Sustainability Snapshot — Part 1

Facts to share.

by ***Wes Ishmael***

Discussions about greenhouse gas (GHG) emissions' role and cattle's contribution to global warming can get deep and confusing in a hurry. With everything from the science and interpretations of the science to misinformation to raw emotions muddying the conversation, here are some key points and facts to keep in mind when such discussions occur.

Rather than being a culprit, beef cattle in the United States have the potential to help reduce greenhouse gas (GHG) emissions that contribute to global warming.

As a ruminant animal, beef cattle convert forages inedible by humans into nutrient-dense beef that is edible by humans — upcycling.

"Approximately 29% of the land in the United States is too wet, rocky, steep or arid to support cultivated agriculture.[1] However, cattle graze on plants native to their surroundings that humans can't eat," according to Cattle: The Ultimate Upcyclers. "Their unique, four-compartment stomach and digestive system is home to trillions of microbes. These microbes allow cattle to benefit and gain nutritional value from these sources that other animals can't digest."

Urgent global needs

"We know cattle are natural upcyclers. We also know how much more efficient U.S. beef production has become over time in terms of producing more beef with fewer cows on less land. The American cattle producer is the most efficient in the world," says Jack Ward, executive vice president of the American Hereford Association (AHA). "But we also know the global population is expected to grow by almost 2 billion by 2050. So, how do we become more efficient and how do we, from a genetic standpoint, affect overall sustainability?"

The International Database (IDB) estimated the world population at 7.9 billion in 2022, 8.5 billion in 2030 and 9.7 billion in 2050. IDB estimates for the U.S. population are 337.3 million in 2022, 355.1 million in 2030 and 388.9 million in 2050.

The Food and Agricultural Organization (FAO) of the United Nations estimated 720 to 811 million people faced hunger in 2020.[2] FAO estimated that 22% (149.2 million) children under 5 years of age were affected by stunting, 6.7% (45.4 million) were suffering from wasting and 5.7% (38.9 million) were overweight.

In 2021, USDA's Economic Research Service (ERS) estimated 10.2% (13.5 million households) in the United States were food insecure.[3] "Food-insecure households had difficulty at some time during the year providing enough food for all their members because of a lack of resources," according to the ERS report.

At the same time, the global average surface temperature continues to increase.

According to the 2021 Annual Climate Report from the National Oceanic and Atmospheric Administration (NOAA), the combined land and ocean temperature has increased at an average rate of 0.08 degrees Celsius per decade since 1880. The average rate of increase since 1981 has been more than twice that rate at 0.18 degrees Celsius.

The United Nations' Paris Agreement on Climate Change — the United States is a member — seeks to limit global warming to well below 2 degrees Celsius and preferably to 1.5 degrees, compared to pre-industrial levels. Depending on the literature reviewed, scientists and policymakers say global temperatures beyond 2 degrees (Celsius) warmer than pre-industrial temperatures pose significant risk to the earth's population.

Reducing GHG is a key strategy to achieve the temperature goal. Carbon dioxide, methane and nitrous oxide receive the primary reduction focus.

Cattle and GHG

"Greenhouse gases associated with the beef industry include carbon dioxide, methane and nitrous oxide. However, there's a clear difference between biogenic carbon (ruminant digestion), and carbon from fossil fuels," according to Beef's Role in Greenhouse Gas Emissions. "While the biogenic carbon cycle happens on a short time scale, the cycle of carbon from fossil fuels takes 1,000 or more years. This is because carbon from burning fossil fuels comes from deep geological reserves (e.g. deep soils) that take thousands of years to be redeposited after being released. Therefore, while biogenic carbon has a short-lived impact on our climate, carbon from fossil fuels has a longstanding and much more significant impact on the environment."[4]

Beef cattle produce approximately 2% of U.S. GHG emissions, according to the U.S. Environmental Protection Agency's (EPA) GHG emissions inventory.[5] Key sources are enteric methane — a byproduct of rumen fermentation — along with methane and nitrous oxide from manure.

In fact, the nation's brood cow herd produces about 70% of beef cattle's carbon footprint in the United States.[6]

"Between 1961 and 2019, the U.S. beef industry, through continued sustainability efforts and improved resource use, has reduced emissions per pound of beef produced by more than 40% while also producing more than 67% more beef per animal[7]," according to Beef's Role in Greenhouse Gas Emissions. "Emissions from cattle, including those that come from the feed production, fuel and electricity account for 3.7% of the total greenhouse gas emissions in the U.S.[8] Currently, emissions from U.S. beef cattle are less than 0.5% of the world's greenhouse gas emissions.[8, 10] In fact, emissions from beef cattle represent 2.2% of total U.S. greenhouse gas emissions.[9]"

Even so, societal focus is demanding a smaller carbon footprint from the U.S. beef cattle industry. That requires increased production efficiency along with ways to directly reduce GHG emissions.

Genetics serve as an example of the latter.

Ward explains the Hereford breed is the first in the U.S. to tackle understanding genetic opportunities to reduce methane emissions and nitrogen excretion. Previous research indicates genetics play a significant role in both.

Documenting breed-specific GHG

The AHA is conducting collaborative research with Colorado State University's (CSU) pioneering AgNext program to evaluate the breed's genetics for methane production and nitrogen excretion.

"Beef industry stakeholders including the National Cattlemen's Beef Association have committed to improving the environmental impact of U.S. cattle production. This project aims to develop a selection tool for the American Hereford Association and the broader cattle industry that helps producers identify genetics that will have reduced greenhouse gas emissions without sacrificing animal productivity," says Kim Stackhouse-Lawson, Ph.D., director of AgNext.

These units at Olsen Ranches, Harrisburg, Neb., collect individual methane emissions for the collaborative research project between the AHA and Colorado State University.

By leveraging existing animal performance data and monitoring animal emissions, Stackhouse-Lawson explains the goal is to identify genetic traits that influence emissions from individual animals and then develop selection indices that can be used to select traits associated with lower emission levels, while maintaining, and ideally improving economic returns to producers.

Specifically, AHA-CSU research aims to enhance understanding of the genetic differences in seedstock relative to enteric methane production and nitrogen excretion.

Methane emission, as a genetic trait in cattle, appears to be moderately heritable with genetic correlations (modest to strong) to economically relevant production traits, such as measures of growth, dry matter intake and various estimates of feed efficiency.[11]

Previous research also suggests genetics play a significant role in nitrogen excretion by cattle.

"As with other moderate to highly heritable traits, genetic improvement is available, additive and permanent," Ward says. "That's a distinct advantage compared to options such as feed additives and feed processing, which must be continually added to the system."

Ward emphasizes the U.S. beef cattle industry has a long history of demonstrating extraordinary gains in efficiency over time, using genetics, technology and management to produce more beef with fewer cows and less land.

"Increasingly, we also believe this kind of documentation will be useful to those in the supply chain who are required to track Scope 3 emissions," Ward says. "Overall, we believe this research will help us identify ways to magnify the gains the industry has already achieved."

Genetics for efficiency

"Over time, we've documented the value of Hereford genetics in commercial cow herds in terms of fertility, longevity, feed efficiency and other traits associated with production efficiency. All of those things, as we understand currently, are going to have a positive effect in terms of sustainability as we move forward in the industry," Ward says.

The Hereford breed's inherent genetic advantages for production efficiency enhance the opportunity for beef cattle to reduce GHG emissions while providing more pounds of beef per cow bred.

Feed efficiency is perhaps the most striking Hereford advantage.

Consider data from the U.S. Meat Animal Research Center documenting that Hereford consumed 1.7 pounds less feed per day when compared to Angus. This advantage equated to 191 pounds less corn per Hereford steer during the feeding period.

For broader perspective, this advantage multiplied by the number of fed cattle marketed as Certified Hereford Beef® in fiscal year 2021 equates to saving 31.6 million pounds of corn — enough corn to feed a 100,000-head feedlot for 19 days. Given that it takes about 54 gallons of water to produce 1 pound of corn, the Hereford advantage in this example saves an estimated 1.7 billion gallons of water.

Increased feed efficiency is also evident in the pasture. Research conducted by Oklahoma State University (OSU) documented that Hereford-sired black baldy females consumed about 2 pounds per day less moderate-quality forage (Oklahoma pasture) compared to straightbred Angus peers. On an annual basis the black baldy cows would be expected to consume about 725 pounds less forage.

"By using the crossbred female and taking advantage of lower feed intake and maintenance requirements of Hereford cattle in our crossbreeding system, we should be able to increase stocking rate or reduce the number of acres required by about one acre per cow-calf unit," says Dave Lalman, OSU Extension beef cattle specialist.

Hereford genetics also offer advantages in cow fertility and longevity, especially when magnified through heterosis in planned crossbreeding systems.

Previous AHA research documents 7% higher pregnancy rate and more calves weaned per cow exposed, when comparing Hereford-sired black baldy females to straightbred black Angus cows in the same study.

Industry research across decades documents that maternal heterosis yields 38% more cow longevity, 17% more calves produced during the production lifetime and 25% more cumulative weaning weight, among other advantages. Benefits of direct heterosis include almost 2% increased calf survival to weaning and almost 4% more weaning weight.

The bottom line is fewer cows are needed to produce a similar amount of beef, and these cows and their progeny consume less feed to produce a similar amount of beef. This results in a gross reduction of GHG.

The second part of this story, which will run in the February *Hereford World*, will provide an overview of Scope 3 emissions and why many in the beef supply chain are scrambling to measure and reduce them.

If you're looking for more details about these and other sustainability topics relative to beef cattle, check out the checkoff-funded *BeefResearch.org/programs/beef-sustainability* and U.S. Roundtable for Sustainable Beef goals *at usrsb.org/goals*. HW

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