Research article

Resynchronization Strategies for Reproductive Management in Dairy Herds

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Home Messages:

- Inseminating second-service cows based on an observed return to estrus is the most economically efficient method for second insemination.
- Employing a resynchronization system will generally increase efficiency by reducing the interval between inseminations for cows that are not pregnant.
- If a resynchronization system is used then the most important considerations are:
- The interval between the first AI and the resynchronized AI;
- The conception rate of the resynchronized AI;
- The speed and accuracy of the pregnancy diagnosis method.
- The short resynchronization program reduced the time to pregnancy because of a reduction of the inter-insemination interval for cows with a CL at non-pregnancy diagnosis.

Key Words: Resynchronization of ovulation; short resynchronization programs; pregnancy per artificial insemination; inter-insemination interval; dairy cows

Introduction:

productive performance in a dairy herd is determined by how rapidly the reproductive management program turns nonpregnant cows into pregnant cows. When designing or evaluating a reproductive management program, the following 2 questions need to be addressed:

(1) How and when are cows submitted for first artificial insemination (AI)?

(2) How and when are nonpregnant cows identified and re-inseminated?

The strategies and technologies implemented to address these 2 questions vary from farm to farm and form the foundation of the reproductive management program that determines the 21-d pregnancy rate. A variety of management strategies can be implemented to achieve excellent reproductive performance on dairy farms. Two factors under management control that determine the 21-d pregnancy rate are the AI service rate (management's ability to inseminate nonpregnant cows, thereby giving them a chance to conceive) and the resulting fertility of inseminated cows measured by the pregnancies per AI (P/AI) at a given time after AI (the proportion of inseminated cows that actually conceive). Thus, one or both of these factors must be increased to cause a concurrent increase in the 21-d pregnancy rate. Current reproductive technologies now allow dairy managers to affect both the AI service rate and P/AI to timed AI (TAI), thereby increasing the 21-d pregnancy rate.

Resynchronization:

After submitting cows to the first postpartum AI, it is imperative to identify nonpregnant cows as soon as possible and to reinseminate them as early as possible. The most common strategies to reinseminate nonpregnant cows in dairy herds are either detecting estrus or inseminating them using TAI programs after a non-pregnancy diagnosis (NPD). Several strategies were developed to increase the reinsemination rates of cows by detection of estrus.

In theory, the non-pregnant cows will return to estrus approximately 21 days after the first AI. In practice, the return to estrus interval is 18 to 28 d. The variable return to estrus interval can be explained by the normal variation in estrous cycle length, early embryonic death (causing partial extension of the estrous cycle) and the fact that some cows do not respond to the first synchronization (they were never actually synchronous within the group). Many inseminated cows that are not pregnant will not express estrus before pregnancy examination. The combination of a poorly synchronized natural return to estrus and also poor estrus expression in non-pregnant cows makes the second AI a difficult task.

If a resynchronization system is used then the most important considerations are 1- the interval between the first AI and the resynchronized AI; 2- the conception rate to the resynchronized AI; and 3- the speed and accuracy of the pregnancy diagnosis method (chemical test, ultrasound test, or palpation) that is needed for the system.

Strategies for Resynchronization:

One Injection of PGF2α The original system for resynchronization in dairy cows was the single injection of the PGF2α system. Cows that were diagnosed not pregnant with a corpus luteum (CL) were given PGF2α to induce estrus. The primary limitation of the system is that the age of the CL is not known and therefore the CL may not regress in response to the PGF2α injection. Dairy cows are also poor in terms of estrous expression. Cows that respond to the PGF2α may not show overt signs of estrus and will not be inseminated.

Using Progesterone Supplements:

Treating cows with progesterone from 14 to 21 d after AI blocks estrus and ovulation in non-pregnant cows that regress their CL. The treatment causes resynchronization because cows that would otherwise come back into estrus from d 14 to 21 are delayed and come back into estrus after d 21. The improved synchrony in non-pregnant cows reduces the time devoted to estrous detection and may stimulate estrous expression by increasing the number of cows in estrus on a given day.

Using Timed AI Protocols:

One of the limitations of resynchronization with progesterone is the requirement for estrous detection following treatment. An alternative approach would be a system for TAI of a second AI.

The most common TAI system is Ovsynch 56 (injections of GnRH 7 days before (G-1) and 56 hours after PGF2α (G-2), with AI administered at 72 hours after PGF2α or 16 hours after G-2 treatment). The programs can be started before pregnancy diagnosis and completed for cows that are later found not pregnant (the PGF2α should not be given to pregnant cows). An alternative is to start the program after pregnancy diagnosis (on day 32).

Employing a Presynchronization Treatment before Ovsynch

Dairy cows that initiated Ovsynch on days 5 to 9 had greater fertility than cows that initiated Ovsynch on other days of the cycle. These results and other similar results in heifers provided the physiological basis for subsequent presynchronization methods that attempted to maximize the number of cows at a more optimal stage of the estrous cycle at Ovsynch initiation.

Presynch-11, Double-Ovsynch, PG-3-G and G-6-G.

Short Resynchronization Protocols:

Most non-pregnant cows cycle back 18 to 24 d after the first AI but their estrus (if expressed) is not detected. If ultrasound pregnancy diagnosis is done at approximately d 30 then non-pregnant cows will be between d 6 and 12 of the subsequent estrous cycle. There is a PGF2α-responsive CL and a dominant follicle on the ovary at this time. A simple two-injection system (PGF2α given to regress the CL and GnRH given 48 to 72 h later to cause ovulation) is possible. Cows can be inseminated 0 to 24 hours after the GnRH injection. The advantage of the system is that it is fast (2 to 3 d from NPD to reinsemination). The disadvantage is that some cows will not respond or respond poorly to the PGF2α and (or) the GnRH because they are at the incorrect stage of the cycle.

Wijma et al. (2017) evaluated the P/AI of cows submitted to different resynchronization of ovulation protocols (5). The base protocol started at 25 ± 3 d after AI and was as follows: GnRH, 7 and 8 d later PGF2α, GnRH 32 h after second PGF2α, and fixed TAI 16 to 18 h after GnRH. At 18 ± 3 d after AI, cows were randomly assigned to the G25 or NoG25 treatments. The protocol for G25 and NoG25 was the same, except that cows in NoG25 did not receive GnRH 25 ± 3 d after AI. At NPD, 32 ± 3 d after AI, cows from G25 and NoG25 with a CL ≥15 mm in diameter and a follicle ≥10 mm completed the protocol, whereas cows from both treatments that did not meet these criteria received a modified Ovsynch protocol with P4 supplementation. The results showed that removing the first GnRH of a modified Resynch-25 protocol for cows with a CL at NPD and a modified Ovsynch protocol with P4 supplementation for cows without a CL at NPD resulted in a greater percentage of cows re-inseminated at detected estrus and a similar proportion of cows pregnant.

In 2018, Wijma et al. evaluated time to pregnancy after the first service postpartum and P/AI in dairy cows managed with 2 resynchronization of ovulation programs (6). Lactating Holstein cows were randomly assigned to the d 32 Resynch (R32; n=1,010) or short resynch (SR; n=1,000) treatments. Nonpregnancy diagnosis was conducted 32±3 d after AI by transrectal ultrasonography. Nonpregnant cows in R32 received the Ovsynch protocol. Cows in SR with a CL ≥15 mm and a follicle ≥10 mm at NPD received PGF2α-24h-PGF2α-32h-GnRH-16 to 18h-TAI. Cows in SR without a CL ≥15 mm or a follicle ≥10 mm at NPD received a modified Ovsynch plus CIDR protocol. The median time to pregnancy was 95 and 79 d for the R32 and SR treatments, respectively. Treatment did not affect overall P/AI 32 ± 3 d after AI or for cows with a CL at NPD. For cows with no CL at NPD, P/AI was greater for the modified Ovsynch plus CIDR treatment (36.9%) than for the R32 treatment (28.6%). The SR program reduced the 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.

Sauls-Hiesterman et al. (2020) hypothesized that a shortened version of a modified Ovsynch program that excluded GnRH-1 to resynchronize ovulation in cows bearing a CL after an NPD or including progesterone supplementation with the OVS treatment for cows without a CL would produce shorter inter-insemination intervals and P/AI not different from that of cows treated with the OVS treatment (7). Cows were enrolled in the study and assigned to either of three treatments at NPD (32 ± 3 d after AI). Cows with a detected CL were assigned randomly to (1) a modified Ovsynch or (2) Short Synch (SS; PGF2α - 24 h - PGF2α - 32 h - GnRH - 16 h - AI). Cows with no CL were assigned to OVS plus a CIDR. Mean and median inter-insemination intervals were less in SS than in OVS cows, but that in OVS cows did not differ from OVS+CIDR cows. Pregnancy per AI at 32 ± 3 d after AI did not differ when a functional CL was detected accurately. Pregnancy per AI did not differ between OVS and OVS + CIDR cows regardless of CL status. Short synch is an alternative to the entire modified Ovsynch program to produce similar P/AI when the CL status was detected accurately, and regardless of functional CL status, SS reduced inter-insemination intervals by 7 d.

In 2020, Bandai et al. evaluated short-term ovulation synchronization protocol in lactating dairy cows (8). The cows detected to have a functional CL received PGF2α as a luteolytic agent. The cows were randomly assigned to two treatment groups: (1) treatment with estradiol benzoate (EB) 24 h after PGF treatment, and TAI 24-28 h after EB treatment (EB group); and (2) treatment with GnRH 56 h after

PGF treatment, and TAI 16-20 h after GnRH treatment (GnRH group). Pregnancy per AI was significantly higher in cows in the EB group when compared with the GnRH group. Regarding parity, multiparous cows had greater P/AI in the EB group than in the GnRH, whereas primiparous cows showed no significant intergroup difference. The use of a convenient synchronization protocol comprising the administration of PGF and EB 24 h apart, rather than PGF and GnRH 56 h apart, has greater potential to improve pregnancy rates after TAI in lactating dairy cows given that a functional CL was accurately detected. This beneficial effect of the protocol using EB was clearly demonstrated in multiparous cows.

Alizadeh et al. (2022) evaluated the efficiency of two short resynchronization protocols for AI in Holstein dairy cattle compared to the Ovsynch protocol in terms of the P/AI and shortening the inter-insemination intervals over a 12-month period. Non-pregnant cows with a CL ≥15 mm and a follicle ≥10 mm 31±3 days after AI were assigned randomly to (1) modified Ovsynch 56 or (2) Short Resynch (SR; PGF2α-24 h-PGF2α-32 h-GnRH-16 h-TAI) or (3) Short Heatsynch (SH; PGF2α-24 h-PGF2α-24 h-EB-24 h-TAI) (9). Cows without a CL, a CL <15 mm, or cystic and a follicle <10 mm were assigned to G-Ovsynch (G-OVS; GnRH-7 d-modified Ovsynch). In the SR and SH groups, the follicular wave emergence was also investigated. Based on the results, P/AI was greater in OVS (46.2%) compared to SR (37.2%), SH (31.7%) and G-OVS (33.1%) groups (P=0.001). Median inter-insemination interval was less in SR (35d) and SH (35d) than in OVS (41d) and G-OVS (48d) groups (P<0.001). By removing the cows with follicular emergence and re-comparing the three groups, P/AI in the SR group was not significantly different from the cows that were inseminated with the OVS method (P=0.111). Moreover, P/AI was significantly affected by environmental temperature (≤25°C or >25°C) on the day of AI in SR and G-OVS groups but this effect was not seen in OVS and SH groups.

It was concluded that in addition to the presence of a CL ≥15 mm and a follicle ≥10 mm, the absence of follicular wave emergence on the ovaries should be considered as a criterion, since it increases the accuracy of selecting cows to enter the SR protocol, and as a result, increases the conception rate following the SR method. Therefore, the three-day SR protocol can be a good alternative to the ten-day OVS protocol for reducing the inter-insemination intervals. Heat stress can reduce P/AI in cows following the SR method so it is not recommended in hot weather.

Conclusion:

A reproductive management program that applies different resynchronization methods based on observed ovarian structures at an NPD is a viable alternative to reduce the inter-insemination interval. Removal of the GnRH-1 treatment in short resynchronization cows having a functional CL at NPD produced similar P/AI comparable with the modified Ovsynch program that included a second PGF2a treatment.

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