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A resynchronization of ovulation program based on ovarian structures present at nonpregnancy diagnosis reduced time to pregnancy in lactating dairy cows

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ABSTRACT

Our objective was to evaluate time to pregnancy after the first service postpartum and pregnancy per artificial insemination (P/AI) in dairy cows managed with 2 resynchronization of ovulation programs. After first service, lactating Holstein cows were blocked by parity (primiparous vs. multiparous) and randomly assigned to the d 32 Resynch (R32; n = 1,010) or short Resynch (SR; n = 1,000) treatments. Nonpregnancy diagnosis (NPD) was conducted 32 ± 3 d after AI by transrectal ultrasonography. Nonpregnant cows in R32 received the Ovsynch protocol: GnRH, $PGF_{2\alpha}$ 7 d later, GnRH 56 h later, and timed AI (TAI) 16 to 18 h later. Cows in SR with a corpus luteum (CL) ≥15 mm and a follicle ≥10 mm at NPD received $PGF_{2\alpha}$, $PGF_{2\alpha}$ 24 h later, GnRH 32 h later, and TAI 16 to 18 h later. Cows in SR without a CL ≥15 mm or a follicle ≥10 mm at NPD received a modified Ovsynch protocol with 2 $PGF_{2\alpha}$ treatments and progesterone (P4) supplementation (GnRH plus CIDR, $PGF_{2\alpha}$ and CIDR removal 7 d later, $PGF_{2\alpha}$ 24 h later, GnRH 32 h later, and TAI 16 to 18 h later). Blood samples were collected from a subgroup of cows at the GnRH before TAI (R32 = 114; SR = 121) to measure P4 concentration. Binomial outcomes were analyzed with logistic regression and hazard of pregnancy (R32 = 485; SR = 462) with Cox's proportional regression in SAS (SAS Institute, Cary, NC). For P/AI analysis, the TAI service was the experimental unit (R32 = 720; SR = 819). Models included treatment and parity as fixed effects and farm as random effect. The hazard of pregnancy was greater for the SR treatment (hazard ratio = 1.18; 95% confidence interval: 1.01–1.37). Median time to pregnancy was 95 and 79 d for the R32 and SR treatments, respectively. At NPD, 71.3 and 71.2% of cows had a CL for the R32 and SR treatments, respectively. Treatment did not affect overall P/AI 32 ± 3 d after AI (R32 = 31.0% vs. SR = 33.9%) or for cows with a CL at NPD (R32 = 32.7% vs. SR = 32.8%). For cows with no CL at NPD, P/AI was greater for the SR treatment (36.9%) than for the R32 treatment (28.6%). Pregnancy loss from 32 to 63 d after AI was similar for all services combined (R32 = 8.3% vs. SR = 10.4%) and for cows with no CL at NPD (R32 = 13.2% vs. SR = 7.2%) but tended to be affected by treatment for cows with a CL at NPD (R32 = 6.8% vs. SR = 11.9%). Treatment affected the proportion of cows with P4 ≤0.5 ng/mL at the GnRH before TAI for all cows (R32 = 68.4% vs. SR = 81.8%), tended to have an effect among cows with a CL (R32 = 70.0% vs. SR = 81.8%), and had no effect for cows with no CL (R32 = 64.7% vs. SR = 81.8%). We concluded that the SR program reduced time to pregnancy because of a reduction of the interbreeding interval for cows with a CL at NPD and greater P/AI in cows with no CL at NPD.

Key words: resynchronization, corpus luteum, dairy cow, timed artificial insemination

INTRODUCTION

Dairy farm profitability depends on the reproductive performance of cows, which is primarily determined by the rate at which they become pregnant after the end of the voluntary waiting period. Despite recent gains on first-service pregnancy per AI (**P/AI**) due to improved dairy herd management (Wiltbank and Pursley, 2014), a substantial proportion of cows need immediate reinsemination after the first service. Therefore, to minimize the interbreeding interval, many farms use reproductive management strategies for second and greater AI services that combine insemination at detected estrus and timed AI (**TAI**) after resynchronization of ovulation with Ovsynch-type protocols (Pursley et al., 1995; commonly referred to as Resynch). These protocols are usually initiated at the time of or 7 d before nonpregnancy diagnosis (**NPD**; Fricke et al., 2003; Bartolome et al., 2005; Giordano et al., 2012c).

Farms that combine AI at detected estrus and TAI can initiate Resynch as early as 25 ± 3 d after AI. Although

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this strategy can be beneficial because it shortens the interbreeding interval for cows that receive TAI, the first GnRH treatment of the protocol coincides with the time at which many cows are expected to display estrus (Remnant et al., 2015; Wijma et al., 2017). The GnRH-induced LH surge reduces estrus expression (Mendonça et al., 2012; Bruno et al., 2014; Wijma et al., 2017) through induction of ovulation or by suppressing the estradiol surge responsible for estrus behavior (Jo and Fortune, 2003). Further, the pregnancy status of cows at the time of the GnRH treatment 25 ± 3 d after AI is unknown. Therefore, many pregnant cows receive an unnecessary treatment, thus increasing treatment costs and disrupting cow normal behavior.

To take advantage of a short interbreeding interval for TAI services while avoiding a reduction in the proportion of cows undergoing AI at detected estrus before NPD and unnecessary treatment of pregnant cows with GnRH, we evaluated a reproductive management strategy based on the ovarian structures present at NPD 32 ± 3 d after AI (Wijma et al., 2017). Cows with a corpus luteum (**CL**) ≥15 mm and a follicle ≥10 mm at NPD (hereafter referred to as CL cows) received a resynchronization of ovulation protocol without an initial GnRH treatment to induce a new follicular wave (short Resynch; $PGF_{2\alpha}$, $PGF_{2\alpha}$ 1 d later, GnRH 32 h later, and TAI 16 to 18 h after GnRH). On the other hand, cows not expected to respond to the short Resynch protocol based on their ovarian status (i.e., no CL ≥15 mm or no follicle ≥10 mm; hereafter referred to as no-CL cows) received a modified Ovsynch protocol (i.e., 2 $PGF_{2\alpha}$ treatments 24 h apart) with progesterone (**P4**) supplementation. This management strategy was compared with a similar program in which all cows received GnRH treatment 7 d before NPD. Removing the GnRH treatment 25 ± 3 d after AI resulted in approximately 17% more cows inseminated at detected estrus, but it also resulted in a P/AI reduction of approximately 8 percentage points for TAI services in CL cows. Nevertheless, the cumulative proportion of cows pregnant after AI at detected estrus and TAI was similar because of the greater number of pregnancies generated through insemination of cows at detected estrus before NPD in the short Resynch treatment. Although results from this experiment (Wijma et al., 2017) were promising, additional research is needed to determine whether the strategy based on ovarian status at NPD is superior to traditional programs combining AI at detected estrus and TAI after blanket use of resynchronization of ovulation. Moreover, it is necessary to corroborate that removal of the initial GnRH treatment does not compromise P/AI for CL cows to an extent that may offset the benefit of shorter interbreeding interval.

Thus, we hypothesized that a resynchronization program based on ovarian structures present at the time of NPD (hereafter referred to as short Resynch) would reduce time to pregnancy when compared with blanket use of the d 32 Resynch protocol. Time to pregnancy would be reduced because of the shorter interbreeding interval for CL cows and increased P/AI for no-CL cows. Therefore, the objective of this experiment was to evaluate the effect of short Resynch on time to pregnancy after the first service, P/AI, and physiological outcomes before TAI.

MATERIALS AND METHODS

This experiment was conducted from February 2016 to May 2017 on 2 commercial dairy farms located in Tompkins and Cayuga counties in New York. All procedures were approved by the Animal Care and Use Committee of the College of Agriculture and Life Sciences at Cornell University (Ithaca, NY).

On both farms, cows were housed in freestall barns and were fed a TMR once a day with ad libitum access to feed and water. Farm A milked approximately 1,300 cows, with an average milk yield of approximately 43 kg/d. Cows were milked 3 times per day at approximately 8-h intervals until February 2017, when milking frequency changed to 4 times per day at approximately 6-h intervals. All cows received recombinant bST (500 mg of sometribove zinc; Posilac, Elanco Animal Health, Indianapolis, IN) at 10- or 11-d intervals beginning at 80 ± 3 DIM in primiparous cows and 110 ± 3 DIM in multiparous cows until dry-off. Primiparous cows received first service at 82 ± 3 DIM and multiparous cows received first service at 67 ± 3 DIM after synchronization of ovulation with the Double Ovsynch protocol (Souza et al., 2008). Farm B milked approximately 1,900 cows 3 times per day at approximately 8-h intervals and had an average milk yield per cow of approximately 42 kg/d. All cows received recombinant bST at 14-d intervals beginning at 60 ± 3 DIM until dry-off. Primiparous and multiparous cows were synchronized with the Presynch-Ovsynch protocol (Moreira et al., 2001). Cows were eligible to receive AI after the first and second $PGF_{2\alpha}$ treatments of Presynch-Ovsynch at 53 ± 3 and 67 ± 3 DIM, respectively, whereas cows not detected in estrus received TAI at 79 ± 3 DIM. During the experiment, 86.5% (1,103/1,274) of the cows enrolled received the first service at detected estrus, whereas the remaining 13.4% (171/1,274) of the cows received TAI.

Every week, cows that received a previous AI service were blocked by parity (primiparous vs. multiparous) and randomly assigned to the d 32 Resynch (**R32**) or