REPRO TRACKS

by Cliff Lamb, Texas A&M University

What's Next?

Future opportunities with gene editing in beef cattle.

Last year the U.S. Food and Drug Administration (FDA) cleared short-haired genome-edited cattle known as PRLR-SLICK cattle for meat production and human consumption. The FDA made a low-risk determination for the marketing of products, including food, from two genome-edited beef cattle and their offspring and indicated products from these gene-edited cattle do not raise any safety concerns.

Earlier this year a press release indicated two partner entities (Acceligen and USDA) had developed gene-edited cattle resistant to bovine viral diarrhea (BVD), a disease caused by the bovine viral diarrhea virus (BVDV) that results in respiratory and reproductive problems in cattle. Gene-editing technology in livestock systems will continue to become more efficient, and new edits will provide opportunities for enhanced production efficiency.

While not a GMO (genetically modified organism), care will need to be taken to ensure edits do not result in subsequent negative effects.

Gene editing in cattle could unlock genetic potential in herds across the world. The CRISPR-Cas9 technology, which stands for clustered regularly interspaced short palindromic repeats, combined with a protein known as Cas9, has dramatically decreased the cost of gene editing. It has become one of the most reliable and cost-effective tools for scientists to alter a specific gene associated with an animal.

In cattle, this technique has been used to remove a specific gene known as PRLR-SLICK, aiming to decrease hair thickness and length, resulting in improved head tolerance.

CRISPR-Cas9 can also be applied to create specific genetic combinations in cattle that make them more resistant to certain diseases, which could improve animal health. Gene edits have been made to increase resistance to BVD in cattle. By propagating specific genes associated with more muscle or higher fertility, ranchers can potentially raise more productive cattle, resulting in an increased yield of products for consumers and higher profits for the ranch. This could even result in certain genetic traits that enable the animals to survive more extremes of temperatures and terrain.

Gene editing in other species has demonstrated some of these opportunities. The AquAdvantage® salmon grows faster than conventional Atlantic salmon for the same growing period and grows twice the size of non-edited salmon. It contains a growth hormone gene from Chinook salmon, which is activated by another gene from ocean pout.

Similarly, GalSafe pigs are engineered so they do not produce alpha-gal sugars. Products from GalSafe pigs can be consumed by people with Alpha-gal syndrome, a type of food allergy to red meat and other products made from mammals. While GalSafe meat is not yet available in the U.S. market, it demonstrates opportunities gene editing can provide.

As impressive as the potential outcomes of gene editing in cattle may be, there are also some drawbacks to consider. Removing the gene responsible for the slick coat without knowing the long-term effects could lead to a variety of health issues for the animal. Also, animals that are created to be resistant to a certain disease may be more prone to another one due to gene editing, resulting in a different behavior or temperament in the animals.

Finally, if CRISPR-Cas9 is used to propagate certain traits too quickly, it could lead to inbreeding, as animals with the desired traits are bred together to create offspring with those same traits.

Regardless, the technology has the opportunity to significantly improve beef cattle production efficiency. Still, responsible use is a necessity. By weighing the risks and benefits of gene editing, farmers can help create healthier, more profitable herds of cattle with a reduced risk of diseases. AJ

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