REPRO TRACKS

by Cliff Lamb, Texas A&M University

Looking Ahead

Future implications of big data and artificial intelligence to reproduction of beef cattle.

During the past two years, we have seen how fragile our beef supply chain is when experiencing an insult that affects various aspects of the supply chain, such as labor, food safety, transport or the multitude of other external insults. Although the United States has the safest, most robust food system in the world, we were unable to fully overcome the insults the pandemic brought to disrupt the supply chain.

As cow-calf producers, in the future we will need to position ourselves to withstand a future pandemic using new technology and data that allows us to prepare for such an insult. Today we have tools that are used in our vehicles, cellphones and various other aspects of our daily lives that assist us in making decisions or resolving issues.

Many of these tools are now being utilized in animal agriculture and will shape our industry for years to come. You likely have heard of "big data," machine learning or artificial intelligence. Coupled with new genomic tools and technologies, these new developments will help shape and influence the future of animal agriculture.

New technology

One example we have of the use of big data for reproductive management is the use of activity monitors primarily used in dairy herds to detect cows that are in estrus. This technology utilizes algorithms to determine when a cow increases her activity associated with when she is in estrus. Therefore, using the data, dairymen can accurately determine the best time to artificially inseminate (AI) their cows.

In the coming years, we will see a large increase in the tools available for beef producers to help make decisions using robust data sets and artificial intelligence. Consider where we may be in the future as technology improves and our ability to process large sets of data continues to be enhanced.

As producers, we traditionally work on our livestock on a macro scale, feeding each individual animal or herd of cattle a diet, or we use bulls or AI to breed multiple females or a single cow. However, establishing a pregnancy that is maintained until birth is more complex and involves immune responses and the interaction with multiple tissues and organisms in the reproductive system.

A new area of science focusing on microbe-animal interactions (i.e., microbiome) is fast becoming mainstream to help increase our production efficiency, especially in reproductive management. Obviously, we have been indirectly selecting within these interactions, but the next several decades may bring new opportunities to break open and optimize with intention the microbial interactions within microbiomes and between microbiomes and their hosts and environments to enhance reproductive efficiency.

For example, there are microbial populations in the uterus that may increase the opportunity for a pregnancy to survive that interact with other bacteria or the tissues and fluids in the uterus. With the rise of genomic tools and approaches, microbes may now be the targets for genetic shifts that advance the animal in such a way that they are more likely to become pregnant.

Consider the future of this area of science, given recent estimates that there are a trillion bacterial species —

of which only 30,000 or thereabouts have been named. The technique of sequencing an environment will yield breakthrough insights with regard to these interactions and how they may be harnessed to improve reproductive performance.

New opportunities

In the future, I see opportunities for producers to utilize many tools associated with big data that will enhance how we manage livestock, which may also have significant implications for animal well-being and health. Many of the future tools may also help reduce the incidence of treatment for disease because we would have early warning systems that provide us with knowledge prior to any clinical signs of an ailment.

There is already technology that utilizes sensor technology to manage livestock, such as fenceless fencing systems or drones to conduct surveillance of pasture conditions. Hopefully these tools will provide us the ability to enhance productivity, while also enhancing the management of our natural resources.

Don't neglect the chance to learn more about technologies like this in the future. They may well be relevant for most cow-calf producers. AJ

Editor's note: Cliff Lamb is the animal science department head and a professor at Texas A&M University in College Station, Texas.