J. Dairy Sci. 88:399–405

Inseminations at Estrus Induced by Presynchronization Before Application of Synchronized Estrus and Ovulation*

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ABSTRACT

A controlled field study examined conception rates after 2 timed artificial insemination (TAI) breeding protocols conducted on 2 commercial dairy farms. Estrous cycles in postpartum lactating cows were presynchronized with 2 injections of $PGF_{2\alpha}$ given 14 d apart (Presynch) and then, after 12 d, the standard Ovsynch protocol (injection of GnRH 7 d before and 48 h after an injection of $PGF_{2\alpha}$, with one TAI at 12 to 16 h after the second GnRH injection) or Heatsynch protocol [injection of GnRH 7 d before an injection of PGF_{2a}, followed 24 h later by 1 mg of estradiol cypionate (ECP) and one TAI 48 h after ECP] was applied. Experimental design allowed artificial insemination to occur anytime after the second Presynch injection and during the designed breeding week when estrus was detected. Of the 1846 first services performed, only 1503 (rate of compliance = 81.4%) were performed according to protocol. Numbers of cows inseminated, logistic-regression adjusted conception rates, and days in milk (DIM) were for inseminations made: 1) during 14 d after first Presynch injection (n = 145; 22.6%; 54 ± 0.4 DIM); 2) during 12 d after second Presynch injection (n = 727; 33%; 59 ± 0.2 DIM); 3) during 7 d after the first GnRH injection of Ovsynch or Heatsynch (n = 96; 32.1%; 74 ± 0.5 DIM); 4) after estrus as part of Heatsynch (n = 212; 44.6%; 76 ± 0.3 DIM); 4) after TAI as part of Heatsynch (n = 154; 21.1%; 76 ± 0.4 DIM); 5) after estrus as part of Ovsynch (n = 43; 48.7%; 77 ± 0.7 DIM); and 6) after TAI as part of Ovsynch (n = 271; 24.4%; 77 ± 0.3 DIM). Conception rates when AI occurred after one Presynch injection were less than when AI occurred after 2 Presynch injections. Conception rates for those inseminated after either Presynch injection did not differ from those inseminated after combined Heatsynch + Ovsynch. Cows in the Ovsynch and Heatsynch protocols inseminated after estrus during the breeding week had greater conception rates than those receiving the TAI, but overall conception rates did not differ between protocols. Among cows inseminated after detected estrus, conception was greater for cows in the Heatsynch + Ovsynch protocol (77 ± 0.4 DIM) than for those inseminated after either Presynch injection (54 ± 0.4 or 59 ± 0.2 DIM). We concluded that conception rates after Heatsynch and Ovsynch were similar under these experimental conditions, and that delaying first AI improved fertility for cows inseminated after detected estrus.
(**Key words:** calving difficulty, compliance, conception, synchronized estrus)

Abbreviation key: CDS = calving difficulty score, **ECP** = estradiol cypionate, **Heatsynch** = injection of GnRH 7 d before an injection of $PGF_{2\alpha}$, followed 24 h later by 1 mg of ECP and one fixed-time AI 48 h after ECP, **Ovsynch** = injection of GnRH 7 d before and 48 h after an injection of $PGF_{2\alpha}$, with one timed AI at 12 to 16 h after the second GnRH injection, **TAI** = timed AI, **VWP** = voluntary waiting period.

INTRODUCTION

Various programmed-breeding protocols have been developed to synchronize estrus and ovulation in lactating dairy cows to initiate first services. These include the standard **Ovsynch** protocol (Pursley et al., 1997a) and variations that may include estrogen administration to induce estrus during the breeding week (**Heatsynch**; Pancarci et al., 2002). Recently, the only estrogen product in the United States (estradiol cypionate; **ECP**) was removed from the market. In general, conception or pregnancy rates after either of these 2 protocols are similar (Pancarci et al., 2002; Stevenson and Tiffany, 2004). When estrous cycles are presynchronized (Moreira et al., 2001; El-Zarkouny et al., 2004) or staged according to days of the estrous cycle (Vasconcelos et al., 1999) so that a majority of cows are in mid-diestrus (d 5 to 12) at the onset of the Ovsynch protocol, resulting pregnancy rates are enhanced, compared with those of cows beginning the Ovsynch protocol at random stages of the estrous cycle.

Received July 13, 2004.
Accepted August 18, 2004.
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*Contribution Number 04-442-J, from the Kansas Agricultural Experiment Station, Manhattan.

The question often asked is whether it is advisable to inseminate cows earlier during the administration of these protocols when estrus is detected after either of the Presynch injections of $PGF_{2\alpha}$ and the cow is at or near the end of the voluntary waiting period (**VWP**). Conception rates for cows inseminated after estrus tend to be greater (Stevenson et al., 1996; 1999; DeJarnette et al., 2001) or similar to those of cows receiving timed AI (**TAI**; Pursley et al., 1997b) to which are applied various Ovsynch-like protocols.

A related question is what is the ideal VWP to be applied on individual dairy farms or in the industry today, when most cows are inseminated after some controlled breeding program. Earlier studies (before application of controlled-breeding programs) in which cows were submitted for AI at predetermined DIM generally reported a significant or numerical trend for increased conception after a longer VWP (Whitmore et al., 1974; Britt, 1977; Stevenson et al., 1983). A recent study was conducted in which low- and high-producing dairy cows were inseminated at different DIM as part of the Ovsynch protocol (Tenhagen et al., 2003). In both milk-production groups, conception rates were improved by delaying first services 3 wk from 53 to 59 (14.4%) to 73 to 81 DIM (34.5%) for low-producing cows and from 73 to 81 (28.2%) to 94 to 102 DIM (41.4%) for high-producing cows, respectively.

The objective of our study was to determine pregnancy outcomes of 2 standard breeding protocols (Ovsynch and Heatsynch) in which estrous cycles were presynchronized with 2 injections of $PGF_{2\alpha}$ (Presynch) and inseminations occurred whenever estrus was detected anytime after the second Presynch $PGF_{2\alpha}$ injection. Ancillary objectives were to determine compliance to the designed protocols and whether DIM was a significant factor in accounting for different conception rates.

MATERIALS AND METHODS

Management of Cows

A controlled study was conducted at 2 (dairy #3 and dairy #5) of 5 Foster Dairy Farms, Hickman, CA. Lactating Holstein cows (n = 1846) that calved between February 2, 2001, and February 1, 2002, were included in the study, consisting of first postpartum inseminations conducted between March 22, 2001 and April 28, 2002. All 5 Foster Dairy Farm herds were managed similarly by one central management team, having different herdsmen and inseminators at each dairy. All cows at each dairy were fed a TMR to meet or exceed requirements recommended for lactating dairy cows (NRC, 1989). Diets were mixed from common ingredients located at dairy #2 to feed cows at dairy #2 and #3 or at dairy #5 to feed cows at dairy #4, #5, and #6. Diets consisted of alfalfa, soybean meal, bypass soya, corn silage, barley, flaked corn, brewer's grains, beet pulp, and added minerals. Cows were milked and fed three times daily so fresh feed was available when cows returned to pens from the milking parlor after each milking (0400, 1200, and 2000 h). No recombinant bST was used in these herds.

Experimental Design

The study was designed to compare conception rates of lactating dairy cows inseminated at first service in response to 2 estrus- and ovulation-synchronization protocols [Ovsynch (injections of GnRH 7 d before and 48 h after $PGF_{2\alpha}$) and Heatsynch (injection of GnRH 7 d before and an injection of ECP 24 h after $PGF_{2\alpha}$)]. Before applying each protocol, estrous cycles of cows were presynchronized by using 2 injections of $PGF_{2\alpha}$ (13 to 15 d apart; Presynch), with the second Presynch injection occurring 11 to 12 d before initiating either of the 2 protocols. Cows were assigned to begin the Presynch injection sequence based on calving dates, grouped into breeding clusters every 10 d, beginning no sooner than 40 DIM. Doses and sources of hormones were: $PGF_{2\alpha}$ (25 mg; Lutalyse, Pharmacia Animal Health, Kalamazoo, MI); estradiol cypionate (1 mg; ECP; Pharmacia Animal Health), and GnRH (100 μg; Cystorelin, Merial Ltd., Iselin, NJ). All hormones were administered i.m. into the gluteal muscles.

Experimental protocols were designed for insemination of cows after detected estrus that occurred: 1) during 12 d after the second of 2 Presynch injections; 2) during 7 d after the first GnRH injection of Ovsynch or Heatsynch (some received $PGF_{2\alpha}$ 7 d later and were inseminated that day); or 3) during the breeding week when the ECP injection of Heatsynch or the second GnRH injection of Ovsynch was administered. Therefore, any cow that was detected in estrus 24 or more hours after the $PGF_{2\alpha}$ injection of the Ovsynch or Heatsynch protocol was eligible for insemination by design. In the absence of previous AI, cows in the Ovsynch protocol were inseminated at 12 to 16 h after the second GnRH injection and those in the Heatsynch protocol were inseminated at 48 h after ECP.

All hormonal injections and their dates of administration, calving difficulty scores (**CDS**), calving and breeding dates, AI at estrus or TAI, pregnancy outcomes, etc., were recorded in DHI records (DHI-Provo). As a result, actual dates of hormonal injections and inseminations could be verified to determine protocol compliance. Of the 1846 inseminations recorded during the experimental period, some cows were inseminated contrary to study design.