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EFFECT OF BREED AND SEASON ON THE ABILITY OF
THE CORPUS LUTEM TO PRODUCE PROGESTERONE

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SUMMARY

Brahman cows had smaller corpora lutea (CL), the tissue on the ovary
that produces progesterone and maintains pregnancy, than did Hereford x
Holstein cows. Both breeds had heavier CL's in the winter than in the
summer. Brahman CL's had more progesterone during the winter than during
the summer as did the Hereford x Holstein CL's. When the cells were
dispersed and placed with luteinizing hormone in the laboratory Hereford x
Holstein CL cells released a greater amount of progesterone than did
Brahman CL cells. The progesterone release from CL cells from both breeds
was lower during the winter than during the summer. The depression of CL
progesterone production due to winter was found in both breeds but the
significance is that the Brahman was very low during the winter.

MATERIALS AND METHODS

Six Brahman and six Hereford x Holstein heifers, having normal estrous
cycles, had corpora lutea removed on day 13 after estrus within 20 days of
the longest day (summer) and again within 20 days of the shortest day (winter).
Each corpus luteum was removed by mid flank laparotomy. Each corpus luteum
was blotted, weighed, and divided. One half was snap frozen and stored for
progesterone analysis. The other half was placed in ice cold Ham's Nutrient
Mixture F-10 and subsequently sliced into .5 mm sections using a Stadie
Riggs microtome. The first and last slice of the luteal tissue was discarded
in order to minimize the amount of capsular material placed in culture. The
luteal slices were then transferred to a spinning flask of medium and warmed
to 32 C. The tissue was then dispersed by using collagenase and the con-
centration of cells determined. The cells were then incubated (100,000 cells/
tube) with 0, 1, 5, 10, 50, 100, 500 or 1000 μg of luteinizing hormone per
tube. Dispersed cells were then incubated for 1 hour at 37 C in a Dubnoff
Metabolic shaker. At the end of the incubation the medium was removed from
the cells and frozen for progesterone analysis by radioimmunoassay.

RESULTS

Brahman CL were more deeply imbedded in the ovary and had a less distinct papillum than CL of the Hereford x Holstein heifers. Corpus luteum weight was greater (P<.001) in Hereford x Holstein heifers than in Brahman heifers (Table 1). There was a tendency for CL weight to be greater during the winter than in the summer.

Corpus luteum progesterone concentrations (μg progesterone/g tissue) expressed on a wet luteal tissue basis varied (P<.10) between breeds (Table 2). A seasonal effect was observed in the Brahman but not in the Hereford x Holstein heifers. Summer CL progesterone concentrations were lower than in the winter in the Brahman heifers.

Progesterone content expressed on a whole CL basis varied (P<.01) with both breed and season (Table 3). Corpus luteum progesterone content was greater in Hereford x Holstein than Brahman and greater in winter than in summer.

Luteal cell viability in the dispersed cell culture did not differ by breed, season or LH dosage. The minimal LH dosage to stimulate the cells was 5 ng in both breeds at both seasons. Although the minimal LH dosage was similar between breeds and seasons, the amount of progesterone released at the 5 ng LH level varied with both breed and season (Figure 1, Table 4). The Hereford x Holsteins winter level exceeded their summer level while the reverse was true of the Brahmans.

Maximal release of progesterone was associated with the 500 ng LH dose level for the Hereford x Holstein during both the summer and winter; however, maximal release of progesterone by cells from the Brahman CL occurred at 100 ng LH during the summer and 50 ng LH during the winter (Table 5). These data indicate that a change in the sensitivity of the Brahman CL to stimulation by LH occurs from summer to winter.

The magnitude of progesterone change was greatest for the Hereford x Holstein during the summer, followed by the Hereford x Holstein winter, followed by the Brahman summer and least in the Brahman winter CL (Table 6).

Table 1. Effect of breed and season on corpus luteum (CL) weight.

| | CL weight (g) | |
| | Brahman | Hereford x Holstein |
Season	Mean ± SE[a]	Mean ± SE
Summer	$2.74 \pm .10^b$	$4.58 \pm .44^c$
Winter	$3.01 \pm .29^b$	$5.11 \pm .49^c$

[a]SE = standard error of the mean.

[b,c]Means ± SE followed by different letters differ (P<.001).

Table 2. Effect of season and breed on corpus luteum progesterone concentration.

| | Progesterone Concentration (µg/g) | |
| | Brahman | Hereford x Holstein |
Season	Mean ± SE[a]	Mean ± SE
Summer	30.8 ± 2.8^b	39.0 ± 7.1^d
Winter	52.6 ± 7.8^c	40.4 ± 1.9^d

[a]SE = standard error of the mean.

[b,c,d]Means ± SE followed by different letters differ (P<.10).

Table 3. Effect of breed and season on total CL progesterone content.

| | Progesterone (µg/CL) | |
| | Brahman | Hereford x Holstein |
Season	Mean ± SE[a]	Mean ± SE
Summer	104.0 ± 5.3^b	174.1 ± 35.9^d
Winter	153.2 ± 20.8^c	201.9 ± 9.5^e

[a]SE = standard error of the mean.

[b,c,d,e]Means ± SE followed by different letters differ (P<.01).

Table 4. Effect of breed and season on the progesterone concentration at 5 ng LH.

| | Progesterone (ng/10^5 cells/hr) | |
| | Brahman | Hereford x Holstein |
Season	Mean ± SE[a]	Mean ± SE
Summer	34.5 ± 3.0	44.2 ± 5.1
Winter	21.5 ± 2.2	55.0 ± 5.5

[a]SE = standard error of the mean.

Table 5. Effect of breed and season on the LH dose required for maximal progesterone release and the associated progesterone concentration.

| | Breed | | | |
| | Brahman | | Hereford x Holstein | |
Season	LH dose (ng)	Progesterone Mean ± SE[a]	LH dose (ng)	Progesterone Mean ± SE
Summer	100	66.1 ± 7.0	500	109.2 ± 5.8
Winter	50	40.1 ± 4.0	500	98.7 ± 10.6

[a]SE = standard error of the mean.

Table 6. Effect of breed and season on magnitude of progesterone change.

| | Breed | |
| | Brahman | Hereford x Holstein |
Season	Mean ± SE[a]	Mean ± SE
Summer	43.9 ± 5.6[b]	82.7 ± 2.0[d]
Winter	26.8 ± 2.2[c]	73.3 ± 5.8[e]

[a]SE = standard error of the mean.

[b,c,d,e]Means ± SE followed by different letters differ (P<.05).

21

FIGURE 1. EFFECT OF BREED AND SEASON ON PROGESTERONE RESPONSE OF LH CHALLENGED LUTEAL CELLS

● HEREFORD × HOLSTEIN - SUMMER
○ HEREFORD × HOLSTEIN - WINTER
▲ BRAHMAN - SUMMER
△ BRAHMAN - WINTER