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VARIOUS ESTRUS-SYNCHRONIZATION PROGRAMS FOR HEIFERS

J. S. Stevenson

Summary

Various programs of estrus synchronization have been tested during the last 6 years to determine the least costly and most efficacious for dairy heifer replacements. Four systems were tested: 1) a modified Ovsynch treatment (GnRH 7 days before PGF_{2α} followed by GnRH either at 24, 30, 33, 40, or 48 hr, with one fixed-time insemination 16 to 20 hr later); 2) a similar protocol that used GnRH 7 days before PGF_{2α} followed by insemination at estrus (GnRH+PGF_{2α}); 3) inseminations after one or two injections of PGF_{2α} given 14 days apart (PGF_{2α}; heifers not detected in estrus after the second of two PGF_{2α} injections were given one fixed-time insemination at 72 hr); and 4) two injections of PGF_{2α} given 14 days apart followed by GnRH at 33 hr, with one fixed-time insemination 16 to 18 hr later (2×PGF_{2α}+GnRH). The PGF_{2α} treatment in which heifers were inseminated after detected estrus following one or two injections of PGF_{2α} was the least costly for heifers and produced the best measures of fertility.

(Key Words: GnRH, PGF_{2α}, Estrus Synchronization, Heifers.)

Introduction

During the last 20 years, various estrus-synchronization programs have been tested to control precisely the onset of estrus and facilitate the use of A.I.-breeding and fixed-time inseminations. In the past 5 years, the hypothalamic decapeptide, gonadotropin-releasing hormone (GnRH) has been used in various schemes to control follicular development in conjunction with PGF_{2α} to control the life span of the corpus luteum. Three GnRH products (Cystorelin®, Factrel®, and Fertagyl®) and two PGF_{2α} prod-

ucts (Lutalyse® and Estrumate®) are available currently. Together, both hormones offer several options in controlling the estrous cycle in dairy heifers before A.I.-breeding. The objective of this brief report is to summarize the results for heat-detection, conception, and pregnancy rates achieved in four different programmed-breeding systems.

Procedures

Holstein heifers housed at the Kansas State University Dairy Teaching and Research Center were used in various experiments between 1991 and 1997. Heifers ranged in age from 11 to 16.5 months (avg = 13.4 months) and in weight from 745 to 1133 lb (avg = 880 lb) near the onset of each experiment. Descriptions of the various treatments are found in Figure 1. The dose of PGF_{2α} used was 25 mg (5 ml of Lutalyse®, Pharmacia & Upjohn, Kalamazoo, MI). The dose of GnRH was 100 µg (Cystorelin®, Rhone-Merieux, Athens, GA). Pregnancy was diagnosed by palpation of the uterus and its contents between 38 and 52 days after insemination.

Results and Discussion

Results of these experiments are summarized in Table 1. Rates of heat detection were less ($P<.05$) in the modified Ovsynch and 2×PGF_{2α}+GnRH treatments than in the GnRH+PGF_{2α} and PGF_{2α} treatments because the GnRH injection given at 24, 30, 33, 40, or 48 hr after PGF_{2α} in the modified Ovsynch treatment produced expression of estrus in only 14.2, 0, 20, 61.5, or 52.2% of the heifers treated at those times, respectively. Reports indicate that some heifers show heat between the injections of GnRH and PGF_{2α}; however, similar heat-detection rates occur whether intervals between GnRH and PGF_{2α} are 6 or 7 days.

The LH released from the pituitary gland in response to GnRH will prevent further secretion of estradiol-17 by the maturing preovulatory ovarian follicle and thus prevent some sexual behaviors associated with estrus. Detection of heifers in estrus following the GnRH+PGF_{2α} hormonal sequence is very good and compares to that when heifers receive two injections of PGF_{2α} (78.7%). In contrast, the combined heat-detection rate of heifers detected after one injection of PGF_{2α} (inseminated at that time) and those detected after the second of two PGF_{2α} injections improves to 93.3%.

Conception rates (based on those inseminated after detection of estrus or at one fixed time) were reduced ($P<.05$) in the modified Ovsynch and the 2×PGF_{2α}+GnRH treatments compared to the other two treatments (Table 1). This reduction in conception rate in the latter treatments generally occurs because all inseminations are given at one fixed time compared to most inseminations

made after detected estrus in the other two treatments (GnRH+PGF_{2α} and PGF_{2α}). The best conception rate occurred in the GnRH+PGF_{2α} treatment, where all inseminations were made after detected estrus; however, even in the PGF_{2α} treatment, inseminations made at 72 hr after the second PGF_{2α} injection in the absence of detected estrus actually produced an acceptable conception rate (15 of 20 or 75%) compared to that after detected estrus (15 of 27 or 55.6%). Pregnancy rates followed very closely results for conception rates. Regardless of the method used, the total pregnancy rates after repeat inseminations exceeded 90% in each treatment.

When comparing the per-heifer cost of hormones used in the various treatments, the modified Ovsynch system is most expensive (\$15). The remaining treatments, in order of hormonal cost, are: 2×PGF_{2α}+GnRH = \$12; GnRH+PGF_{2α} = \$9; and PGF_{2α} = \$3-6 (depending on whether the heifer is detected in heat after the first or second PGF_{2α} injection). Based on the economics of treatments, the PGF_{2α} treatment is the least costly method that seems to maximize measures of fertility with the least handling of each heifer before insemination.

Table 1. Reproductive Performance of Holstein Heifers after Various Programs

Item ²	Treatments ¹			
	Modified Ovsynch	GnRH+PGF _{2α}	PGF _{2α}	2×PGF _{2α} +GnRH
No. of heifers	88	60	77	25
Estrus-detection rate, %	31.7 ^a	87.4 ^b	83.7 ^b	20.9 ^a
Conception rate, %	39.3 ^a	71.6 ^b	61.3 ^b	55.8 ^{ab}
Pregnancy rate, %	40.5 ^a	61.7 ^b	59.0 ^b	55.5 ^{ab}
Total pregnancy, %	98.0	95.8	91.4	95.3
No. of handlings (per heifer)	3	2	1-2	3
Cost of hormones ³ , \$	15	9	3-6	12

¹See Figure 1 for descriptions of treatments.

²Estrus-detection rate = proportion of heifers detected in heat during the 72-hr detection period of the total assigned to treatment. Conception rate = proportion of heifers detected in heat and inseminated that became pregnant. Pregnancy rate = proportion of heifers that became pregnant during the 72-hr detection period of the total assigned to treatment. Total pregnancy = proportion of treated heifers eventually conceiving in the herd after repeat inseminations.

³Veterinary costs for PGF_{2α} = \$3 and GnRH = \$6.

^{a,b}Percentages with different superscript letters differ ($P<.05$).

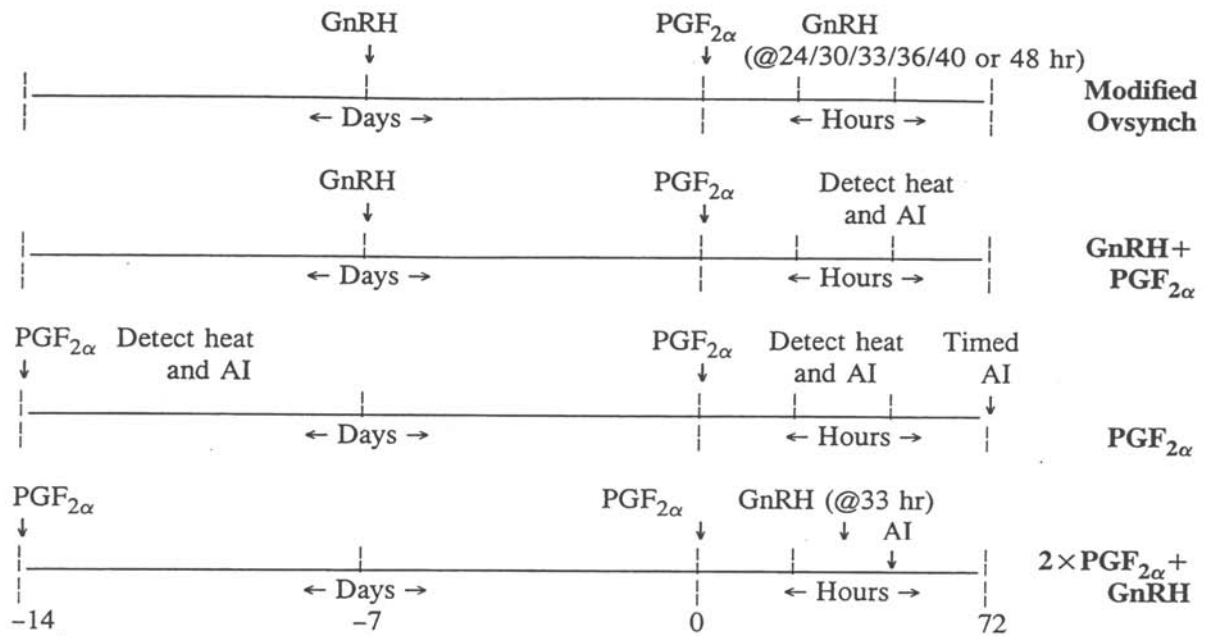


Figure 1. Experimental Protocols. Modified Ovsynch = GnRH 7 days before PGF₂; second GnRH given at either 24, 30, 33, 40, or 48 hr after PGF₂; insemination between 16 and 20 hr after GnRH. GnRH + PGF₂ = GnRH 7 days before PGF₂; insemination after detected estrus. PGF₂ = two injections of PGF₂ given 14 days apart; insemination followed detected estrus after either the first or second injection of PGF₂. Any heifer not detected in estrus by 72 hr received a fixed-time insemination at 72 hr. 2xPGF₂ + GnRH = two injections of PGF₂ given 14 days apart; GnRH given 33 hr after the second PGF₂ injection; insemination 16 to 18 hr after GnRH.