ANGUS MEANS BUSINESS
NATIONAL CONVENTION & TRADE SHOW

Adaptability

Angus genetics will grow in ability to thrive in every environment.

*by **Steve Suther,** Certified Angus Beef LLC*

Angus cattle are very adaptable, but it helps to have plans and strategies, according to presenters at the Angus Means Business National Convention & Trade Show Nov. 2-4 in Overland Park, Kan.

Angus Genetics Inc. Genetic Service Director Tonya Amen moderated the animal scientist panel of Megan Rolf, Oklahoma State University; Jared Decker, University of Missouri; and Mark Enns, Colorado State University (CSU). Their topic, "Matching Angus Genetics to Your Environment," was part of Angus University's 21st Century Cattle Production track.

Rolf reprised some points from her recent white paper, "Genetic basis for heat tolerance in cattle," available at the Angus Foundation's website *(www.angusfoundation.org),* and began by noting the environmental challenges.

Along with those of water and forage amount and quality, elevation and terrain, heat stress ranks among leading concerns. That's not only because of annual economic losses that total some $369 million for the beef industry, Rolf said, but the potential decline in animal well-being, too.

Heat stress results when animals take in or produce more heat than they're dissipating. Sources include solar radiation, high temperature, metabolic heat and humidity. If there is wind, humidity can also be a mitigation, along with shade, sweating, panting and passive transfer. High-performing animals tend to produce more of that metabolic heat, she added.

PHOTOS BY LEANN SCHLEICHER, ANGUS MEDIA

►Tonya Amen moderated the panel discussing adaptability.

Research says heat tolerance is a heritable trait, though there are genetic antagonisms between that and both milk production and failure to return to estrus in dairy cattle.

"The correlation is small in some cases, but we can make progress in both economic and animal well-being with the right focus," Rolf said. Conversely, the data from dairy studies says continual selection for increased performance without regard to heat stress actually reduces heat tolerance.

How long does it take to make a difference through genetics? Adapting one dairy breed took more than 20 generations, so any progress will take a firm commitment over time.

"But it can work," she said.

Elevation

Mark Enns laid the groundwork for his discussion of pulmonary arterial pressure (PAP) and high-altitude disease by summarizing the 35 years of research by veterinarian Tim Holt. That work involved studies on 340,000 head of various breeds from sea level to 14,300 feet in elevation and from -42° to 107° F.

He explained the physiology that triggers blockage of pulmonary veins and the chain reaction that results in congestive heart failure in cattle with severe "brisket disease."

Studies on two groups of Angus cattle at CSU differ in correlations found between PAP and several production traits, but, Enns noted, that comes from the many challenges of studying high-altitude disease in cattle.

"The most valuable PAP observations are those at elevations above 6,000 feet, and animals need to be in that environment for at least 30 days," he said. "At lower elevations, PAP readings are good for identifying poor animals, but not for selecting those suitable for high elevation."

As an example, he said, at 5,000 feet animals with a PAP of 60 are known to be not suited for the high country, but if the reading is 38, an animal "may or may not be suitable for high elevations. We need more data, more study to know what the lower numbers mean."

►Panel members (from left) Mark Enns, Megan Rolf and Jared Decker discussed research on adaptability to a variety of environments.

Showing a color slide representing work at the chromosome level, Enns said there is sufficient variability in PAP to make genetic improvement, but the main questions for research are, "What is the effect of altitude and how do we best account for it? And are we looking at two traits, one in effect above 6,000 feet and another below 6,000 feet? Is it the same trait in bulls and heifers?

"Finally, what are the opportunities for better genomic tests?" Enns asked, offering that PAP is controlled by many genes, and sires can be tested for their suitability for use at high altitudes. "Together with the American Angus Association and the Angus Foundation, we hope to answer these questions and develop a better selection tool for breeders."

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Additional challenges

Decker continued the session by reviewing the wide variations in environment across the country, showing the challenge of adapting is "more than heat stress and altitude, cold, desert, fescue toxicosis." The latter, he said, now costs the beef industry an estimated $1 billion per year.

Progress can be made in adapting to help overcome just about any challenge, and artificial insemination (AI) is one part of the solution.

"We have the data, technology and methods, and must provide beef producers with the necessary tools to effectively identify animals suited to their region," Decker said.

He described a University of Missouri project for identifying commercial cattle selection by each of nine regions in the United States with similar topographies and climates.

"Our approach is to design region-specific genomic predictions focusing on variants responding to local adaptation selection," Decker explained. In the case of fescue toxicity, data is supplemented by analyses of body temperature, hair shedding and water intake.

The university is sequencing data from more than 1,700 animals with whole-genome sequence data, then inferring genotypes on more than 10 million DNA variants using patterns from 50K SNP genotypes, using imputation.

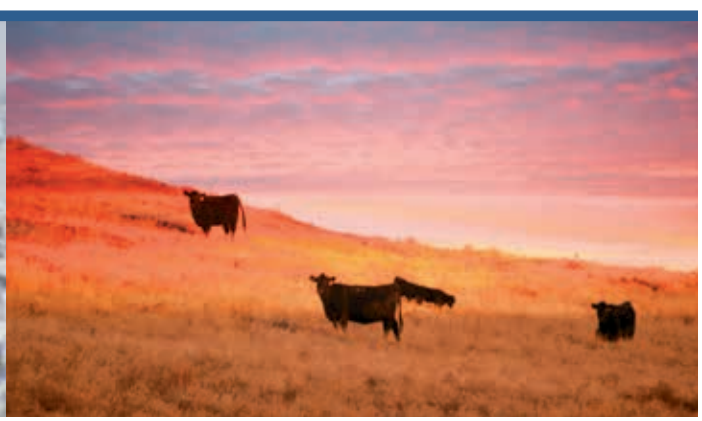
"If an animal is adapted to a region, it performs well and produces progeny in that region," Decker reasoned. "If an animal is not adapted to a region, it underperforms, so it is culled and there are no progeny. This naturally occurring selection changes the frequency of DNA variants responsible for local adaptation."

The early work done on fescue toxicity is a model for wider application to identify DNA variants associated with many traits such as heat, cold, altitude, humidity, aridness, parasite tolerance, disease immunity, feed intake "and others we can't measure or wouldn't think to measure," Decker said.

He said he looks forward to working with the 140-year history of Angus cattle in those nine regions, and testing the outcomes of selection between regions. Genetically enhanced expected progeny differences (GE-EPDs) and dollar value indexes ($Values) will provide the tools cattle producers need to better adapt Angus cattle to their regional environments.

"We can train genomic predictions focusing on variants previously shown associated with regional adaptation, use only information from animals in that region and then predict region-specific effects for each variant," Decker said. AJ

Editor's Note: *Steve Suther is the director of industry information for Certified Angus Beef LLC.*



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