| # Washington Animal Agriculture Team	
Fact Sheet # 1002-2010	

Improving Beef Heifer Reproduction via Synchronization and Timed AI

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Genetic selection and record-keeping practices employed by beef seed stock producers and researchers during the last several decades are paying off. Cow-calf producers now know where to go to get the genetics they need to make targeted improvements in their herds. Need to reduce birth weights to reduce dystocias yet maintain weaning weights? Use Expected Progeny Difference data published by bull studs to select the bull you need. Other heritable traits producers often select for include carcass traits, calving ease, milking ability, feet and leg conformation, tractability, and many others.

Figure 1. Distribution of weaning weights in a normal population.
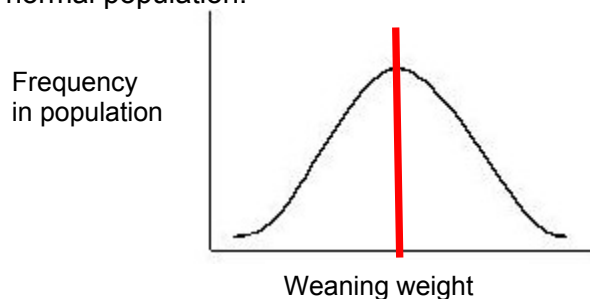
The bell-shaped curve in Figure 1 is the typical distribution pattern of many given traits in a natural population of individuals. For this example, let's use the economically-important trait of beef weaning weight. Most individuals will be around the average, at the point in the center of the figure. Some fall well below average and some are well above average. If

you could increase the likelihood your beef herd's average weaning weight would quickly increase as a result of the genetic selection decisions you made, would you do it?

The use of artificial insemination (AI) has been widespread in the dairy industry for decades and is now standard practice for progressive dairies. Thanks to AI, rapid advancements in the national dairy herd's genetic potential for milk production, in combination with improved nutrition, have resulted in an increase in average milk production from 9,434 lbs. per cow per year in 1969 to 20,576 lbs. in 2009.[1]

Despite the lessons to be learned from the dairy industry about the value of AI, AI is used in just 7.1% of the nation's beef herd.[2] Why has the beef industry been so much slower to adopt this beneficial practice? Vastly different housing and husbandry practices are one reason. Particularly in the west, U.S. cow-calf beef herds use extensive managements systems with large numbers of animals run on large acreage with minimal year-round labor. This management system and traditional production cycles are not easily compatible with AI; most cow-calf producers therefore use natural service via multiple bulls per herd instead.

Goals and Benefits of Synchronization Programs

- Make AI and heat detection less labor-intensive
- Encourage cycling females to conceive earlier in the breeding period
- Induce cycling in post-partum anestrous cows and pubertal heifers
- Narrow the breeding season duration
- Narrow the calving season duration to meet market targets and/or concentrate farm labor efforts
- Improve reproductive efficiency
- Contribute to improvements in herd genetics, carcass quality and farm profitability
- Realize increased financial returns from AI bull calf sales

Natural service has its drawbacks:

- Genetic progress is slower
- Bulls can become injured, sick or die
- Bulls must be fed and maintained year-round despite narrow window of use (60 days)
- Each bull needs a breeding soundness examination before every breeding season
- Bulls increase risk of damage and injury to farm personnel and facilities
- Bull purchases represent a significant farm biosecurity risk
- Without accurate record keeping and sire replacement, inbreeding will occur

One way to have the best of both worlds—maintain high conception rates yet increase the rate of genetic progress—is to use AI in the heifer herd. It is a Best Management Practice to separate cow and heifer herds anyway. This practice allows managers to feed proper rations to both groups and ensure heifers are not bullied by mature cows.

Dairy producers aim for year-round production of their fluid milk product and consequently perform many production and management practices on individual animals. However, beef producers need to maximize profitability by minimizing labor costs, so they perform production and management practices on a herd basis. Although most dairy producers are willing to dedicate time each day to observing their herd for signs of estrus in individual animals and making breeding decisions on a case-by-case basis, most cow-calf beef producers are not eager to devote time to this labor-intensive practice. For beef producers interested in the opportunity for rapid genetic advances available through AI yet reluctant to devote time to watching animals for heat, there is a solution: estrus synchronization followed by timed artificial insemination (TAI).

Many TAI synchronization protocols have been developed for both beef cows and heifers; some are depicted in Figures 2 and 3 below. Refer to Table 1 for definition of terms and abbreviations used in the graphics.

Table 1. Legend for beef estrus synchronization protocols.

Abbreviation	Definition	Purpose	Commercial products	Route	Withholding time
Progestins	Progesterone	Suppress the estrous cycle; quiet the ovary and uterus	MGA® CIDR®	Feed Vaginal insert	0 0
PGF	Prostaglandin	Destroy structure on the ovary that produces natural progesterone; induces heat	Estrumate® Lutalyse® IN-SYNC® ProstaMate®	IM injection IM injection IM injection IM injection	0 0 0 0
GnRH	Gonadatrophin releasing hormone	Causes surge of natural hormone that induces ovulation	Cystorelin® Factrel® Fertagyl®	IM injection IM injection IM injection	0 0 0

Figure 2. Two common timed insemination synchronization protocols for cows.

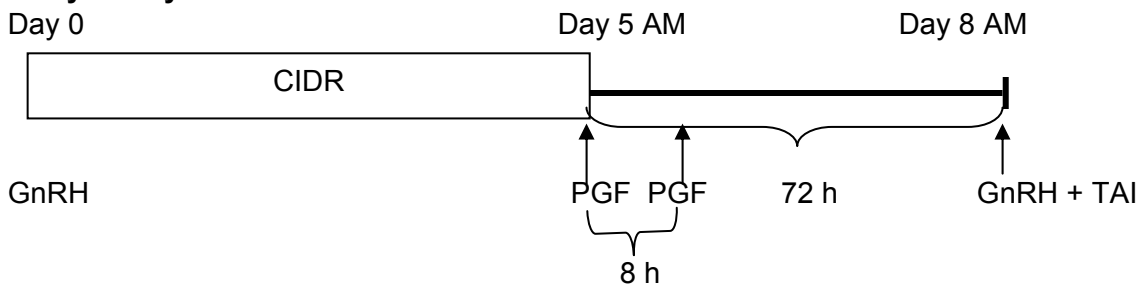
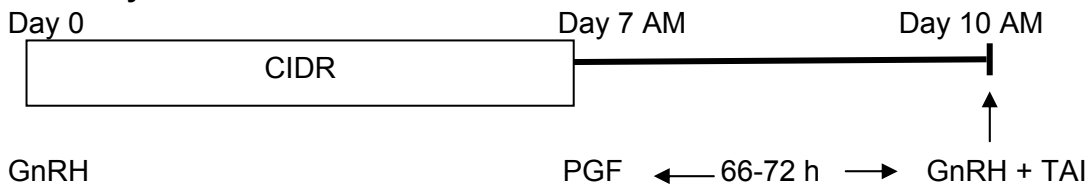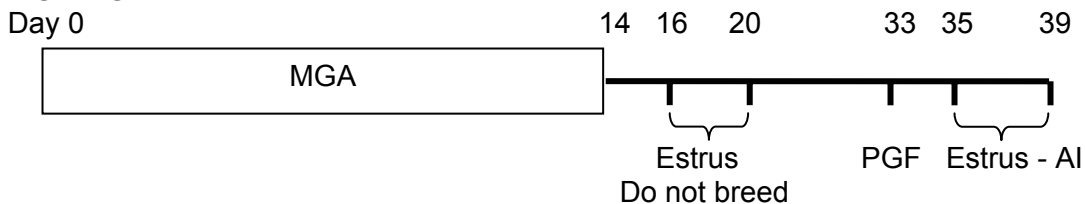**7 day CO-Synch + CIDR®**
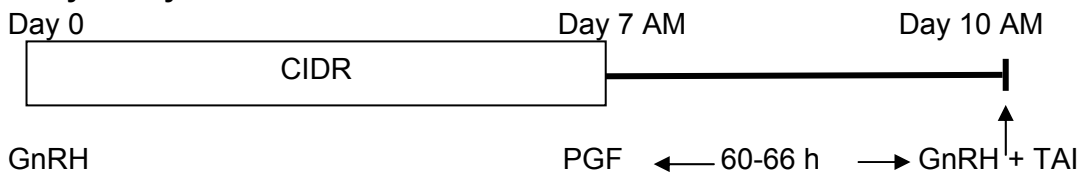
5 day CO-Synch + CIDR®

Figure 3. Two common TAI synchronization protocols for heifers.

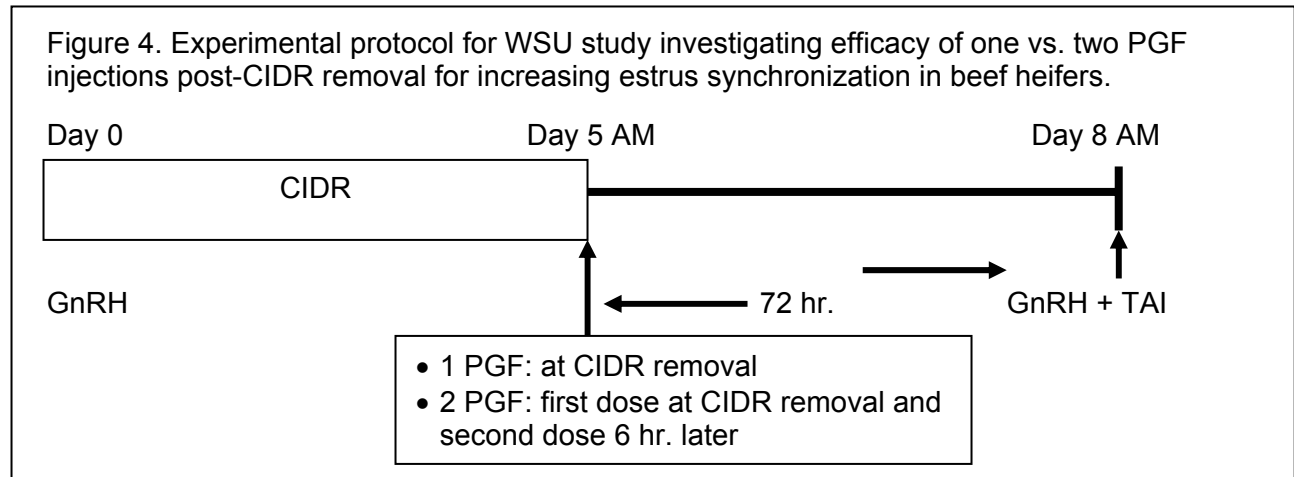**7 d Co-Synch + CIDR®**

MGA-PGF

In 2009-2010, a team of Washington State University (WSU) faculty conducted a field trial to compare two beef heifer synchronization protocols. Although many other protocols exist (see Figure 3 above), the researchers designed this experiment to determine if a second dose of PGF after CIDR removal would improve conception rates with TAI. As depicted graphically in Figure 4 below, all heifers were given GnRH and an intravaginal CIDR was implanted on Day 0 of the trial. The CIDR was removed five days later and one PGF injection was administered to all heifers; a second dose was given to half the heifers six hours later. Three days later, all heifers received a second dose of GnRH and were inseminated.

Heifers were turned out with bulls two weeks after a single artificial insemination. Although heifer conception rates after single-service AI reported in the literature vary widely, AI with clean-up bull service routinely results in 5 to 9% higher pregnancy rates compared to natural service alone[4]—another reason for producers to consider using AI.

Three or four trips through a chute may seem like a lot of work, but the outcome can be having most heifers settled within a week and ready for a short and targeted heifer calving season.

What are the costs associated with estrus synchronization and TAI in heifers? In addition to labor and insemination costs, the 2009 costs of the medications used in the two-PGF dose per heifer protocol totaled about $26.90. Although good conception rates are obtainable with just one injection, two doses will likely be more profitable because of the increased conception rates. When using natural service without synchronization, first service conceptions occur throughout the breeding period, resulting in widely distributed calving dates. If heifers are synchronized, their calving dates will be concentrated; managers will be better able to make plans to monitor this higher-risk group around these dates.

Figure 4. Experimental protocol for WSU study investigating efficacy of one vs. two PGF injections post-CIDR removal for increasing estrus synchronization in beef heifers.

Day 0	Day 5 AM	Day 8 AM
CIDR		
GnRH	72 hr.	GnRH + TAI

- 1 PGF: at CIDR removal
- 2 PGF: first dose at CIDR removal and second dose 6 hr. later

Ultrasound pregnancy detection was conducted 60 days after breeding. Pregnancy rates to AI varied from 53 to 84%, mostly due to ranch and inseminator differences. Overall, heifers receiving two injections of PGF had an 8% higher pregnancy rate than the heifers receiving just one PGF injection. The most noteworthy finding was that in just eight days, half the herds in the study achieved over 60% conception rates to AI after just one service.

Although it can be cost effective and an excellent genetic program management practice to synchronize heifers and use AI, not every heifer is a good candidate for these advanced reproductive technologies. Here are several important recommendations:
- Heifers must be at least 60% of mature body weight with a Body Condition Score of 5 one month before breeding
- Individuals must be examined before

breeding to identify freemartins, immature tracts, cysts, anestrous, pregnancy or other issues; reproductive tract scores should be at least a 2

- To calve by the economically-desirable 24 months of age, heifers must cycle and conceive by 15 months old.

Low-stress handling facilities must be available for any AI program to be successful. AI technician technique and availability are also factors to consider. Regardless of type of breeding, bred heifers must continue to be fed for growth throughout pregnancy.

The purpose of this fact sheet was to convey the results of an estrus synchronization and TAI protocol for beef heifers. A secondary purpose was to educate producers about AI in cow-calf herds and encourage producers to consider using this practice to make more rapid advancements in their herd's genetic base.

Your herd may be a good candidate for AI if:

- You take time to study your records and use them in making management decisions
- You are good at picking the right AI bulls to mate with your cows
- You feed cows to a body condition score 5 or higher for breeding
- You have good working pens and handling facilities
- Your cattle docile when quietly worked through your facilities

- You keep accurate and up-to-date cow records
- You have a herd health program and keep a clean environment around your cattle handling facilities
- You have excellent and dependable AI technician or learn to do AI yourself
- You have adequate storage space or facilities for AI materials included a well-maintained semen tank
- You follow a daily routine and can observe heats
- You have "penciled out" costs and potential returns using the Estrus Synch Planner (see link below)
- You are willing to make the commitment to at least five breeding seasons before assessing results
- You understand and appreciate the additional and potentially-lucrative marketing options advanced reproductive technologies such as estrus synchronization and AI make available to you.

If you are considering AI and a synchronization program, a good place to start is with your replacement heifers. Discuss synchronization programs with your veterinarian and start breeding heifers a month before the cow herd. These heifers represent the future of your herd and can quickly improve your overall herd genetics as well as turn out great calves.

For more information
www.beefusa.org/prodstandardperformanceanalysis_spa_.aspx
www.iowabeefcenter.org/content/estrussynchplannermain.htm
www.appliedreprostrategies.com/index.html
www.csubeef.com/dmdocuments/442.pdf
www.csubeef.com/dmdocuments/407.pdf
http://msucares.com/pubs/publications/p2486.pdf

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[3.] USDA Market News Washington State Weekly Combined Cattle Report for week ending Nov 5, 2010.
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