Take-home messages on heifer repro

A look at 12 years of research on dairy heifer reproduction offers ideas on what works best

By Raymond Nebel

Before reviewing major research in dairy heifer reproduction, let's look at some basics about breeding this group of animals.

- A longer lasting estrus and more mounting activity make estrous detection in heifers easier than in lactating cows.
- For optimum fertility, heifers should have three or more estrous cycles before breeding. If age at first calving is 24 months, then heifers must be inseminated between 13 and 14 months of age, on average. So heifers should reach puberty by 10 months of age.
- Most heifers begin cycling when they reach approximately 60% of their expected mature body weight.
- Adequate nutrition and development are critical for successful heifer AI programs.
- In general, insemination after a detected estrus is associated with higher conception rates (CR) compared with timed AI following estrous or ovulation synchronization. (See several of the research projects here.)
- A 65% pregnancy rate (PR) is a reasonable goal for heifers in a single-service AI program.
- In a 1987 national survey, dairy producers identified "inadequate heat detection for AI" and "lack of time to supervise AI" as two important reasons they limit AI use in heifers.

Research review

A look at seven research projects sheds light on effective reproduction practices for heifers.

1. Timing of insemination. To determine the effect of AI timing on CR, 372 heifers were used at the University of Illinois (Rankin, T.A., et al. 1992). If AI occurred within the first 13.5 hours after estrus was first observed, conception was

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61%, compared to a 43% CR if heifers were inseminated between 13.5 and 33 hours after estrous detection. Data further suggest:

- No benefit to following the AM-PM guideline. Research shows that there's no reason to delay AI after estrous detection. The heifer should be inseminated at the next practical opportunity after estrus detection.
- Standing estrus should trigger AI to maximize CR.

2. Influences on intensity, duration and onset of estrus. Using a radiotelemetric system (HeatWatch), we measured the estrous behavior of lactating cows and heifers (Nebel, R.L., et al. 2002). Heifers exhibited estrus approximately 40% longer than cows. Also, there is no best time to observe heifers for standing activity, but movement prior

FYI

- Raymond Nebel is a professor and Extension project coordinator in Virginia Tech's Department of Dairy Science.
- The paper "Heat Detection, Breeding Programs and Fertility Issues for Heifers" was excerpted here with permission of Dr. Nebel and from "Dairy Calves and Heifers: Integrating Biology and Management" (NRAES-175). 2005. Natural Resources, Agriculture, and Engineering Service, Ithaca, NY. Tel: (607) 255-7654. Website: www.nraes.org

to observation appears to slightly increase standing activity.

3. Insemination with sexed sperm. A series of studies used beef and dairy heifers to evaluate CR from freshly collected semen or frozen-thawed semen (Seidel, G.E., et al. 1999). PR differed little between sexed unfrozen and sexed frozen semen.

In most recent trials, PRs with sexed-sorted frozen sperm were within 90% of unsexed frozen controls that had seven to 20 times more sperm per insemination dose. But in a few trials, control pregnancy rates were substantially higher than with low doses of sexed sperm.

Timed AI

The following four research projects look at various heat synchronization protocols. In general, the studies conclude: Insemination after detected estrus usually results in higher CR compared to fixed-time AI following estrous or ovulation synchronization. Heifers can be successfully synchronized using CIDR-based protocols, which provide an opportunity to use fixed-time AI without estrous detection. Although CR are slightly reduced after synchronization, the overall reproductive performance usually improves because all heifers are inseminated, not just those detected in estrus.

When it comes to deciding which approach to use, dairies must balance all costs, including labor and time, for both approaches –standing heats or synchronization – against their performance.

4. Pregnancy rates per AI at synchronized ovulation or estrus (Pursley, J.R., et al. 1997). The research used two synchronization protocols for heifers 13 to 23 months old. One group received 25 mg of prostaglandin F_{2a} (PGF^{2}_{a}) and was inseminated under the AM-PM guideline following detected estrus. The second group received the Ovsynch protocol. They were inseminated 16 to 20 hours after the second gonadotropin-releasing hormone (GnRH).

PR for heifers in the first protocol was 74.4% compared to a 35.1% PR for those receiving the Ovsynch protocol. The conclusion: For heifers, the Ovsynch protocol wasn't an effective synchronization method. The first injection of GnRH didn't synchronize luteal function, so CR was lower.

5. Fertility after ovulation synchronization and timed AI, or AI after removed tail chalk. PR per insemination, days to first AI and days to pregnancy were compared for heifers identified in estrus by removal of tail chalk and for heifers on the Ovsynch protocol combined with tail chalking (Rivera, H., et al. 2004). The Ovsynch protocol was modified so that 25 mg of PGF_{2a} was given on day 6, not day 7, following the initial GnRH injection. AI was done at the time of the second GnRH injection 48 hours after the PGF_{2a}.

The take-home message: Modified Ovsynch protocol resulted in acceptable reproductive performance when estrus detection and AI were performed during the protocol. This protocol might help producers who want to breed a group of heifers within an eight-day period to reduce extended periods of estrus detection.

6. Reproductive performance after estrus synchronization and fixed-timed AI. The study compared the reproductive performance of heifers following estrus synchronization and timed AI and non-synchronized heifers from 25 New Zealand pastured-based spring-calving dairies (Xu, Z.Z. and L.J. Burton. 1999). Heifers in the synchronized group received a CIDR and a capsule containing 10 mg of estradiol benzoate. After six days they received 12.5 mg of Lutalyse (PGF_{2a}). Heifers were inseminated 50 to 54 hours after CIDR removal.

Heifers in the control group didn't receive any hormonal treatment, and AI was performed the morning after an animal was detected in estrus. The study found that the CR of synchronized heifers was lower than that of non-synchronized heifers in the first 24 days of the breeding season.

This study also resynchronized returns to first service by inserting a used CIDR between 16 and 21 days after the timed AI. The CR for inseminations after resynchronization was 53.1%, which was lower than the 63.7% CR in control heifers to first AI.

7. Evaluation of three synchronization treatments (Richardson, A.M., et al. 2002).

The study looked at two things: the characteristics of estrus before and after first insemination and the fertility of heifers after synchronized estrus. Results of the three protocols – GnRH, PGF_{2a} and progesterone (P4) – are shown in the table.

Table 1. Rates for estrus detection, conception rate (CR) and pregnancy rate (PR) for Holstein heifers

Protocol	Estrus detection rate	CR	PR
GnRH + PGF_{2a}	73.5	47.5	34.9
P4 + PGF_{2a}	85.5	69.0	59.0
P4 + GnRh + PGF_{2a}	79.0	57.8	45.7

Heifers receiving a CIDR insert had a significantly higher PR, and GnRH given when a CIDR is inserted is probably unnecessary. Heifers had similar estrus characteristics – duration and number of standing events – regardless of the synchronization protocol.