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# Interrelationship of Endocrine and Physiological Events During the Estrous Cycle in Brahman Cattle

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# BEHAVIORAL EFFECT OF VARIOUS DOSE LEVELS OF ESTRADIOL-17β UPON OVARIECTOMIZED BRAHMAN, BRAHMAN X HEREFORD AND HEREFORD COWS

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## SUMMARY

Brahman cows failed to accept the bulls at any dose level of estrogen. Brahman x Hereford cows were less active at 1 mg of estrogen than were the Herefords ($P<0.10$). If homosexual standing behavior is accepted as standing heat the Brahmans were less active, Brahman x Hereford intermediate and Herefords the most active. Brahman cows had a significantly ($P<0.05$) longer time from injection of estrogen to first standing behavior than did either Brahman x Hereford or Hereford cows (Brahman = 19.3 hours, Brahman x Hereford = 12.8 hours and Hereford = 10.1 hours). Brahman cows appear to have a different biological timing system than do Brahman x Hereford or Hereford cows.

## PROCEDURE

Six long term ovariectomized cows each of Brahman, Brahman x Hereford or Hereford breeding were injected with Estradiol-17β (estrogen) at dose levels of 1, 2, 4 and 8 mg. Following the estrogen injection all cows were placed in a grassy one acre plot with free access to Coastal bermudagrass hay and water and accompanied by 18 sterile heat check bulls. The cows behavior was observed constantly for 36 hours after injection. A two week recovery period was allowed between estrogen dose level treatments.

The behavior noted was: 1)number of homosexual mounts and stances, 2) number of heterosexual mounts and stances, 3) number of all stances, 4) number of sexual events, 5) time from injection to each event, and 6) the duration of each category of behavior.

## RESULTS

Ovariectomized Brahman cows failed to accept mounting by the bull at any dose level (Table 1, $P<0.005$). The Brahman x Hereford cows were also less reactive to the 1 mg estrogen dose level than were Hereford cows (Table 1, $P<0.10$).

Although the Brahman cows did not exhibit heterosexual activity, Brahman x Hereford and Hereford cows displayed a high degree of heterosexual behavior. There was a tendency for increased number of heterosexual stances as estrogen dose levels increased (Table 2).

If homosexual activity is to be accepted as standing heat then the Brahman cows were still less reactive to the estrogen than were the Brahman x Hereford and Hereford cows (Table 3).

Total stance behavior (homosexual + heterosexual) varied with dose level ($P<0.005$) and showed a breed x dose level interaction. At the 4 mg level Hereford cows had more events than did Brahman or Brahman x Hereford (Table 4; $P<0.05$), while at the 8 mg dose level both Hereford and Brahman x Hereford had more events than did Brahman cows.

Duration of estrus, as measured by the length of time from first homosexual or heterosexual stance to final homosexual or heterosexual stance, was longer ($P<.005$) in Hereford than Brahman x Hereford cows at 1 and 2 mg dose levels and longer for Hereford than Brahman cows at 1 and 8 mg dose levels (Table 5).

Brahman cows had a significantly longer time from injection to first stance at any estrogen dose level than did Brahman x Hereford or Hereford cows ($P<0.05$; Table 6).

Since the time from injection to the first stance did not vary with dose level, the mean response time of each breed was, respectively, 19.3, 12.8 and 10.1 hrs for Brahman, Brahman x Hereford and Hereford cows. It has been reported that time from first standing estrus to ovulation is, respectively, 18.9, 29.0 and 28.6 hrs in Brahman, Brahman x Hereford and Hereford heifers. If one adds the response time (time elapsed from estrogen injection to estrus response) to the time interval from first standing estrus to ovulation, within breeds, one finds that the sum of the times does not differ between breeds (i.e. Brahman 38.2 hr; Brahman x Hereford 41.8 hr; and Hereford 38.7 hr). Therefore, Brahman cows have a different biological timing system than do Brahman x Hereford or Hereford cows. The implications of these data appear to show that AI timing normally used on the English breeds will be less useful in cattle of Brahman breeding.

These data strongly indicate inherent differences between the Brahman cow and European breeds of cattle with regard to biological timing as related to standing heat behavior.

TABLE 1. PROPORTIONS OF OVARIECTOMIZED COWS ACCEPTING HETEROSEXUAL MOUNT AFTER INJECTION OF ESTRADIOL-17β

| Breed | Dosage Estradiol-17β 1 mg | 2 mg | 4 mg | 8 mg |
|---|---|---|---|---|
| Brahman | 0/6** | 0/6** | 0/6** | 0/6** |
| Brahman x Hereford | 2/6† | 6/6 | 6/6 | 6/6 |
| Hereford | 5/6 | 6/6 | 5/6 | 6/6 |

** P<.005

† P<.10

TABLE 2. HETEROSEXUAL STANCE BEHAVIOR FOR BRAHMAN X HEREFORD AND HEREFORD COWS.

| Breed | Dosage Estradiol-17β 1 mg | 2 mg | 4 mg | 8 mg |
|---|---|---|---|---|
| Brahman x Hereford | 0.3±0.2[a] b | 6.7±1.5 c | 13.3±4.5 d | 15.8±7.6 d |
| Hereford | 3.7±1.1 b | 9.8±2.5 c | 5.8±2.5 c | 16.0±3.7 d |

a Number of events ± standard error

b,c,d Mean stances within the same column and/or within the same row followed by a different letter differ significantly (P<.05).

TABLE 3. PROPORTIONS OF OVARIECTOMIZED COWS ACCEPTING HOMOSEXUAL MOUNT AFTER INJECTION OF ESTRADIOL-17β

| Breeds | Dosage Estradiol-17β 1 mg | 2 mg | 4 mg | 8 mg |
|---|---|---|---|---|
| Brahman | 4/6† | 5/6† | 4/6† | 5/6† |
| Brahman x Hereford | 5/6 | 6/6 | 6/6 | 6/6 |
| Hereford | 5/6 | 6/6 | 6/6 | 6/6 |

† P<.10

TABLE 4. TOTAL STANCE BEHAVIOR OF THREE BREEDS AT FOUR LEVELS OF ESTRADIOL-17β

| Breed | Dosage Estradiol-17β 1 mg | 2 mg | 4 mg | 8 mg |
|---|---|---|---|---|
| Brahman | 3.8±2.2[a]b | 11.5±3.4 c | 11.7±5.2 c | 7.5±3.6 c |
| Brahman x Hereford | 1.3±0.4 b | 9.3±2.1 c | 24.7±8.2 d | 30.7±18.6 d |
| Hereford | 5.0±1.1 b | 11.3±2.9 c | 7.3±2.3 c | 43.0±11.7 d |

[a] Number of events ± standard error

b,c,d Mean stances within the same column and within the same row followed by a different letter differ significantly (P<.05).

TABLE 5. DURATION OF ESTRUS FOR THREE BREEDS AT FOUR LEVELS OF ESTRADIOL-17β

| Breed | Dosage Estradiol-17β 1 mg | 2 mg | 4 mg | 8 mg |
|---|---|---|---|---|
| Brahman | 3.78±1.73[a] | 15.12±2.15* | 9.97±0.88* | 4.10±1.97 |
| Brahman x Hereford | 2.55±2.50 | 6.40±1.03 | 10.64±1.40* | 13.85±1.90* |
| Hereford | 14.64±2.17* | 9.98±2.64* | 10.74±3.98* | 13.98±2.69* |

[a] Mean hrs ± standard error

* P<.05

TABLE 6. RESPONSE TIME FOR THREE BREEDS AT FOUR LEVELS OF ESTRADIOL-17β

| Breed | Dosage Estradiol-17β 1 mg | 2 mg | 4 mg | 8 mg |
|---|---|---|---|---|
| Brahman | 19.59±1.48[a] | 16.75±6.39 | 26.00±7.37 | 20.20±5.88 |
| Brahman x Hereford | 16.19±3.05 | 11.52±0.98* | 13.85±1.52* | 10.22±2.16* |
| Hereford | 5.49±0.99* | 10.81±1.48* | 12.75±3.70* | 10.61±1.03* |

[a] Mean hours ± standard error

* P<.05