THE FOUNDATION OF GENETIC IMPROVEMENT

Reproductive technologies can be the ticket to quicker improvement and a better bottom line.

by Whitney Whitaker, American Angus Association

How you breed may be just as important as what you breed to. Potential genetic and economic gains give producers plenty of incentive to try reproductive technologies.

During an Angus University workshop at the 2021 National Angus Convention & Trade Show, Ky Pohler, animal scientist at Texas A&M University, shared recent advancements and ways to make big gains with the tools.

Regardless of time spent in the industry or amount of knowledge, producers should only adopt reproductive technologies if they fit the operation, Pohler said. Technology can improve the speed of genetic gain when producers set goals. However, when goals are not outlined and the wrong decisions are made, change can go backwards.

"If you unknowingly make a bad genetic decision, you're going to create change a lot more rapidly than if you did it through natural selection or natural breeding," Pohler said.

Think beyond the "cool factor," he advised. Implementation and labor can be barriers, so cattlemen should consider their goals to make certain the technology fits and is realistic.

Some technology is in use, but there is still plenty of room for implementation in the beef industry.

OPPORTUNITY FOR GROWTH

According to a 2021 USDA report on reproductive technology adoption, only 25% of operations in the United States use some form of pregnancy diagnosis. That's one missed opportunity, Pohler said.

The beef industry is significantly behind the advancements in swine and poultry. More than 85% of commercial pig farms with more than 500 sows use artificial insemination (AI). Pohler grew up on a poultry farm in south Texas and saw firsthand the drastic genetic change. In just four weeks, broilers grow to a full, mature size today compared to the 10 weeks it took four decades ago.

Other livestock industries may spur ideas on what's possible for the beef producer, though many technologies may not work exactly the same way when applied to the bovine. Changing perspectives can lead to improvement, too, Pohler said, sharing an example.

"If a cow ends up open or losing a pregnancy, she gets sold most of the time, right?" Pohler said. "But most likely, you can still find the bull running around in the pasture."

Conventional wisdom says once sperm are sent up a reproductive tract to fertilize the eggs, the pregnancy loss is the female's fault. That's not accurate, Pohler said. Research shows the male is a major contributor to getting the placenta attached to the uterus.

"I think there's a huge opportunity to really increase our understanding of male fertility."

— Ky Pohler

"I think there's a huge opportunity to really increase our understanding of male fertility. If you think about it, our male population is a lot smaller than the cow population. So we can make a lot quicker advances by understanding bull fertility or male fertility than we can probably by understanding female fertility."

TECHNOLOGIES

With more research comes more knowledge. Advanced reproductive technologies may have been completely foreign to producers at one point. However, during the last 50-70 years, it has advanced and there are multiple options:

Estrous synchronization is one of the simplest tools to adopt. That's where hormones are used to synchronize the estrous cycle in a herd. Pohler described it as "a process with two flavors" in the ability to check heat and breed based on the a.m.— p.m. rule, or breeding 12 hours after an animal comes in heat or fixed timed artificial insemination (TAI). A third option that is not commonly talked about, Pohler said, but could be a big opportunity for the beef industry is estrous synchronization on natural service.

Sexed semen is another tool that has been around for a few years but has low adoption rates. Pohler said this is likely due to perceived fertility problems on the product, dispelling the myth.

"I think we're selecting for a specific population of sperm that most likely have just as good of fertility as a conventional straw," Pohler said. "There is less of them, and they are tighter versus in a conventional straw."

AI pregnancy rates across the world have a 50% success rate, and sexed semen was just four percent points lower at a 46% pregnancy rate.

Embryo transfer (ET) has also advanced and multiple ovulation embryo transfer (MOET) is an

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Advancing the understanding of genetic link to fertility

by Miranda Reiman, senior associate editor

It's easy to be patient when you know the project you're working on could help Angus breeders tackle a hard-to-improve trait.

Duc Lu is a research geneticist with the American Angus Association and spends his days either asking a software program to run complicated genetic analysis or interpreting the results of those requests. It's all in the name of improved fertility.

He and the team at Angus Genetics Inc. (AGI) are looking for haplotypes that affect fertility. Haplotypes are segments of DNA inherited together that could be related to everything from performance to reproduction. The work has been ongoing for several years.

Using the latest version of the NEOGEN AngusGS℠ and the updated Zoetis HD50K tests — both have single nucleotide polymorphism (SNP) arrays included specifically for Angus — the AGI team combs for associations between specific genomic regions and phenotypic data, such as the heifer pregnancy (HP) expected progeny difference (EPD) and other production and carcass quality traits.

"Then we say, 'Okay, now these might be interesting regions to investigate further,'" Lu says. They've identified potential haplotypes that could impact the viability, or livability, of an embryo when it carries two copies of one of those haplotypes.

"We look for regions in the genome where two copies of the haplotypes do not exist," Lu explains. "There's individuals that may carry one good copy and one not so good copy, so they're heterozygous, but you don't see any cattle in your population that carry two copies of the not so good one."

On the ranch, that scenario could explain the times a cow is bred and then comes up open in early gestation, Lu suggests.

"We've identified a few of those haplotypes, and we're in the process of validating them," he says. That means testing against a different Angus population outside the Association's database to determine that they exist and have some level of frequency.

Special software helps with the large amount of data that inherently exists with genomics over a large population, but it is still tedious, careful work, he says.

"The second thing we want to see is an association between the not so good haplotype and low pregnancy rate in our data," Lu says.

That can be difficult, simply because of who is genomically tested and who is not.

"There is a tendency to only genotype good animals, or the animals a producer is going to keep," he notes.

The "selective genotyping" can be economical for an individual breeder, but it makes it hard for the AGI team to identify potential carrier by carrier matings that resulted in pregnancy loss or if that offspring was simply not reported because it was culled early in life. The goal of the research is not only to determine how widespread these haplotypes are in the breed but also to find ways cattlemen can develop strategies to avoid any problems.

"It's more of a breeding tool," Lu says. "The purpose for us in identifying those haplotypes is so you can manage to get away from mating a carrier female to a carrier male."

If validation work confirms the initial indications, it could be a fertility tool of the future.

In general, fertility traits are lowly heritable, Lu says — all the more reason to be patient enough to get the haplotypes tool right. There's no concrete timeline yet, he says, but the work goes on.

emerging option. MOET occurs when a breeder uses conventional AI and then super ovulates a donor after she is bred. Little research is being done in this area, but Pohler says the advantages are that it can be done on farm and it allows for a greater, more consistent pregnancy rate. Disadvantages include the increased cost of hormones and labor.

Depending on goals and accessibility, beef producers can adopt a multitude of technologies to improve the reproductive and genetic efficiency of their operations.

VALUE

Making breed and industry improvements always remains valuable, but some hesitations exist with new technology. To those who argue the tools will require too much labor or cost, Pohler disagrees. The cost of doing nothing may be greater.

"If you look at the financials of any beef cattle operation, pregnancy is five times more influential than any other factor that goes into it," he said. "The importance of getting your animals bred early and getting them right early in the breeding season so they calve early should be a high priority."

Looking at the differences between a calf born on Day 1 of the calving season, one born on Day 30, one born at the end and a cow that never calves provides a case study.

"We never really feel the loss of that, because it's not like someone came along and snatched the money out of our pocket. It's money that we never realize," Pohler said.

The difference between calving on Day 1 and Day 60 might be $60 per calf on the commercial market, when considering lost opportunity for added pounds. If you add it up over several animals, it starts to accrue a lot of money.

Pohler concluded by encouraging producers to think of the overall value of reproductive efficiency.

"It really is asking the question, 'what does reproductive efficiency cost me?'" Pohler said. "How much value is it I can add back to my program by increasing the reproductive efficiency of my herd?" AJ