BY THE NUMBERS

by Kelli Retallick, director of genetic services, Angus Genetics Inc.

Elevating selection to new heights

Decreased appetite, labored breathing, lethargy and glazed eyes are telltale signs of respiratory issues in cattle. However, for operations at high elevations the diagnosis could be much different. Right-heart failure (RHF), also known as high-altitude or brisket disease, is problematic in higher-elevation cow-calf operations and could be related to increased incidences of heart failure in feedlots.

Commonly mistaken for severe pneumonia, RHF has more specific symptoms, including swelling in the brisket, belly and jaw due to high blood pressure forcing fluid out of vessels. Unless treated, death is inevitable.

Early research

RHF has been known to affect cattle operations since the early 1800s. George Glover and Isaac Newsom were first to investigate the disease in South Park, Colo., in 1917. Termed brisket disease due to swollen briskets associated with affected cattle, these two researchers concluded the disease was linked with low oxygen levels at high elevations causing the heart to work harder, leading to eventual failure. While directly measuring an animal's RHF risk is not available, taking pulmonary arterial pressure (PAP) measurements is possible and useful.

Veterinarians are specifically trained to take PAP measurements due to the procedure's invasive nature. Colorado State University (CSU) and Tim Holt, well-known veterinary pioneer in the field, provide a short course every other year for veterinarians to be trained in the subject. The next course is scheduled for early fall 2018.

With proper modeling, Pauling's work supports using PAP scores taken at lower altitudes for national cattle evaluation.

To assign an animal a score, it first must be restrained. Then a catheter with a bore needle is passed down the jugular, through the right atrium, into the right ventricle and finally into the pulmonary artery. Here, a pressure transducer connected to the end of the needle reads the systolic and diastolic pressures to calculate PAP scores. Animals scoring a mean PAP greater than 49 mmHg are considered at risk in high elevations and should be moved to lower elevations to avoid RHF onset.

Extensive research done at CSU from 1978 to 2016 has predicted moderate to high heritability estimates (0.20-0.77) for PAP, suggesting genetic selection for improvement is possible. Members operating in high-altitude country,

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testing animals for PAP, have been submitting scores to the Association for further investigation.

Current research

Research done in conjunction with CSU used PAP scores from several sources, including the American Angus Association (n = 4,511), CSU (n = 5,433) and Holt (n = 4,821). Scores were combined into a single research project to study the relationships among PAP scores taken at different elevations, between 4,000 feet (ft.) and 8,000 ft.

CSU graduate student Rachel Pauling analyzed the data specifically looking at the genetic relationships among PAP observations at high and moderate altitudes. Scores were categorized high or moderate by evaluating the associations between PAP observations and elevation. Previous to this study, acceptable testing elevations were predetermined through producer reports, with some stating PAP scores taken only at elevations of 7,200 ft. or greater were acceptable.

Pauling determined significant differences in PAP scores start to arise at 5,314 ft. Therefore, high-elevation PAP (HE PAP) scores were those taken at or above 5,314 ft. while moderate-elevation PAP (ME PAP) observations were those taken below this threshold but above 4,000 ft., the lowest altitude for this study.

Pauling estimated similar heritability estimates for both HE PAP and ME PAP scores of 0.34 and 0.29, respectively. She also reported strong positive genetic correlation estimates between HE PAP and ME PAP scores, r = 0.83. While not perfect — a genetic correlation (r) of 1 is perfect — this work shows PAP scores taken at lower elevations have the potential to be a good indicator trait for predicting PAP at high elevations.

Predicting a high-altitude PAP expected progeny difference (EPD) using both HE PAP and ME PAP observations in one analysis would be similar to carcass evaluations used to predict carcass weight, ribeye area, marbling and fat EPDs, where carcass kill data is the directly measured trait and carcass ultrasound measures are indicators. The genetic correlation between high and moderate PAP scores (r = 0.83) is actually stronger than the current relationship between carcass data and ultrasound records (r = 0.70).

With proper modeling, Pauling's work supports using PAP scores taken at lower altitudes for national cattle evaluation to predict PAP EPDs to select for cattle better-suited for high-altitude environments.

Throughout the next several months Angus Genetics Inc. (AGI) will be exploring the modeling of this trait in a prototype evaluation in hopes to release a research EPD by the end of 2018. AJ

Table 1: Heritability estimates for high and moderate PAP observations on the diagonal, genetic correlation above the diagonal

	High PAP	Moderate PAP
High PAP	0.34	0.83
Moderate PAP		0.29

Source: Research credited to MSc Thesis, Pulmonary arterial pressure in Angus cattle: environmental influences and relationship with growth and carcass traits, 2017, by Rachel Pauling, Colorado State University.