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and Physiological Events
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in Brahman Cattle**

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INTERRELATIONSHIP OF ENDOCRINE AND PHYSIOLOGICAL
EVENTS DURING THE ESTROUS CYCLE IN BRAHMAN CATTLE

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GENERAL SUMMARY

This report covers research funded jointly by the Texas Agricultural Experiment Station and the American Brahman Breeders Association. The research began in the fall of 1975 and this 1979 report concludes this research project. A large amount of this data has previously been reported to the American Brahman Breeders Association in a progress report. The purpose of this research has been to discover the hormone levels, time of changes of hormone levels and relationships between standing heat, ovulation, development of the corpus luteum and fertility in Brahman cattle as compared to European cattle.

Almost all systems for artificial insemination, estrus synchronization, embryo transfer and clinical treatments for reproductive disorders were developed using European cattle. Critical differences in the endocrine system and timing of events related to reproduction alter the effectiveness of these treatments in Brahman cattle.

Many behavioral and other differences have long been recognized factors in practical production of Brahman cattle. In this summary, I wish to point out the important differences found during the course of these studies.

Standing heat is caused by the hormone, estrogen. As the effect of this hormone was studied, it was found that spayed Brahman cows (cows with their ovaries removed) needed a larger dose of estrogen to cause standing heat than did spayed Hereford cows. The time from estrogen treatment to standing heat was longer in Brahman than Hereford cows and the time the Brahman cows were in heat was shorter. Estrogen concentrations in the blood of normal cows were measured near estrus. The estrogen surge, which precedes estrus, was earlier in Brahman, intermediate in Brahman x Hereford and latest in Hereford cows. Another function of estrogen is to cause the brain of the cow to release

a hormone, gonadotropin releasing hormone, which in turn causes release of the luteinizing hormone which causes the egg to be released from the ovary of the cow. When a dose of estrogen was given to spayed Brahman and Hereford cows, the luteinizing hormone surge was later and smaller in Brahman cows than in Hereford cows. When the same type of cows were given the gonadotropin releasing hormone, the release of luteinizing hormone occurred at the same time but was lower in Brahman than in Hereford cows. We compared the normal luteinizing hormone surge in normal heifers and found that Brahman heifers had a smaller surge than did Herefords. The time from beginning of standing heat to ovulation, when the egg is shed from the ovary, was found to be 19 hours in the Brahman compared to 29 hours in the Hereford.

To further summarize this information: the Brahman cow, as compared to the Hereford, needs more estrogen to come into heat, responds differently to the estrogen as it affects the brain, has a lower output of the hormone causing ovulation (luteinizing hormone) and ovulates earlier in relation to standing heat. This, in part, explains the greater number of odd heat periods in Brahman cows and lowered conception rates.

After ovulation, the spot where the egg is shed from the ovary develops into a tissue called the corpus luteum which produces progesterone, the hormone of pregnancy. We have found that Brahman cows have a smaller corpus luteum with less progesterone in it than do Hereford cows. Also, during the time from day 2 through day 11 after heat, Brahman cows have less progesterone in their blood stream than do Hereford cows. Brahman cows, therefore, may need less progesterone to maintain pregnancy than Hereford cows. In an attempt to increase the amounts of progesterone available to maintain pregnancy, a treatment for Brahman cows was developed. A hormone, Human Chorionic Gonadotropin, which causes the cow to develop a larger corpus luteum and produce more progesterone, was given to Brahman cows at breeding. This treatment increased pregnancy rates.

These data indicate that selection of Brahman cattle for a larger corpus luteum and higher progesterone levels could increase conception rates. Additionally, we have a treatment available which can increase conception rates to artificial insemination.

This research shows that treatments to alter reproduction in Brahman cattle need to be developed using the Brahman cow as the model rather than the European cow. When the differences are taken into consideration, we should expect to have fertility in our Brahman herds equal to that found in any other breed.

OBJECTIVES

As previous researchers had noted that Brahman CL were smaller by total examination, this research was done to accurately define the effect of Brahman breeding upon CL size and progesterone content.

PROCEDURE

Corpus lutea (CL) were removed surgically at days 2 and 12 after standing heat from 10 two year old heifers each of Brahman, Brahman x Hereford and Hereford breeding. CL were frozen and assayed for progesterone using a colorimetric procedure.

RESULTS

Brahman CL were significantly smaller ($P < 0.005$) than were Brahman x Hereford or Hereford CL (Table 1). Progesterone content of the CL was determined with Hereford CL as the highest followed by Brahman and Brahman x Hereford CL (nonsignificant). The amount of progesterone available is a function of size and functional ability of the tissue (Table 2).