Reproductive Management of Dairy Heifers

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Take Home Messages

- Dairy producers should breed replacement heifers to sires used in artificial insemination (AI) to maintain genetic progress for milk production.
- Use of AI to breed heifers is underutilized on many dairy farms because of time and effort needed to detect heat; consequently, the use of bulls alone or in combination with AI is preferred.
- The success of heat synchronization programs with the use of approved hormones depends on efficient heat detection practices.
- A recently developed timed AI program (CoSynch + CIDR 5 days) is an efficient management program for dairy heifers that reduces extra handling and labor costs related to daily heat detection and AI.

Introduction

To make genetic progress and maintain an economic advantage for higher milk production, dairy producers should breed replacement heifers to sires used in artificial insemination (AI). Overton and Sischo (2005), showed that milk yield in daughters of AI-proven bulls was 366-444 kg greater compared to natural service sires. Despite this advantage, the use of AI to breed heifers is underutilized on many dairy farms and thus, the use of natural service alone or in combination with AI is preferred (Hogeland and Wadsworth, 1995; Fricke, 1997). Time and effort to detect estrus are reasons why farmers do not use AI extensively on replacement dairy heifers (Erven and Arbaugh, 1987).

Lifetime profit of dairy replacement heifers is maximized when heifers calve between 23 and 25 months of age (Head, 1992). However, actual calving ages on first calf heifers are greater than this on many herds. Thus, to maintain genetic progress and maximize profitability heifer breeding programs should include AI and attainment of pregnancy rate that result in calving age around 24 months. This manuscript discusses reproductive management strategies that dairy producers can use to obtain an optimal calving age in dairy heifers.

▪ Hormonal Control of the Estrous Cycle

Prostaglandin ($PGF_{2\alpha}$)

By synchronizing a group of heifers with $PGF_{2\alpha}$ heat periods are concentrated within a 7-day window which helps increase heat detection rate. Heifers are commonly given $PGF_{2\alpha}$ 11 to 14 days apart when they reach breeding age. This interval is recommended based on the fact that sufficient time must pass to allow those heifers with an ovarian structure known as yellow body or corpus luteum [CL] that responded to the first $PGF_{2\alpha}$ injection to have a new CL mature enough to respond to the second injection of $PGF_{2\alpha}$. Further, those cyclic heifers that did not respond (i.e., did not have a mature CL) to the first injection should have a mature responsive CL at the second $PGF_{2\alpha}$ injection 11 days later.

Controlled Internal Drug Release (CIDR)

Intravaginal progesterone inserts (Controlled Internal Drug Release; CIDR), coupled with $PGF_{2\alpha}$ is approved for use in dairy heifers in the United States by the FDA (Eazi Breed®, Pfizer Pharmaceutical, New York, NY; Figure 1) to control heat behavior in replacement heifers. It has been reported that the CIDR device is effective in synchronizing heat and increases pregnancy rates for the first 3 days of the AI period after CIDR removal (Lucy et al., 2001).

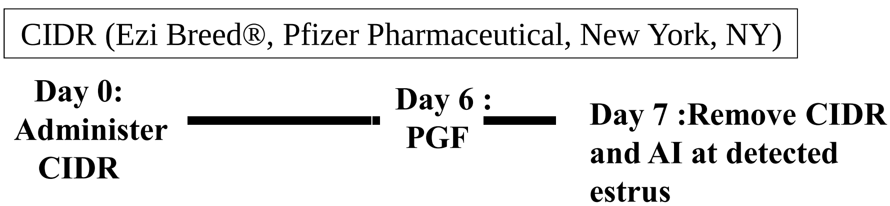

Figure 1. Eazi Breed® protocol for heifers

The CIDR inserts are used for 7 days and $PGF_{2\alpha}$ is administered 24 hrs prior to CIDR removal. In general, heat occurs 2 to 5 days after CIDR removal. If the $PGF_{2\alpha}$ is administered at the time of CIDR removal, heat is delayed by 12 to 24 hrs and is more variable (Stevenson, 2005). With the use of CIDR various insemination options are available after removal; AI only based on detected heat or AI those heifers detected in heat and timed AI of heifers not seen in heat at 60 to 66 hrs after $PGF_{2\alpha}$ administration (Stevenson, 2005).

■ Timed Artificial Insemination (TAI)

It is noteworthy to mention that the success of synchronization options mentioned above depend on efficient heat detection practices. Compared to lactating dairy cows, heifers display more intense signs of heat. Nevertheless, on many dairy farms efficiency of heat detection is suboptimal in the heifer breeding program and many producers choose to breed heifers by natural service using bulls of unknown genetics. Therefore, methods employed to improve heat detection should be utilized or a better option would be to implement the use of ovulation-synchronization protocols that allow for timed artificial insemination (TAI), avoiding the need for estrus detection.

The OvSynch protocol in lactating dairy cows successfully synchronizes ovulation and allows TAI without the need of heat detection. However, due to the number of follicular waves (Pursley et al., 1997) or inconsistent follicular wave emergence (Nebel and Jobst, 1998; Schmitt el al., 1996) dairy heifers respond poorly to OvSynch and TAI. Consequently, the OvSynch protocol has not been recommended for use in heifers. However, Rivera et al. (2004) modified the OvSynch protocol by administering $PGF_{2\alpha}$ 6 days after the first GnRH, and the second GnRH was administered 48 hrs after $PGF_{2\alpha}$ together with TAI, resulting in a pregnancy rate (PR) to first TAI of 38%.

A problem with the OvSynch protocol is that heifers can come in heat between the first GnRH and $PGF_{2\alpha}$ administration, resulting in failure to synchronize ovulation in all heifers submitted to the TAI protocol. The CIDR device allows better control of synchronization of ovulation in heifers during TAI protocols. Inclusion of CIDR inserts (OvSynch + CIDR) suppressed ovulation and heat during the 6 day of CIDR presence, thereby allowing 100% submission rate for TAI without affecting fertility (Rivera et al., 2005).

A modification has been made to the OvSynch + CIDR protocol that shortens the interval between the 1st GnRH and $PGF_{2\alpha}$ to 5 days (CIDR period) and lengthens the interval from the $PGF_{2\alpha}$ to GnRH to 3 days, performing TAI together with the second injection of GnRH (CoSynch + CIDR 5 days; Figure 2a). Using the CoSynch + CIDR 5 days in beef cattle, the difference in PR was 10% higher compared to a CoSynch + CIDR 7 days (Bridges et al., 2008). When the CoSynch + CIDR 5 days protocol was applied in dairy heifers the PR to the 1st TAI was 58% (Thatcher et al., 2008). In the original CoSynch + CIDR 5 days protocol, two injections of $PGF_{2\alpha}$ (12 hrs apart) were applied to regress eventual accessory CL formed. Recent research from Florida (Rabaglino et al., 2010; Figure 2b) performed in dairy heifers to determine if one injection of $PGF_{2\alpha}$ at the time of CIDR withdrawal is as effective as two injections of $PGF_{2\alpha}$, found no differences in PR to 1st TAI (56.1% and 57.4% at 32 days and 53% and 55.4% at 60 days for one or two doses of $PGF_{2\alpha}$ respectively, (P=0.88). An experiment was performed with sexed semen employing the CoSynch + CIDR 5 days protocol by Rabaglino et al. (unpublished) and no difference in PR to 1st TAI was found (43.2% and 42.0% at 32 days and 37.5% and 38.6% at 45 days for one or two doses of $PGF_{2\alpha}$ respectively.)

Day 0: CIDR in + GnRH — **Day 5: CIDR out + PGF AM/PM** — **Day 3: GnRH + TAI**

Figure 2a: CoSynch + CIDR 5 days (Bridges et al., 2008)

Day 0: CIDR + GnRH — **Day 5: CIDR out + PGF AM only** — **Day 3: GnRH + TAI**

Figure 2b: CoSynch + CIDR 5 days one PGF (Rabaglino et al., 2010)

The Florida studies indicate that in dairy heifers, one injection of $PGF_{2\alpha}$ at the time of CIDR withdrawal is as effective as two injections of $PGF_{2\alpha}$ given approximately 12 h apart in the CoSynch + CIDR 5 days protocol for 1st TAI. Further, this program is an efficient management program for TAI of dairy heifers that can reduce extra handling and labor costs related to daily estrus detection and AI.

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