Medical breakthrough could help produce more beef

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Bos indicus cattle, such as these, lag in their reproductive efficiency, something researchers are trying to help fix with a recent medical breakthrough. Credit: Texas A&M AgriLife photo by Rodolfo Cardoso

A recent research breakthrough in human medicine could help a Texas A&M Department of Animal Science researcher find a way to increase

beef production to help meet the demands of global population growth.

Bos indicus cattle breeds are very important to global beef production due to their adaptability to tropical and sub-tropical climates, including those found in Texas and other southern U.S. states.

But a big challenge or disadvantage for Bos indicus, or Brahman, cattle is that their overall reproductive performance is inferior to that of Bos taurus cattle breeds such as Angus and Hereford, which predominate in the Midwest and Northern states.

Rodolfo Cardoso, DVM, Ph.D., assistant professor and reproductive physiologist in the Department of Animal Science of the College of Agriculture and Life Sciences, is leading a four-year project funded by a $500,000 grant from the U.S. Department of Agriculture, USDA, National Institute of Food and Agriculture. Among the collaborators are Gary Williams, Ph.D., Texas A&M AgriLife Research professor emeritus, and graduate students Viviana Garza and Sarah West.

Cardoso said revolutionary advances in neuroendocrine research have defined the mechanisms controlling the secretion of gonadotropin-releasing hormone, GnRH. The new insights, he believes, can help his team determine neuroendocrine differences between Bos taurus and Bos indicus genotypes of cattle and use that to enhance reproductive efficiency in Bos indicus-influenced cattle.

"Very recently, there was an important breakthrough on the understanding of how the secretion of GnRH is regulated in rodents and primates," he said. "Our preliminary research suggests that similar mechanisms are also important in cattle and could explain the differences in reproductive performance between Bos taurus and Bos indicus animals.

"If confirmed, those findings can have practical implications to reproductive management of Bos indicus cattle. In human medicine, several pharmacological strategies to improve fertility in women have already been developed based on these novel findings."

Calving timing matters

As many as 70% of the world's cattle are raised in tropical and sub-tropical regions, and approximately 30% of U.S. beef herds have some Bos indicus influence, particularly in the southern and southeastern regions.

One major challenge is that Bos indicus and Bos indicus-influenced cattle reach puberty markedly later than Bos taurus breeds. That late puberty essentially means one less calf in a cow's lifetime and also presents challenges when breeders try to synchronize estrus cycles for the annual breeding season.

Cardoso said typically Bos taurus heifers reach puberty at 10 to 12 months, whereas Bos indicus heifers often won't reach puberty until 15-17 months.

"That five-month delay makes them not reach puberty in time for their first breeding season, and so they have to wait another whole year to be bred and have their first calf," Cardoso said.

With more than 4 million replacement beef heifers entering the U.S. cow herd annually, the difference between having a calf when the heifer is two versus three years old can make a big difference in beef production. In Texas and Florida, less than 50% of beef heifers reach the goal of calving at two years old due to the Bos indicus influence.

Cardoso said heifers that calve for the first time at two years of age

produce approximately 300 more pounds of weaned calf weight in their lifetime, or a $500 difference, compared to heifers that calve at three years of age.

This project will utilize the recent discoveries to determine whether distinct differences observed in reproductive function in Bos indicus and Bos taurus breeds can be attributed to functional differences in the brain area that controls the secretion of the GnRH hormone.

Predetermined breeding seasons are key to efficiency

A predetermined breeding season typically lasts between 45 to 90 days and allows for more efficient management of a beef cattle operation, Cardoso said.

"You can have a very uniform calf crop, which makes it much easier to manage those calves—vaccinate and do all the health protocols at the same time," he said. "You can wean and sell the calves at the same time because you have a uniform group, so it makes management much, much more efficient in a cow-calf operation. It also allows for culling of animals that are not efficient."

In addition to better understanding the cattle's reproductive function, Cardoso said, a second goal from a pharmacological strategy is to develop synchronization protocols for artificial insemination tailored to Bos indicus heifers. Most protocols currently used in the U.S. were developed specifically for the Bos taurus breeds.

"These Bos indicus heifers already have, at 12–14 months of age, the skeletal size and maturity required to support a safe and healthy pregnancy," he said. "There's no question about that. They're just not cycling yet. We don't want to induce these heifers to reach what we call precocious puberty (puberty before 10 months of age). That's not

desirable, and that's not what we're trying to accomplish here."

A key benefit, Cardoso said, of synchronizing the breeding season more efficiently is being able to use artificial insemination more in Bos indicus-influenced cattle.

"Artificial insemination is the most powerful tool we have available to improve genetics in beef cattle herds," he said. "Artificial insemination is a way that a beef cattle producer can, over time, start improving the genetics of the herd."

But currently, breeders' ability to synchronize estrus of Bos indicus-influenced animals for artificial insemination is not optimal, Cardoso said.

"We hope by the end of this four-year project we will have a very good understanding about the neuroendocrine differences between Bos taurus and Bos indicus-influenced heifers," he said. "And, more importantly, we think at that point we'll have some good strategies to pharmacologically control the estrus cycle in Bos indicus-influenced heifers."

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