The Case for Genetic Engineering

by **SHELBY METTLEN,** *assistant editor*

One of the most controversial topics in agriculture today is the use of genetically modified organisms (GMOs). The use of improved genetics has fostered incredible progress for many important areas of agricultural production, including dramatic increases in crop yields and animal growth.

So why are consumers so averse to the adoption of genetic engineering? Alison Van Eenennaam, Cooperative Extension specialist in animal genomics and biotechnology with the University of California–Davis, broke it down for her audience at the 118th annual Cattle Industry Convention & NCBA Trade Show Jan. 28, 2016, as a presenter at the 23rd annual Cattlemen's College®.

"I really hate the term 'genetically modified organism,'' she said. "It's really an ill-defined term. When the general public uses that term, they are usually referring to genetic engineering."

According to Van Eenennaam, the USDA defines genetic engineering as "manipulation of an organism's genes by introducing, eliminating or rearranging specific genes using the methods of modern molecular biology, particularly those techniques referred to as recombinant DNA (rDNA) techniques."

Some examples are the creation of herbicide- or insect-resistant plants, and fast-growing salmon.

Globally, about 18 million farmers grow 448 million acres of genetically modified crops. We tend to think of biotechnology and use of genetically engineered crops as a First World technology, but 16.5 million farmers in developing countries grow GMO crops.

Safe for consumption

Between 70% and 90% of the GMO crop varieties produced are consumed by livestock animals. Since the introduction of genetically engineered crops in 1996, Van Eenennaam said there have been no safety issues related to animal or human consumption of feed or food ingredients from genetically engineered crops.

There are "literally hundreds" of studies that have been conducted and published to prove the safety of genetically engineered crop varieties for animal consumption, she shared with the audience. Genetically modified plants are nutritionally equivalent to their non-GMO counterparts, she added.

They are safe to use in feed and food, she emphasized. "The science is very solid. They are not unsafe for animals to eat."

Van Eenennaam and her colleagues conducted a meta-analysis to explore any possible implications of consuming genetically modified crops in commercial livestock populations. Approximately 105 billion livestock animals, including about 400 million beef cattle, consumed genetically engineered crop varieties between 2000 and 2011. What Van Eenennaam found was no change in the positive production trends following the introduction of genetically engineered crops — not a trend you would expect from sick or ailing animals, which is the effect some believe genetically engineered crops have on livestock.

She and her colleagues discovered overall decreases in percent mortality and condemnation, as well as increased average daily gain and decreased feed-to-gain ratios.

"I feel very confident that there are no implications to consuming GMO crops," she said.

Van Eenennaam explained that the milk, meat and eggs from animals consuming GMO feeds "contain no full-length rDNA or the newly expressed protein." The products from animals fed genetically engineered crops are indistinguishable from those produced by animals fed their non-GMO-feed counterparts.

Labeling discussion

For this reason, she said, it is unnecessary to require a product derived from an animal fed GMO crop varieties to be labeled.

"They're fundamentally, exactly the same," she said. "There's no way to detect one from the other."

There is currently no mandatory labeling required for the milk, meat and eggs derived from animals that have been fed genetically modified crops. However, there is a voluntary system in place, which Van Eenennaam said is sometimes "false or misleading." Companies are labeling their bananas as "non-GMO," when, in fact, there are no genetically modified varieties of bananas.

"What concerns me is that when you start mandating a process on the label, what's the end of it?" she asked. "In this case, we're trying to mandate the process of having used genetic engineering in the breeding process that produced a particular crop that was used to feed the animal that then produced the steak that then ends up in the market.

"If it doesn't change the composition or safety of the end product, the logistics — or keeping it straight — would get kind of unmanageable," she said. "If we start labeling food for things other than for food safety, just based on concern for the process, where do we stop?"

Genetic engineering is just one of many breeding methods, she explained. It's just like breeding through traditional selection of superior traits. The technology has been used to produce millions of genetically engineered lab animals, animals that produce pharmaceuticals in their milk and eggs, fluorescent aquarium fish, and the AquAdvantage salmon. She also pointed out that a lot of pharmaceuticals, including insulin, are produced in genetically modified microbes.

Van Eenennaam spoke in detail on the AquAdvantage salmon — a genetically engineered Atlantic salmon carrying a gene from the Chinook salmon. It reaches market weight in 18 months rather than 30 and is approximately 20% more feed efficient.

Since the initial transmittal of the gene from one breed of salmon to the other in 1989, there has been no further genetic engineering done to the animal. Subsequent breeding of the fish has been conducted solely through conventional breeding.

The fish was approved by the Food and Drug Administration (FDA) last November. It took about $85 million and 25 years to approve the animal for the market, even though following the transgene introgression in 1989 it has been bred in the same way as chickens, cattle and any other livestock animal — using conventional breeding. Chickens have been bred by selecting for fast-growing animals; the salmon were bred by transplanting one gene that causes the fish to grow faster. It's the same principle, Van Eenennaam said.

Gene editing

Another technology Van Eenennaam said is exciting for the industry is gene editing.

Like you can make the word "wine" into "wing" by changing one letter, scientists can edit the genome.

"If we know what genes we want to target, we can go in and precisely turn them off," she said.

By tweaking one gene, scientists can design hogs that aren't susceptible to disease. They can reduce the effects of bovine respiratory disease (BRD), or shipping fever, in feedlot cattle. They can breed Holstein cattle that are polled, eliminating the need for the painful process of dehorning.

Why is this important? Because scientists can eliminate suffering, disease and pain by modifying single genes in livestock animals.

At present, the global livestock industry loses 20% of its productivity to disease. Employing biotechnology to produce animals that are less susceptible to disease would help to improve the overall health of livestock animals, decrease the use of antibiotics to treat sick animals, decrease the environmental footprint of food production, and eliminate suffering and death in livestock populations.

Editor's Note: *More convention coverage can be found at* www.4cattlemen.com.