Research Update

► **Summaries** of current **beef cattle** research

Looking for the genes that affect vaccine response

South Dakota State University (SDSU) livestock research is trying to determine whether the genes cattle inherit help determine the way they respond to vaccinations. The result could be new knowledge about how to make cattle herds healthier.

Assistant professor Michael Gonda in SDSU's Department of Animal and Range Sciences is leading that study with assistance from graduate student researcher Xin Fang. Gonda is looking at individual genes as well as the whole genome, or the entire system of genes carrying hereditary information.

Michael Gonda and his colleagues are looking specifically at polymorphisms, or regions of genes where there are differences from animal to animal.

The work has implications for other species besides cattle and could also add to the understanding of vaccine response in humans.

"It's often assumed that animals, and humans as well, respond uniformly to a vaccine," Gonda said. "In reality there's a lot of variation in vaccine response. Some animals respond very well and very robustly to the vaccine; other animals don't respond at all. In fact, there is a certain fraction of the population that simply does not respond to the vaccine. One of the goals of my laboratory is to determine how much of the non-response to vaccines, or differences in response to vaccination, is actually controlled by genetics, by the animal's own genes."

Researchers are vaccinating in total about 1,500 calves over a two- to three-year period. They're using animals at the SDSU campus as well as at some outlying SDSU research stations, such as the Cottonwood Research Station and the Antelope Research Station in western South Dakota, and the SDSU Cow Camp in Miller. In addition, the study uses a beef and a dairy research herd at North Carolina State University, where some of Gonda's collaborators work.

Scientists are vaccinating all the animals with a commercially available vaccine that protects against both types of bovine viral diarrhea (BVD). Twenty-five to 30 days later, researchers go back and measure how the animals have responded to the vaccine — whether the response is strong, moderate, low or if they have not responded at all.

The scientists measure vaccine response by enzyme-linked immunosorbent assay, or ELISA, a technique that can detect the presence of antibodies produced by the animal's immune system in response to the vaccination. Measuring these antibodies gives a good picture of how an animal responds to the vaccine.

"Our objective is once we get these vaccine response measurements, we want to determine, is vaccine response heritable? That means, is there a genetic component to vaccine response? And if there is, can we find any genes or any loci that are associated with vaccine response?" Gonda said. "We do have some preliminary data that suggest the vaccine response is heritable."

If there is a genetic component to response to vaccination for BVD, it's possible that the same genes would be involved, no matter what vaccine is being given. And it's at least possible that a gene found to help regulate vaccine response in cattle could play an important role in vaccine response in other species of livestock or in humans.

Gonda and his colleagues are looking specifically at polymorphisms, or regions of genes where there are differences from animal to animal. Researchers are focusing on genes that are known to be important from an immunological standpoint, such as the major histocompatability complex, a genomic region important to the immune system.

They're also studying the leptin gene, which is thought to have a role in regulating the immune system. A polymorphism within the leptin gene has already been shown to affect vaccine response to a rabies vaccine in cattle by researchers at the University of Saskatchewan.

Eventually, Gonda said, his research could look at the entire genome.

"One of the biggest applications of genomics is going to be to identify molecular markers within genomes that can be used to select for traits in livestock," Gonda said. "One of the long-term goals of the studies that I'm doing is to identify molecular markers or genes that are associated with vaccine response so that perhaps one day livestock producers can go out and they can select animals that have favorable marker alleles for vaccine response and make their cattle healthier."

The South Dakota Agricultural Experiment Station is funding the research.

— Release provided by SDSU

Are RFI, tenderness connected?

Pork producers, too, are eyeing residual feed intake (RFI) as a means of improving production efficiency and producer profitability. Recently reported research from Iowa State University (ISU) in the *Journal of Animal Science* may pose a caution to beef producers targeting high-quality beef. An article submitted by S.M. Lonergan (*J. Anim. Sci.* 2011. 89:192-200) suggests selection for decreased RFI can have corresponding changes in pork quality.

The ISU researchers compared carcasses of pigs from the fifth generation of selection for decreased RFI (select) and a randomly selected line (control). One experiment looked at barrows from control and select lines paired based on age and body weight. Control barrows were heavier at the end of the test period. Calpastatin activity was greater in the longissimus muscle of the select line. Calpastatin is the inhibitor of the calpains, the enzymes that break down muscle for a tenderizing effect.

The second experiment looked at the composition of gilts from control and select lines, with 80 gilts in each group. The select line had 0.043 kg less RFI per day than the control line. Compared two days postmortem, carcasses from the select line tended to have less backfat, greater loin depth, and greater fat-free lean. Loin chops from the select line had less intramuscular lipid content.

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The authors note selection for decreased RFI could negatively affect tenderness and texture because of decreased lipid content and decreased postmortem protein degradation.

— *Shauna Rose Hermel*

A twist on feed efficiency

"Be careful what you ask for, because you just might get it — and that is especially true with genetic selection," said William Herring, as he addressed participants at the 2010 Beef Improvement Federation (BIF) symposium June 29 in Columbia, Mo.

William Herring suggests producers think of efficiency in terms of a group closeout.

Herring, who formerly conducted beef genetic research, shared comments on genetic improvement of feed utilization from the perspective of the swine industry. Through his role with Smithfield Premium Genetics*, Herring has successfully transformed swine genetic evaluation into a state-of-the-art statistical and technical process.

Herring noted that the swine industry has changed over the last few years and will likely continue to do so given the continuing changes in the economic, environmental and international climate. Most notably, he pointed out that the sow inventory has been reduced by 5%-15%, while production has been able to remain relatively constant.

Herring shared that Smithfield Foods operates an integrated system with an internal unit focused on genetics. "Efficiency is important, especially over the last several years," Herring stated.

With regard to feed efficiency or feed conversion, Herring challenged the beef industry to rethink the definition. Traditionally, feed efficiency is defined as pounds of feed consumed divided by the pounds of gain realized, he explained. "I challenge you to think about it from a commercial perspective. Rather than individual animal, evaluate group closeout."

In that scenario, Herring likes to monitor pounds of feed placed divided by pounds actually sold or marketed. With this equation, he explained, all feed cost is realized, but you don't get credit or revenue for any animal that dies, which gives a better indication on profitability.

"That's how we monitor if we are being successful or not," Herring said.

Herring acknowledged that several factors can influence efficiency — from gender to environmental and disease stressors. He noted that the swine industry pays close attention to several non-genetic factors, including feed manufacturing and delivery.

"We look for any inefficiency from the mill to delivery to the pig feeders themselves," he said. These, combined with genotype, all have a role in efficiency. As an example, Herring gave comparisons of two genotypes — a super efficient lean animal compared to a fatter, slower-growing animal. Whether a hog or beef animal, Herring noted, when put in a commercial setting and exposed to stress, the leaner animal has a higher maintenance and will likely have a reduced intake and average daily gain.

"Those animals that present a lean type of genotype are more susceptible to environmental stressors. Stressors drive down intake and that is not good," he stated.

Recognizing this, Herring said, whether

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you are working with swine or beef, it is important to put the right genes in the system to create that next generation.

Herring noted that Smithfield Foods is always testing breeds/genetics to monitor performance on a commercial level. They utilize expected progeny differences (EPDs), indexes and measure individual animal consumption at the purebred level. The data is then used in multiple-trait models. "Windows of acceptability" guide genetic selection.

In his closing comments, Herring noted that his colleagues in the poultry industry have had similar conclusions to the pork industry with regard to genetic improvement for feed efficiency on the commercial level.

"They've selected for it and made progress. But the big take away is they feel like they've created genetic gain, but it's also resulted in a bird that has less intake, and they view that as a bad thing," Herring stated.

His parting advice to the beef industry: "As you push forward with selection for efficiency, I really think this area deserves more attention just to be sure you're heading down the right path." He cautioned that intake efficiency influences several other traits.

Specifically, Herring said, "Any response that reduces intake during lactation is a bad thing. I want sows consuming and to breed back. I don't care how efficient she is, if she is not breeding back that's a bad deal. My gilt replacement cost is not insignificant."

He concluded, "Reduced intake during lactation for a breeding female certainly could be the first step to reducing pounds of calf weaned per cow exposed."

Themed "Gateway to Profit," the 2010 BIF Annual Research Symposium and Annual Meeting was hosted by BIF June 28-July 1 in Columbia.

— *Kindra Gordon*

***Note:** *In September 2010, William Herring joined Pfizer Animal Genetics as senior director of global technical services. In his new role he will lead the global technical services team to maintain Pfizer Animal Genetics' commitment to customer-focused solutions through its portfolio of genomics-based products and services.*

Editor's Note: *For additional coverage of the symposium, visit* www.bifconference.com, *Angus Productions Inc.'s (API's) event coverage site. This coverage is made possible through collaboration with BIF and sponsorship by BioZyme Inc. through its significant gift to the Angus Foundation.*