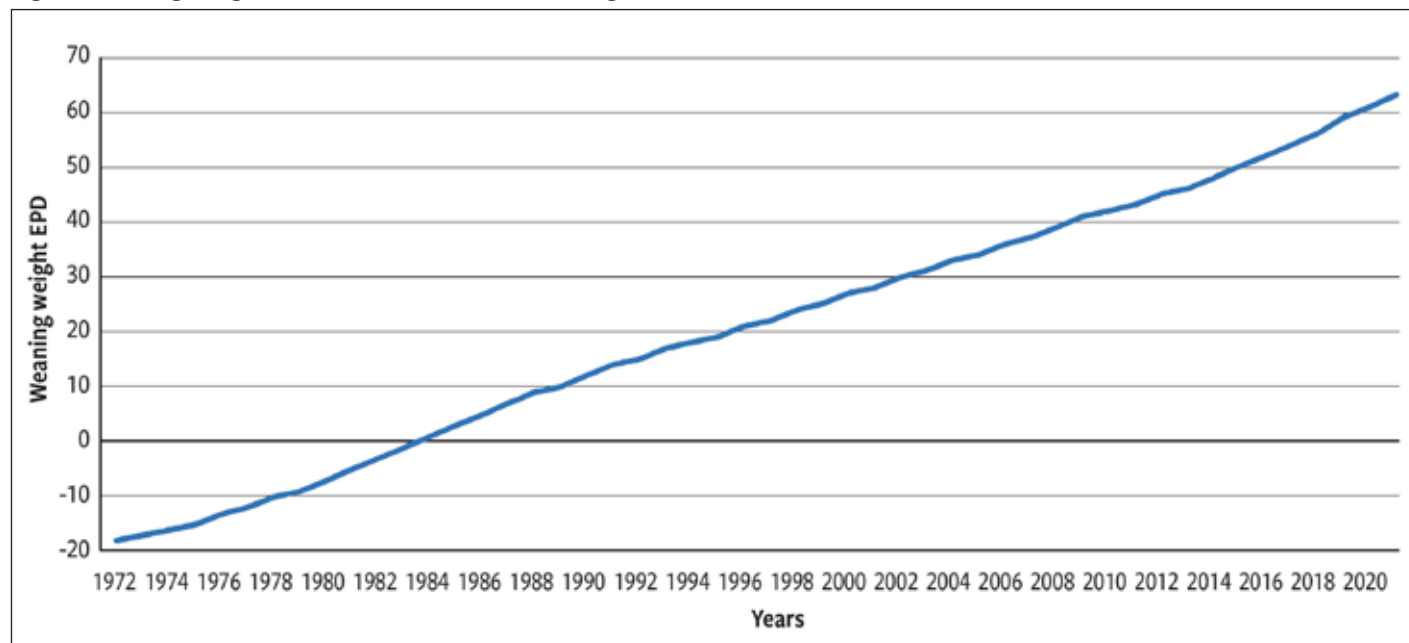
The welfare breed

Consumers often couple sustainability and cattle care together, Retallick-Riley says, highlighting the Angus breed’s advantages in that category, too. They’re naturally polled, and are generally good mamas.

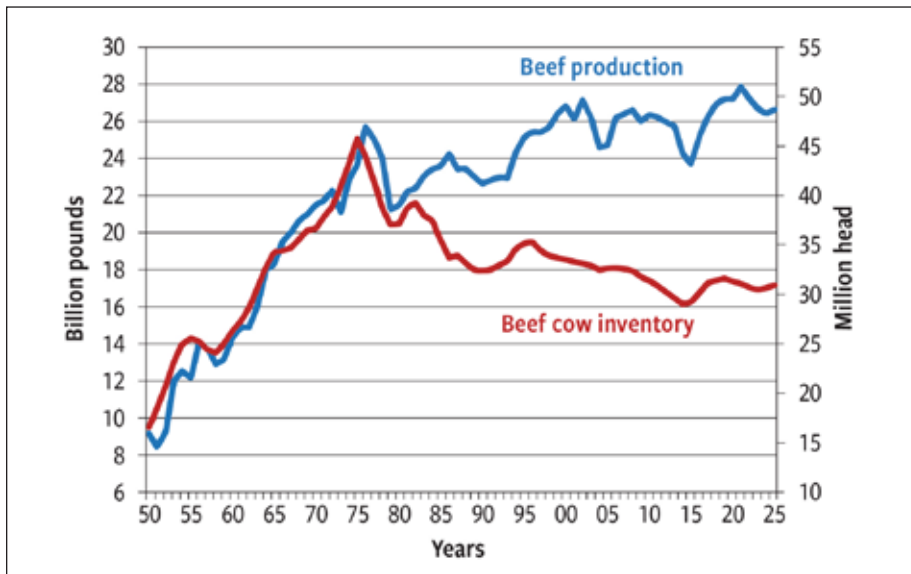
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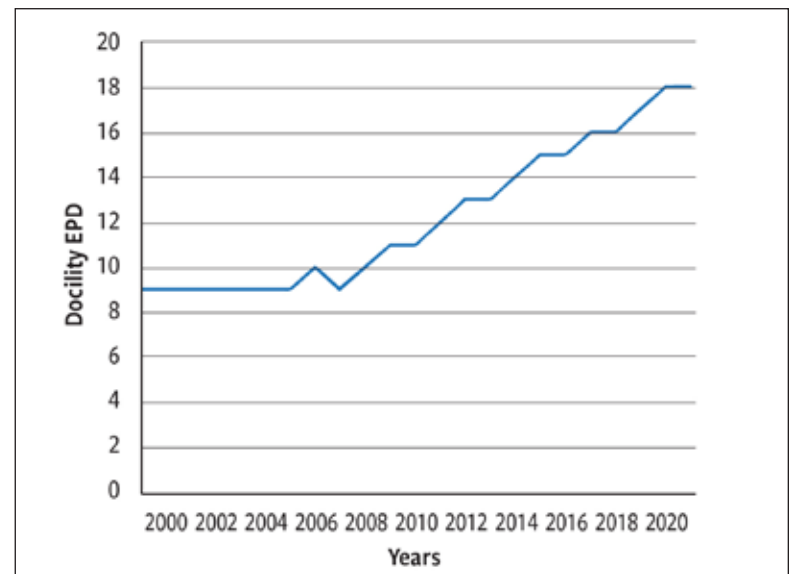
Fig. 1: Weaning weight EPD trend line, American Angus Association



SOURCE: American Angus Association, 2022.

Fig. 2: U.S. beef cow inventory vs. production

SOURCE: USDA, CattleFax projection, 2022.

Fig. 3: Docility EPD trend line, American Angus Association

SOURCE: American Angus Association, 2022.

perspective, we're allowing cows to lay down and have those calves by themselves and not be stressed, and I think that's a cool story," she says, noting Angus members record a less than 6% assistance rate through AHIR.

She credits the attention breeders have paid to the calving ease direct (CED) EPD.

Being able to select for temperament also helps reduce welfare issues. As a whole, breeders have placed pressure on the docility (DOC) EPD, doubling it to a +18 today, compared to a low of 9 in the mid-2000s (see Fig. 3). In 2000, 60% of the recorded temperament scores were 1, or docile. In 2020, around 78% hit that mark.

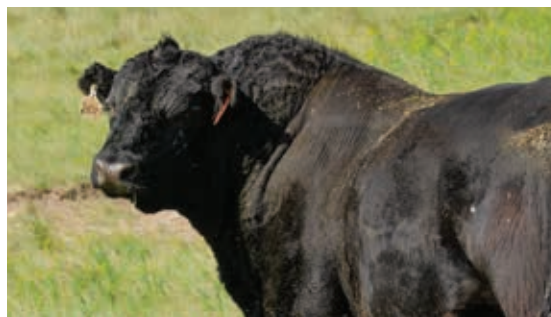
"Environmental adaptability is going to play a role, too," Retallick-Riley says.

Tools like the hair shed (HS) and pulmonary arterial pressure (PAP) EPDs allow breeders in specific regions to create cattle with more tolerance to heat or altitude, which is both a welfare benefit and improves reproduction and efficiency.

The yardstick

"The biggest challenge right now is to be able to set our goalposts," Retallick-Riley says.

Before there's a genetic index for sustainability or another tool, there needs to be



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a consensus on what traits contribute and a standard on how to address those.

"You can't manage what you don't measure, and you definitely can't manage what you can't measure when you don't know what to measure," she says.

Then the challenge is collecting phenotypes on hard-to-get traits, such as methane emissions. Researchers have collected limited data in respiration chambers, but new technologies could allow for easier capture in the future. The Angus Foundation recently funded Kansas State University research using GreenFeed systems to spot-sample multiple respiration patterns throughout the day and understand more.

"If we can work with the research community and look for correlated traits that can capture this in the commercial beef industry, that's how we're going to have to drive this forward," Retallick-Riley says.

Actual methane measurements on a smaller population could help identify those correlations to create a tool, similar to the way

feed intake is measured on a smaller number of animals and applied to the larger herd.

"Genomics allow us to tie those animals back to the reference data," she says.

Crowley says it's important to get it right in this discovery and research phase. For all the animal science community across the globe has learned, there are still many unknowns.

"You have to have due diligence around whether you're selecting for the right things. You don't want to select for a reduced energy demand and it have a negative consequence," he says.

If you can make good progress with the right tools, you can also magnify mistakes with the wrong ones, he says.

There are advancements in the management space — from feed additives to improvements in crop production — but Crowley is especially encouraged by the lasting effect genetics could have.

"When it comes to sustainability, genetics as a solution is going to be cumulative and permanent," he says. "It's a good cost-effective way to mitigate greenhouse gas emissions. With any trait, you have a genetic component and a management component. The genetics piece works quite well, because it locks in gain over a long period of time. It changes the population's genetics to have a more sustainable herd."

It seems "bred-in continuous improvement" could become the popular phrase of the next decade. ■

Editor's note: John Crowley covered "Fitting Environmental Impacts Into Economic Selection Indexes" at the 2022 Beef Improvement Federation meetings in June. Sara Place presented "Beef Sustainability: Opportunities for Genetic Improvement" as part of the National Beef Cattle Evaluation Consortium's 2021 Brown Bagger Series.

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