IMMUNIZATION OF BEEF HEIFERS AGAINST GnRH PREVENTS PREGNANCY

J.A. Vizcarra[1] and R.P. Wettemann[2]

Story in Brief

Ninety Angus x Hereford heifers were used to determine the effect of immunization against GnRH on ovarian activity, pregnancy rate, body weight (BW), and production of granulomas at the site of injection (MGS). Heifers were blocked by BW, body condition score (BCS) and luteal activity and assigned to three treatments. Heifers (30 per treatment) received a primary immunization against GnRH conjugated to ovalbumin (OA-GnRH) or immunization against the carrier protein (control) which was emulsified in Freund's incomplete adjuvant and DEAE dextran. The control heifers and the two booster group were given immunizations at wk 3 and 6 after the primary immunization. A three booster group received booster immunizations at wk 3, 6 and 16. Heifers were exposed to fertile bulls from wk 8 until the end of the experiment (wk 32). Weekly blood samples were taken to determine concentrations of progesterone. After wk 6 of treatment, none of the immunized heifers had luteal activity while 61% of the control heifers had reached puberty. By wk 31 of treatment, 52% of the heifers that received two booster immunizations had luteal activity, none of the heifers that received three booster immunizations were cycling while 81% of control heifers had luteal activity. At wk 32, 62% and 13% of the heifers immunized against GnRH with two or three boosters, respectively, were pregnant, while 83% of the control heifers were pregnant. In summary, primary and three booster immunization against GnRH using OA as a carrier protein emulsified in Freund's incomplete adjuvant and DEAE dextran suppressed ovarian activity and prevented pregnancy for 23 weeks.

(Key Words: Heifers, Immunization, GnRH, Pregnancy.)

Introduction

Proper gonadal function in beef cattle depends on gonadotropins secreted from the pituitary gland in a pulsatile manner. The hypothalamus, in turn, controls the secretion of gonadotropins by the pulsatile secretion of gonadotropin releasing hormone (GnRH) into the portal circulation of the pituitary (Knobil, 1989). Active immunization of heifers against GnRH results in delayed puberty and causes cessation of estrous cycles (Wettemann and

[1] Research Associate [2]Regents Professor

Castree, 1994). Conjugation of GnRH to ovalbumin emulsified in Freund's incomplete adjuvant and DEAE dextran is an effective method to produce a maximal antibody response with minimal granuloma production at the site of injection (Duggan et al., 1992; Vizcarra and Wettemann, 1994). The objectives of the present experiment were to evaluate the effectiveness of immunization against GnRH to prevent luteal activity and pregnancy in beef heifers.

Materials and Methods

Ninety Angus x Hereford heifers weighing 300 ± 6 kg were used. Heifers were blocked by body weight (BW), body condition score (BCS; 1=emaciated, 9=obese) and luteal activity. Heifers (30 per treatment) received a primary immunization against GnRH conjugated to ovalbumin (OA-GnRH) or immunization against the carrier protein (control). All antigens were emulsified in Freund's incomplete adjuvant and DEAE dextran. Heifers on the two booster immunizations treatment were given booster immunizations against OA-GnRH at wk 3 and 6 after the primary immunization. Heifers that received three booster immunizations were treated on wk 3, 6 and 16. Control heifers received two booster immunizations on 3 and 6 weeks. Primary and booster immunization injections (4 mL) were given subcutaneously and that intradermally at six sites in the mammary gland. Heifers were exposed to fertile bulls on wk 8 until the end of the experiment (wk 32). Concentrations of progesterone in weekly blood samples were determined by radioimmunoassay and were used to assess luteal ovarian function. Mammary gland score (MGS; 1=no granuloma production 6=open lesions) and BW was recorded every 28 d. The effect of treatment on percentage of heifers cycling, antibody titers and BW were analyzed by split plot analyses of variance (main plot was treatment, subplot was week) and orthogonal contrasts were used to determine differences between treatment means.

Results and Discussion

Luteal activity was suppressed after 6 wk of treatment in heifers immunized against GnRH while 61% of the control animals were cycling (Figure 1). By wk 31, 52% of the heifers that received two booster immunizations had luteal activity, none of the heifers that received three booster immunizations were cycling, while 81% of the control heifers had luteal activity. After heifers were exposed for 24 wk to fertile bulls, 83% of control heifers became pregnant, and 62% of the heifers that received two booster immunization became pregnant. Only 13% of the heifers that received three booster immunizations became pregnant by wk 32 after the primary immunization (Table 1).

Antibody titers against GnRH (1:10,000 dilution) were increased (P<.01) after the first booster immunization in treated heifers. Heifers that received two booster immunizations had greater antibody titers for 13 wk after the first booster when compared with control heifers. Heifers that received three booster immunizations had greater antibody titers for 28 wk after first booster when compared with control heifers (Figure 2).

BW was influenced by treatment (Figure 3). Control heifers gained more weight than heifers that received either two or three booster immunizations against GnRH (P<.01; $.54^{a}$, $.46^{b}$ and $.40^{b}$ kg/d, respectively). The increased weight gain was associated with pregnancy. For instance at wk 28, 83% of the control heifers were at an average of 122 ± 3 days of pregnancy whereas most treated heifers were not pregnant. Mammary gland score was increased after the primary immunization indicating the presence of granulomas at the site of injection and it was greater in heifers that received three booster immunizations as compared with control heifers.

In summary, immunization against GnRH conjugated to ovalbumin with three booster immunizations prevented luteal activity and pregnancy for 23 consecutive weeks in all treated heifers. This procedure is an effective tool to prevent pregnancies and estrous cycles in stocker heifers.

Literature Cited

Duggan, S.L. et al. 1992. Okla. Agr. Exp. Sta. Res. Rep. MP-136:389.

Knobil, E. 1989. J. Steroid Biochem. 33:669.

Vizcarra, J.A. and R.P. Wettemann. 1994. Okla. Agr. Exp. Sta. Res. Rep. P-939:213.

Wettemann, R.P. and J.W. Castree. 1994. Anim. Reprod. Sci. 36:49.

Figure 1. Percentage of control and GnRH immunized (2 or 3 booster) heifers cycling at weeks after the primary immunization against GnRH.

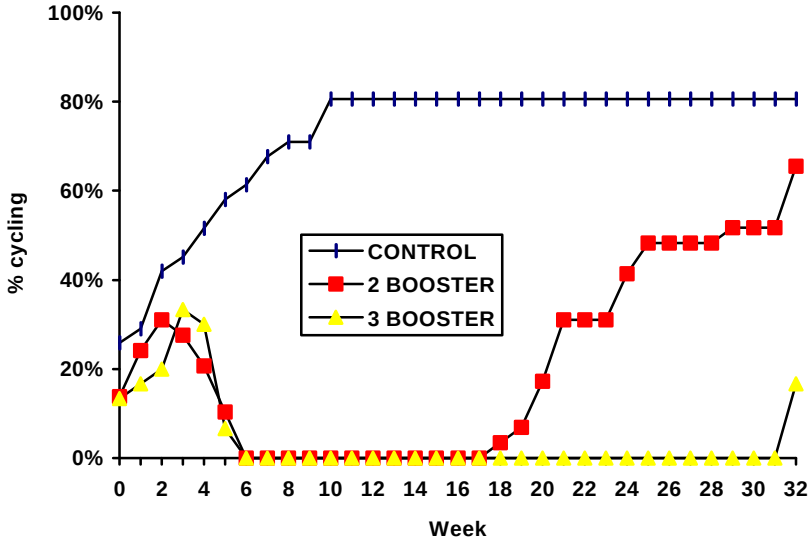

Figure 2. Effect of immuniztion on antisera titers against GnRH (1:10,000 dilution) at weeks after the primary immunization.

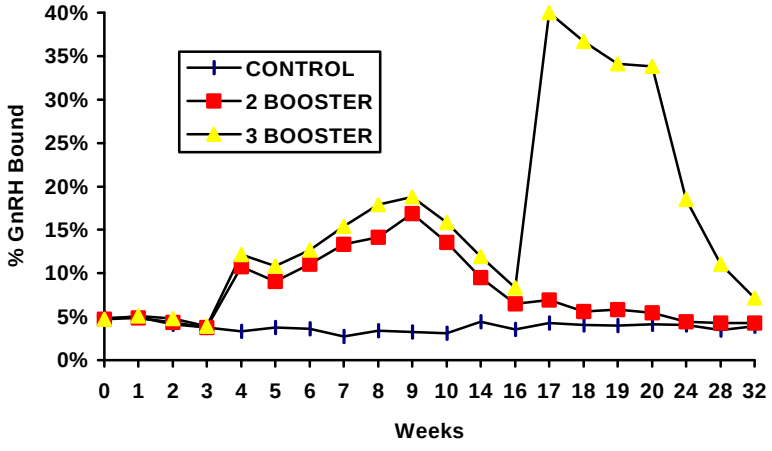

Figure 3. Body weight (BW) of control and GnRH-immunized (2 or 3 boosters) heifers at weeks after the primary immunization.

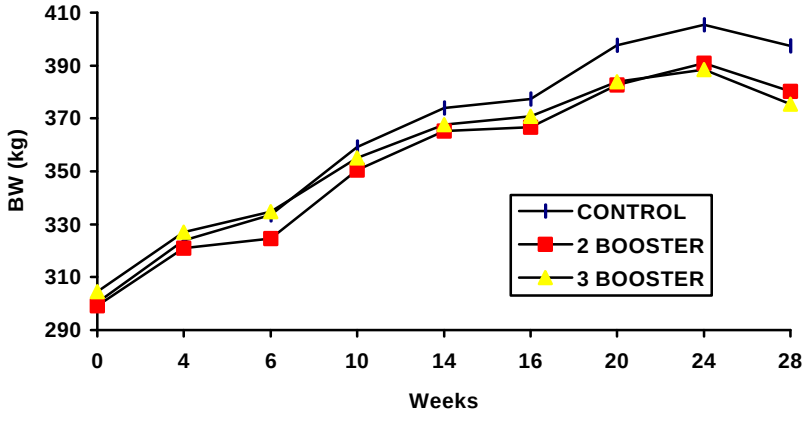

Table 1. Pregnancy rate of control and GnRH immunized (2 or 3 booster) heifers that were exposed to fertile bulls for 24 wk commencing on 8 wk after the primary immunization.

Treatment	Heifers No.	Pregnant at wk 16 of trt, %	Pregnant at wk 32 of trt, %
Control	30	83	83
2 Booster	29	0	62
3 Booster	30	0	13