Data analytics hold the next breakthrough

By harnessing data via technology, we could drastically enhance genetic evaluations and on-farm profitability. How to get there is the question.

by Ashley Yager

FROM smartwatches and Fitbits to global positioning systems in the tractor, farmers rely on electronics to improve efficiency, accuracy, and management on-farm.

At the 2019 National Genetics Conference held in conjunction with the National Holstein Convention, Jeffrey Bewley shared insight as to how producers can utilize data gathered from technology in their operations moving forward.

"We have tremendous opportunities with phenotypic data," Bewley reported in referencing cow conformation. "Traits may be incorporated into robust assessments focused on measuring animal health, reproduction, behavior, and longevity."

Today, even companies like Dell are investing in data for agriculture. Analytics, Bewley said, is the next great scientific breakthrough.

Bewley used basketball as a comparison.

"There's a lot we can learn from basketball in dairy. We have technology that is similar — they can put devices on players to monitor movement, just as we can do for cows," said Bewley, who currently serves as the dairy housing and analytics specialist for Alltech.

Reliable but not flashy

"When we look at an animal versus a basketball player, sometimes the best ones are those who don't get noticed," commented Bewley. "They are not flashy, and no one knows who they are. They likely have high production, great feed efficiency, stay healthy, and breed back quickly.

"Most people don't know a player like Danny Green, but last year he was the most efficient player in the National Basketball Association (NBA). He contributed more to winning the game than anyone else in the NBA and he helped his team win the NBA championship. To determine this metric, his industry uses player efficiency rating to identify his value. Thus, data provides the opportunity to identify the winning players," said the Kentucky native.

"In cows, we can use analytics to look at money-corrected milk, longevity-corrected milk, retention payoff, and summer-winter ratios," he said. Money-corrected milk, trademarked by Dairy Records Management Systems, is a revenue-based metric that considers the value of components. Longevity-corrected milk is adjusted to consider milk yield, as if the herd distribution was 30 percent first lactation, 20 percent second lactation, and 50 percent third lactation-plus cows. This determines the milk production potential of keeping cows in the herd longer. Retention payoff is the value of a cow's future net revenues compared to her replacement, and summer-winter ratios compare milk, somatic cell count, and conception by season to monitor heat stress management.

To drive this point home, Bewley added, "In a basketball video game, for example, as you play, you see a bubble on top of the players' heads with the percentage chance they will make the shot. We have the ability to bring this same concept to the dairy cow's lactation curve," he continued. "We can answer the questions, what is the likelihood of . . .

- Survival?
- Conception?
- Mastitis risk?
- Lameness risk?
- Mastitis recovery?

Precision Dairy Monitoring defined is using technologies to monitor individual variables on individual animals across time. This can include milk, behavior, physiology, or confirmation variables.

"From a management perspective, we're looking for big changes," said the energetic Bewley. "This technology has assisted us in estrous detection, mastitis detection, fresh cow disease detection, lameness detection, calving detection, and management monitoring for the overall herd. There is more coming.

"The human wearable industry is very comparable to what is happening in the animal industry," noted Bewley. "A great example of this is a Fitbit, an item that uses an accelerometer and measures motion in three dimensions. This base technology is available in almost all wearable technologies for dairy animals, and an accelerometer on Amazon sells for just $1 to $2. We've been able to take a technology used widely for humans and bring into the dairy industry," explained Bewley.

"Neck tags measure activity, rumination, and more. Ear tags measure those same things and can be used as a full-time location system. Leg bands measure number of steps, lameness, and more, and there are Fitbits for tails that indicate when an animal is going to calve," continued Bewley.

"There are technologies that sit in the rumen that measure pH and temperature. There is technology in the parlor that looks at variables in the milk, including real-time fat, lactose, and amino acids, with no reagents involved. On the outside of the cow, there are cameras capable of measuring body condition score," said the dairy technology insider.

A different future

Bewley believes, however, the future is not as much in wearable tech — it's in image and milk analysis.

"There is newer technology available looking at light patterns in milk, potentially allowing measurement of somatic cell count and pregnancy detection that could be a game changer. There is even a possibility that pregnancy can be detected in-line with this technology," Bewley continued.

There truly are no boundaries with some aspects of this technology. Bewley was involved in a body condition score (BCS) camera and measurement development study as a graduate student. The $200 camera came right off a store shelf. Initially, the study included Bewley clicking on points around the cow, as BCS is based on geometry.

Using these tools, he was able to predict BCS looking at angles around the hooks, for example. Eventually he met with an engineer who was able to figure out the automation — taking an image and converting to the silhouette of the cow. This same idea can now be used for image analysis to look at feed intake and lameness identification.

"We already have activity trackers for cows, but technology for video behavior is being developed that looks at the motion of a cow," noted Bewley. "This looks at an image of the cow moving from the side, tracks motion of each limb, difference in speed day to day, and movement right to left to identify cows as they become lame."

Bewley believes there's potential to use image analysis for linear evaluations. "We can take a 3D image of an animal and use a similar model to BCS to look at rump width or udder depth. We place a camera in the exit

WHEN IT COMES TO EVALUATING DATA and creating opportunities through technology, Jeffrey Bewley advised, "We might not be 100 percent accurate, but even if we hit 95 percent, that's better than where we were before."

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alley that measures these things automatically, objectively. There is massive data collection potential with this idea," he said. "There are genetic differences in BCS and how animals manage BCS in their lactation. We can use data from management systems to breed better.

"Heat stress, for example, provides the opportunity to look at rectal temperature and how animals measure poor body temperature. In a University of Florida study, they were able to identify single nucleotide polymorphisms (SNPs) relating to rectal temperature, respiration, and sweating rate," explained the animal scientist.

Methane emissions and estrous detection can help us get to know our cows better. Meanwhile, automatic calf feeders that monitor daily intake, drinking speed, average daily gain, and disease provide a unique opportunity to get to know our calves better.

Bewley sees a huge opportunity to bring previously unavailable data into genetic evaluations. "We have potential to improve data accuracy for some things we measure on a more regular basis and collect data more frequently," he said. "The result is more data, and fewer erroneous measurements.

"There is a lot of synergy between precision products and genomics," continued Bewley. "These synergies may lead to improvement in health traits, but we need enough high-quality phenotypic data to calculate the SNP effects. More data is needed for lowly heritable traits. It's also important to think about the quality of the data."

Challenges and limitations

As with every great idea, collecting accurate data comes with its own set of challenges and limitations. "There are brand differences in measures, technology failures, standardization, calibration, data ownership, and the question of who pays for what," Bewley pointed out.

The need for third-party validations of these technologies would be a high priority. "There are some really great technologies out there that have third-party data to show they measure what they say they're measuring," Bewley noted. "On the flip side, there are also inaccurate technologies that people still buy."

Bewley looked at a study that included three different technologies on the same cows. "On average, there was 100 minutes a day difference on activity, with lying time three hours a day difference, and activity 2,000 steps different," said Bewley. "So, which one is right?" he asked.

"The goal was to bring in all the data and create a super-algorithm. Seven different technologies were used on cows, and only 29 percent of the time was all technology working," Bewley reported. "These devices actually fail more frequently than we care to admit.

"We have data coming from other sources sitting in silos, and it doesn't communicate effectively. We need to create systems that can communicate data better. The technical part is easy, but companies don't necessarily want to play together," he shared.