Scrotal Vindication

Researchers find no significant inverse correlation between scrotal circumference and intramuscular fat EPDs.

Story by
ED HAAG

Seedstock and beef producers who have always believed in the merits of scrotal circumference on their bulls but were growing increasingly apprehensive about its relationship to reduced intramuscular fat in progeny can now rest easy, says Aaron Arnett, doctoral candidate at Kansas State University (K-State).

He and his fellow researchers conducted a comprehensive study involving the performance records and expected progeny differences (EPDs) of 290 known Angus sires, more than 85,000 of their calf progeny and 150,000 calf contemporaries.

"There is no way we could have accomplished this without the direct input of the American Angus Association, [which] provided pedigrees and expected progeny differences," Arnett says. "Their records were essential to even attempting this project."

The objective of this study was to investigate the relationship between ultrasound intramuscular fat (IMF), carcass marbling score (MS) and yearling scrotal circumference (SC) in Angus cattle.

By doing the study Arnett and his colleagues hoped to answer two major questions:

- First, determine if there was a significant negative correlation between scrotal circumference of sires and intramuscular fat in progeny;
- Second, determine if there was a need for a corrective mechanism in EPD ultrasound scoring that factored in the recognized relationship between greater scrotal circumference, increased testosterone production and decreased intramuscular fat.

"Some producers are concerned that if you are dealing with a bull that produces a lot of testosterone it is not going to have as much intramuscular fat as his steer offspring would," Arnett says.

He goes on to explain that bulls with smaller scrotal circumferences might have an unfair advantage over ones with larger circumferences in relation to intramuscular fat because testosterone levels in test bulls with large yearling scrotal circumferences would, if the logic followed, be more likely to express themselves in reduced deposits of intramuscular fat.

Arnett adds that with steer offspring, this playing field would be

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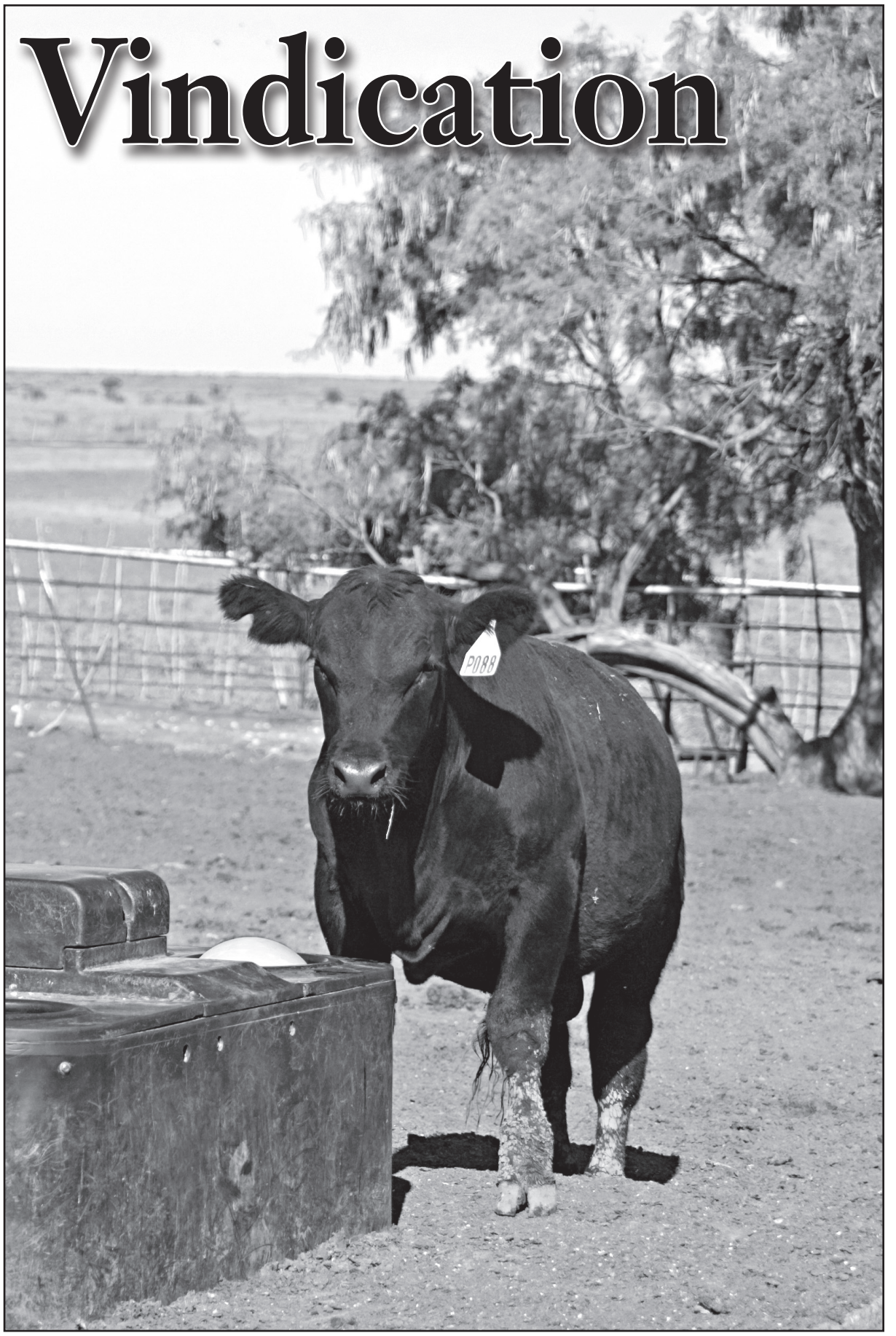
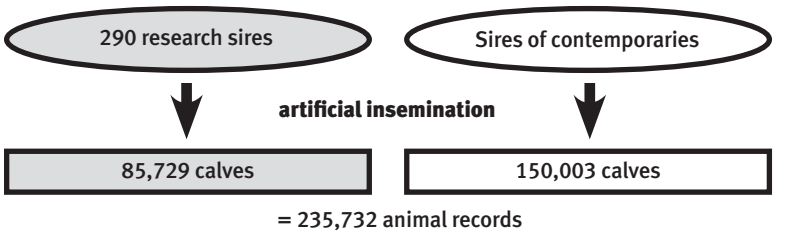


"Some producers are concerned that if you are dealing with a bull that produces a lot of testosterone it is not going to have as much intramuscular fat as his steer offspring would," Aaron Arnett, K-State, says. [PHOTOS BY SHAUNA ROSE HERMEL]

Fig. 1: Materials and methods



In statistical genetics research, the larger the samplings, the more credible the results, Jennifer Bormann, assistant professor, K-State, says.

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leveled by the fact that none of the animals would be producing the testosterone that negatively affected marbling.

Jennifer Bormann, assistant professor in K-State's Department of Animal Sciences and Industry and a participant conducting the study, sees the results of the project as having particular significance to seedstock producers who make their bull selections based solely on ultrasound data.

"Their concern is that if there is a significant negative relationship between scrotal circumference and ultrasound intramuscular fat they might be eliminating bulls that could have very good genetics but do not express those genetics fully because of their high levels of testosterone," she explains, noting that such a concern is valid in an industry that routinely uses EPDs to select bull candidates.

More data, more questions

For Sally Northcutt, American Angus Association genetic research director, Arnett's study reflects a growing interest, on the part of Angus breeders, in specific relationships between traits.

"Our breeders have invested a great deal in submitting performance information to our Angus program on a variety of traits," she says. "The scrotal circumference database has evolved to over 400,000 scrotal records. Out of that, we generate more than 900,000 EPDs."

Northcutt notes, in addition to Angus seedstock producers using this trait data in the form of EPDs as selection tools, the data serve another useful purpose.

"Because we have the largest beef cattle database in the industry, it lends itself well to targeted research projects that answer specific breeder and producer questions," she says, citing the scrotal study as an excellent example of this type of research. "As new traits develop and our technology evolves, we are steadily acquiring more of the resources needed to examine these types of questions."

She adds that this trend is reflected in the growing number of beef studies that utilize the American Angus Association's comprehensive database.

"We do a lot of outsourcing of research projects to land-grant universities," Northcutt says, adding that this helps fulfill an important commitment the Association has to its membership base. "The industry is aware that one of the strong suits of Angus beef is that it is a quality product, so we are always looking to provide additional tools that quantify that."

Study is breeder-driven

Dan Moser, associate professor in K-State's Department of Animal Sciences and Industry and fellow researcher in Arnett's study, says the quest for tools that help promote excellence won't ever lose significance to seedstock producers.

"Cattle breeders are definitely not ones to be satisfied with the status quo," he says. "They are very aggressive about making change and continuing to improve and fine-tune the overall profitability of their genetics."

In this scenario Moser sees the role of the university researcher as clearly defined.

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"As the technology gets better and better, whatever change a breeder sets out to achieve is, in most situations, achievable," he says. "By us studying the relationship between traits, if a breeder makes a particular change he will know ahead of time what might come with it."

Moser cites the genesis of their study as a good example of this type of synergy and points out that the original idea for the study came from Jim Bradford, an Iowa Angus breeder and former director of the American Angus Association. "His original question was, if we were using ultrasound measures of bulls for selection and if bulls that are later-maturing with smaller testicles and theoretically less testosterone deposit more marbling, are we, by using intramuscular fat EPDs derived from ultrasound measurements on bulls as our selection criteria, indirectly selecting for later maturity, less masculinity, less testosterone and smaller testicles?"

An ambitious project

While Moser found Bradford's inquiry intriguing, building a research model around the question in order to determine whether or not the Angus breeder had a valid hypothesis was another matter. Moser and his colleagues were well aware that if they attempted such a study, it would require a prodigious quantity of data just to meet the standards established by the research community.

This was understandable, considering the discipline, Bormann says. She adds that in statistical genetics research, the larger the samplings, the more credible the results.

This fact alone makes the application of statistics to animal breeding a relatively new phenomenon. Prior to the 1980s, the discipline was the exclusive domain of atom-smashing physicists, rocket scientists and population gurus who practiced their craft at one of a handful of institutions influential enough to possess a giant, punch-card-reading super computer. Only those machines had the power to process the kind of data needed to produce useable results.

"The biggest thing that has helped animal breeding research is computation," Bormann says. "Twenty years ago we didn't have access to the computers that were capable of doing this type of analysis."

As a student, Bormann was once told by a professor who was involved in early research that when statistics was first proposed as a tool for animal breeding, only two computers in the country were capable of crunching the numbers — one at a major research university and the other at NASA.

"It wasn't that we didn't have the ideas — we had plenty of brilliant scientists — we just didn't have the computers," she says, adding that with the computer revolution that all changed. "Today, most laptops can do the computations."

Clean data a big plus

Besides having enough computer power, the other challenge facing pioneer beef geneticists was to build a credible database. Since the 1950s, industry visionaries within the American Angus Association have made it a priority to collect performance data on Angus sires and their progeny. It was their belief that it would eventually provide their seedstock producers with a unique and powerful tool for making their breeding decisions. That belief has since come to fruition.

"Angus has done a phenomenal job of collecting data," Bormann says. "They have the best beef cattle database in the country, bar none."

For the researchers, cooperation from the American Angus Association was imperative.

After talking with Northcutt and making a formal proposal to the Association, it was agreed by all parties to proceed with a study. The Association would help fund the project and provide the raw data, while the research team would lend their time and expertise to the effort. This involved developing the appropriate computer model that took

into consideration all potential variables and then applying that model to the data provided by the Association.

Bormann recalls that one of the real advantages of working with American Angus Association data was its quality.

"We always say that the results of a study are only as good as the data going in," she says. "The Association does a real good job of editing out as many mistakes as is humanly possible."

This meant that all records were thoroughly checked for input errors and other anomalies. "In the world of statistics we call this clean data," Bormann says. "Clean data makes our job a lot easier and our results a great deal more accurate."

Results allay some concerns

Arnett was equally impressed by the records provided by the Association.

"The American Angus Association did a very good job of coming up with a well-balanced set of data that was very representative of the breed," he says. "The research sires provided to us were highly sampled with lots and lots of records, so from the beginning we had access to a very powerful data set."

From the data provided and the computer model they developed to conduct the study, Arnett and his colleagues concluded that while the final numbers showed a small, statistically nonsignificant negative association between ultrasound intramuscular fat and yearling scrotal circumference in Angus bulls, it was not observed in the EPD.

They concluded that there was no statistically significant association between Angus bulls' SC EPD and MARB EPD.

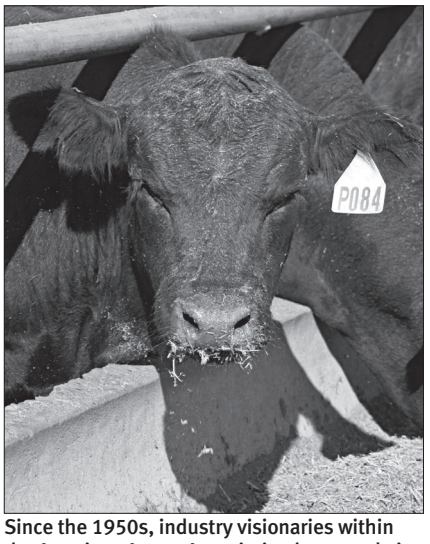
"From what we are seeing preliminarily, there is a very small negative relationship between scrotal circumference and ultrasound intramuscular fat, but it is not enough to call for a significant rearranging of EPD data," Bormann says, noting that the study results are just another affirmation that the science behind EPDs holds up remarkably well under research scrutiny.

Fig. 2: Selection of animals for the study

1. Sires that have both carcass and ultrasound progeny (n=2,424)
2. Require minimum MARB and USIMF EPD accuracies to be >0.50 (n=290)
3. Carcass steer progeny of these sires with contemporary groups of 10 or more (1,714 groups; 59,399 calves)
4. Ultrasound calves of these sires in contemporary groups of 20 or more (3,938 groups 176,333 calves)

Fig. 3: Conclusions and implications

- A small negative association exists between ultrasound %IMF and yearling SC in Angus bulls, though this was not observed in the EPD.
- Adjusting ultrasound %IMF for SC could benefit bulls with extremely large yearling SC and/or when comparing bulls with large differences in SC.
- Adjusting IMF for SC is not likely to change the ranking of sires for marbling potential of progeny.



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