Family Traditions and Genomic Technology Accelerate Production of Better Beef Cattle

Sandhill Farms uses Illumina technology to propel genetic gain for traits in Hereford cattle, ultimately providing their customers with a more accurate, predictable seed stock product.

Introduction

The Hereford breed of cattle originated nearly 300 years ago in Herefordshire, England. Known for their hardiness, low feed requirements, and high maternal ability, they were attractive to farmers trying to meet the increased demands for food production during the Industrial Revolution. Henry Clay brought the breed to the United States in 1817 to improve beef quality in grassland cattle.[1] In addition to their distinguishable white faces, Hereford cattle possess gentle dispositions, efficient feeding patterns, and extreme hardiness in range conditions, making them valuable to extensively managed beef production systems.

Located in south central Kansas, Sandhill Farms is a family-owned and operated Hereford seed stock business managed by Kevin Schultz and his wife, Vera. Kevin and Vera; their children Brooke, Tyler, and Courtney; and Kevin's parents Ron and Arnita make up the 3 generations working the farm today. The land has been passed down through the family since 1867. "I have the original Homestead Act document signed by former President Grover Cleveland from when my ancestors homesteaded the land," Kevin Schultz said. "Our son Tyler just graduated from Kansas State University and is back on the farm learning the trade. He will be part of the seventh generation of the Schultz family to operate on Sandhill Farms."

In addition to growing corn, soybeans, and wheat for cash and feed crops, Sandhill Farms has registered and commercial herds consisting of approximately 350 cows. The commercial herd has been using registered bulls since the mid-1940s. Kevin and Vera added the registered Hereford cow herd in the mid-1980s, soon after they were married. Largely a result of Kevin's passion and vision, Sandhill Farms has evolved into a renowned seed stock operation incorporating and advocating for the use of genomic technologies to accelerate genetic gain for economically important traits in their beef cattle.

Through the American Hereford Association, Sandhill Farms uses the GeneSeek Genomic Profiler, which uses the Illumina BovineSNP50 BeadChip powered by the Infinium® assay, to select young sires and females for their breeding program. Their goal is to improve the predictability of Hereford genetics and provide their customers with accurate estimates for future performance of seed stock.

iCommunity spoke with Kevin Schultz to learn about the philosophies and practices of Sandhill Farms, how he incorporates genomics into the trait selection process, and what he envisions for the future of beef cattle breeding.

Q: Why did your family decide to focus on the Hereford breed?
Kevin Schultz (KS): Hereford cattle are known for their hardiness and feed efficiency. Data have shown that Hereford cattle can help maximize heterosis in a crossbreeding program, increasing growth and fertility. They can forage, survive, and maintain fertility with less food and labor. The Hereford breed also has a naturally docile attitude, which has been a popular trait for selection in recent years.

Q: Before genomics, what methods did breeders use to maintain and improve their herds?
KS: Maintaining and improving a herd has required a lot of patience. With earlier approaches, it took several years to prove a sire. He would be 5–7 years old before he had enough progeny to determine if he had desirable traits, based on weight, carcass merit, and how his daughters performed. Following older methods, we took various physical measurements and put them into ratio form. In the late 1980s, we could translate those ratios into expected progeny differences (EPD). It was more accurate than what we had before, but it still wasn't ideal.

Kevin Schultz is the owner of Sandhill Farms in Haviland, Kansas.

Genomic technology and sound breeding practices have led the Hereford herd at Sandhill Farms to achieve Gold Total Performance Records (TPR) status, a distinction that recognizes dedicated Hereford breeders.

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Q: What are EPDs and how does knowing the EPD value enable you to enhance the quality of your herd?

KS: EPDs can be calculated on measured traits, including birth weight, weaning weight, calving ease, milk production, carcass traits, rib-eye size, and intramuscular fat, or marbling. Each breed has its own EPDs, and each EPD value has an associated level of accuracy for each trait. The accuracy number ranges from 0.1 (lowest accuracy) to 0.99. Different traits have different EPD values and accuracies. As a sire or cow has more progeny records and becomes "proven," the accuracy number goes up. That accuracy addresses the variability you would expect from the bull, cow, or progeny and speaks to the reliability of the estimated EPD for that trait.

Q: Why did you decide to start using genomics?

KS: Genomics increases the accuracy of herd sires faster than traditional methods. If a bull has 10 progeny and they're in large contemporary groups, you might get a sizable contemporary group, about 100 head. As a result, the accuracy of that bull's EPD value will go up. If a bull has a small contemporary group, its EPD accuracy is limited. Traditional EPD accuracy depends on the size of the contemporary group and the number of progeny.

In contrast, genomics allows you to evaluate bulls at birth and to achieve a higher accuracy even though they don't have progeny yet. For some traits, such as birth weight, it provides data equivalent to the bull having already sired 10 calves. Genomic EPDs give us early selection accuracy, reducing risk in the selection process.

Q: How has your use of genomic technology evolved over time?

KS: We first used genomic tools to verify parentage. We used to send in a blood or hair sample to make sure that a calf was from a certain sire and dam. When we began using the tools to identify genetic defect carriers as well, we began to understand that the DNA gives you a lot more information about the animal. As we moved forward, we started identifying the economically important traits and the DNA differences associated with them and applied that information to EPD calculations. That's how we're making decisions now, using enhanced EPD estimates.

Genomics helps you select the sire and dam with more accuracy.

Q: Which traits do you select for in Hereford cattle?

KS: We focus on different traits depending on customer needs. Calving ease is important to our customers, as are carcass traits, such as marbling and rib-eye size. Both are slow to get to without genomics. We can't identify carcass traits until later in the animal's production cycle.

Q: Can you use genomics to improve the nutritional value of beef, such as the iron content?

KS: I know that in the future, we will use genomics to select for nutrition. Some of those traits are highly heritable. I'm sure that as we learn more and there's an economic incentive for it, someday we'll select for nutritional value, as much as we would calving ease or udder quality today.

Traditional EPDs vs Genomic EPDs

Traditional EPDs rely on the relationship between a given calf and its contemporary group. They require pedigrees, ratios (comparison to the average in a contemporary group), and linkage (comparison to another herd). In contrast, genomic EPDs do not require ratios or linkage to other herds. Instead, genomic EPDs enhance traditional EPDs with information about whether a calf has the DNA markers for the specific traits being measured, adding accuracy to physical measurements.

Q: Does the level of heritability affect your ability to select for certain traits effectively?

KS: We can select lowly heritable traits for years and only make small increments of change. In contrast, we can change highly heritable traits rapidly. They affect our selection process and how we determine what to breed for in our cattle.

If you ask only for a car, you might get a white car or a red car. If you ask specifically for a red car, you might get a bright red or a dark red. Each time you make a more accurate description, you'll get closer to the color you want. It's the same with animal selection.

Q: How do you use genetic information in your selection process?

KS: Genomics helps you select the sire and dam with more accuracy. Let's say you're buying a car. If you ask only for a car, you might get a white car or a red car. If you ask specifically for a red car, you might get a bright red or a dark red. Each time you make a more accurate description, you'll get closer to the color you want. It's the same with animal selection.

As we make our accuracy numbers higher, we're going to pinpoint the values that are closer to what we want. It eliminates the guesswork. If our customers need calving ease or carcass traits and we use genomics to select a bull accurately, we have a greater chance of supplying them with a predictable product. When we're predictable, we get repeat customers a lot faster because they trust that we're going to give them the product they request every time, not just half the time.

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Q: By employing genetic selection rather than phenotypic measures, are you able to optimize feeding approaches for breeding animals?

KS: We're now using genomics to inform feeding requirements. If the cattle going into the feedlot have a greater propensity for marbling traits, back fat, or rib-eye size, we can use their genetics to determine whether they need to be fed for longer or shorter periods of time. That way, we don't have to put an extra 30 days of expensive feed on them if they've already reached the optimal point.

Q: How does your partnership with the American Hereford Association benefit Sandhill Farms?

KS: Being a member of the American Hereford Association has been important for Sandhill Farms. We need volumes of data to distinguish between different blood lines, ultimately leading to pedigree accuracy. Our partnership with the American Hereford Association speeds up the decision-making process by enabling us to reach that level of accuracy much faster.

> We have to know what our customers want 5 years before they know it. Otherwise, when they need it, we won't have it. You adapt or you get left behind.

Q: What makes All Star and your other major contributing sires the ideal candidates for genomic selection?

KS: I don't think we will ever achieve the perfect bull, but genomic tools are helping us get closer to that ideal. All our bulls have their strengths and weaknesses, and genomic testing helps us identify them. Our job as animal breeders is to identify the strengths of the parents and mate them, or use the strengths to fix the weaknesses of our cattle. Our goal is to make them all better. As soon as we think we've gotten where we need to go, another customer asks for a different trait. We're always trying to improve our cattle based on what our customers need.

With our bulls, we try to make sure that they complement each other so that we can maintain genetic diversity while keeping the traits that we select for consistent. The more times we breed traits into our animals, the more predictable they will be for those traits. That increases our customer satisfaction. Our goal is for the sires to have the same traits with slightly different genetic backgrounds so we can make the progeny more accurate.

Q: What is more important, overall fertility or the quality of the offspring?

KS: Fertility is the number one driver for profitability in animal breeding. If the animal is infertile, they have no value in the breeding herd. After you get a live calf on the ground, it's important to make the quality of the offspring better each time.

Q: How do you think genomics will influence the future of cattle breeding?

KS: Genomics will play an important role as consumer needs change. We're always selecting for something new, something different. As a registered breeder, we have to know what our customers want 5 years before the customer knows it. Otherwise, when they need it, we won't have it. You adapt or you get left behind.

Q: What are the most important challenges the beef industry faces today and in the future?

KS: Animal health and consumer satisfaction will be important for any breed. Calving ease is the most important trait that breeders buy from us. Animal health is the next valued trait after calving ease. A dead calf doesn't grow, but if you get a live calf on the ground and he dies 6 months later, it actually costs you more money. Any feedlot manager will tell you that the number one profit driver for a feedlot is animal health.

Currently, the catch phrase in the animal world is "no antibiotics." Everyone is talking about doing away with antibiotics in our feeding cattle. In the cattle industry, we don't use antibiotics because we want to. We do it because it keeps the animals healthy. So if we can come up with another way of keeping our cattle healthy, it will make the consumers happier and increase profit for breeders. Someday, we're going to use genomics to select for animal health.

> I think it's like Star Trek in some ways. What we can dream up and what we can do is quite amazing.

Q: What would your homesteading ancestors have thought of using genomic selection in cattle?

KS: My ancestors would be impressed by what we can achieve with genomic tools. I think it's like Star Trek in some ways. What we can dream up and what we can do is quite amazing. Currently, the United States is producing more edible product than ever with the smallest number of cows we've had in 40 or 50 years. Using genomics, we're providing a safe, wholesome product and more pounds of saleable product per animal than ever. Before he passed away, my grandfather was amazed by the things we had changed in his lifetime. I think our ancestors would be impressed with what we've been able to do and what we've built on the foundation they provided.

Learn More

Learn more about Sandhill Farms at www.sandhillfarms.com.

Reference

1. History | American Hereford Association (hereford.org/node/47) Accessed 16 July 2015.

Learn more about the Illumina product mentioned in this article:

- Infinium BovineSNP50 BeadChip, www.illumina.com/products/bovine_snp50_whole-genome_genotyping_kits.html.

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