

ARSBC 2012: Importance of Estrus

Management Improves AI Conception

Physiological factors affect pregnancy rate to artificial insemination.

by **Troy Smith**, field editor

University of Missouri (MU) animal scientist Michael Smith says it is common for cow-calf producers new to estrous synchronization and artificial insemination (AI) to ask what kind of pregnancy rate can be expected. Speaking to a Sioux Falls, S.D., crowd during the 2012 Applied Reproductive Strategies in Beef Cattle (ARSBC) symposium, Smith said it's best to have realistic expectations. He called a 67% pregnancy rate to a single insemination very good, but actual results depend on multiple factors. Results may be far less satisfactory, unless careful

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"When it comes to reproductive management, the things you do well will not compensate for the mistakes you make," Smith stated. "Instead, the mistakes you make cancel out all the things you do well."

Before adopting AI, Smith advised consideration of whether the producer's heifers and cows are good candidates for estrous synchronization. If previous heifer and cow pregnancy rates at the end of the breeding season have been less than 85%, there may be management issues to address before initiating a synchronized AI program.

According to Smith, replacement heifer candidates should not have received growth-promoting implants. They should have been developed to an appropriate target weight by breeding time, and should have undergone reproductive tract evaluation.

"We recommend that a minimum of 50% of the heifers have a reproductive tract score equal or greater than 4 by approximately six weeks before the start of breeding," Smith said.

Considerations for cows include choosing animals that delivered a previous calf unassisted. They should have been in good body condition at calving — at least a body condition score (BCS) 5 — and have been allowed an adequate period of recovery from calving to the subsequent breeding season. Smith recommended a herd average of 45-50 days.

Smith said the choice of synchronization

Control of Estrus in Heifers

MU's David Patterson reviews characteristics of MGA[®]- and CIDR[®]-based heat synchronization protocols for heifers.

by **Kelli Fulkerson**, 2012 intern, & **Shauna Rose Hermel**, editor

Heifers that conceive earlier in their first breeding season stay in the herd longer and produce more pounds of beef in the long run, said David Patterson, professor of animal science at the University of Missouri-Columbia (MU). Patterson was charged with discussing the control of estrus in heifers at the 2012 Applied Reproductive Strategies in Beef Cattle (ARSBC) symposium in Sioux Falls, S.D.

Patterson reviewed considerations for heifer management as it pertains to synchronization success. Prebreeding evaluation, he said, should include target weight at a year of age, reproductive tract score (RTS) and pelvic measurement.

Tract scores can be a significant aid in evaluating heifers going into synchronization programs, Patterson emphasized. "Once we have producers begin using this system, their success

rates with synchronization have increased remarkably."

Patterson said producers should be aware that exposure to implants during the suckling phase can significantly affect reproductive development of heifers, slowing glandular development in the uterus. He recommended RTS be taken four to six weeks before the breeding season to give producers time to make adjustments if needed. Heifers are ready to go on a synchronization program when 50% or more of the heifers are scoring 4 to 5.

"Why use synchronization?" Patterson asked.

"When heifers become pregnant is a big deal," he answered. Patterson noted that we have tools available to help facilitate earlier conception dates. Those tools are in the form of progestin-based products, either MGA[®] or CIDR[®]



► Long-term CIDR-based protocols enhance synchrony of estrus in estrous cycling and pre- or peripubertal heifers compared to short-term CIDR-based or MGA-based protocols, David Patterson concluded.

According to the National Animal Health Monitoring System (NAHMS) survey conducted in 2008, the reasons U.S. beef producers cite for not using this reproductive technology are time/labor and cost. Patterson said in his area of the country more people want to move toward timed artificial insemination (TAI) programs.

He reviewed many of the protocols



PHOTOS BY TROY SMITH

► MU's Michael Smith called a 67% pregnancy rate to a single insemination very good, but he emphasized that results may be far less satisfactory unless careful attention is paid to the details of managing a synchronized AI program.

protocol will be influenced by each producer's time and labor constraints. Protocol cost may be another factor. He advised producers to consider whether they want to check heat and inseminate 12 hours following detection of standing heat, or inseminate all animals at a predetermined time. Another option is to detect estrus for 72 to 84 hours, depending upon the protocol,

Table 1: Effect of estrous detection and conception rate on pregnancy rate in cattle

Estrous-detection rate ¹	Conception rate ²	Pregnancy rate ³
95%	70%	67%
75%	70%	53%
95%	50%	48%
75%	50%	38%

¹Estrous-detection rate — total number of females detected in estrus divided by the number of females exposed to breeding (expressed as a percent).

²Conception rate — percentage of females that become pregnant to a designated insemination (expressed as a percent).

³Pregnancy rate — total number pregnant during the breeding season divided by the number of females exposed to breeding (expressed as a percent).

and inseminate any cows not detected in estrus at a fixed time.

Smith emphasized that estrous-synchronization protocols must be followed precisely. Each product must be administered at the correct dose and at the correct time. Understanding the basic principles of the bovine estrous cycle and how the products synchronize estrus and ovulation can be helpful in reducing the probability of administering the wrong product at the wrong time (see Smith's proceedings paper for greater detail).

"While estrous-synchronization products and protocols have changed over time, the

basic physiological principles underlying how these products work have not," Smith stated. "An understanding of the importance of estrous expression and the basic physiological factors affecting pregnancy rate following estrous synchronization and artificial insemination can facilitate the application of these technologies."

Smith spoke during Monday's ARSBC session focused on the importance of estrus. Visit www.appliedreprostrategies.com/2012/SiouxFalls/newsroom.html to listen to his presentation and to view his PowerPoint slides and proceedings paper.



developed for synchronization of estrus in heifers, beginning with the MGA-prostaglandin protocol developed by Ken Odde. The protocol calls for feeding MGA for 14 days, waiting 17-19 days and administering a shot of prostaglandin (PG). For programs using natural service, Patterson reminded that the estrus expressed three to five days after withdrawal of MGA is a subfertile estrus, so bulls should be turned out afterward — about 10 days after MGA withdrawal.

Patterson said heifers synchronized with

MGA and PG in combination will display heat within a three- to five-day period. However, if you use MGA and bypass the PG shot, the heifers will come into heat during a 7- to 10-day period. "That's advantageous in a lot of respects for bulls that are going into synchronization programs," said Patterson.

Another topic Patterson felt was important to discuss was what happens to females that are placed in backgrounding yards then, at last moment, are pulled out of MGA-feeding and are bred. The study compared heifers fed MGA for 87 days vs. the standard 14

days. Once heifers were taken off MGA, they received an injection of PG 17 days later. Heifers that failed to respond were reinjected 11 days later.

Results indicated that after the first injection there was an advantage to the short-term feeding program, but after the second injection results evened out. Scanning the ovaries by ultrasound revealed no abnormalities for heifers in the short-term MGA group, but 37% of those fed MGA long term had luteinized follicular cysts. In

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Table 2: Reproductive tract score (RTS) summary

RTS	n	Wt., lb.	Pelvic ht., cm	Pelvic width, cm	Pelvic area, cm ²	Estrous response, %
1 Infantile	61	594 ^a	13.9 ^a	10.9 ^a	152 ^a	54 ^a
2 Prepubertile (>30 days from puberty)	278	620 ^b	14.1 ^a	11.2 ^a	158 ^a	62 ^b
3 Prepubertile (<30 days from puberty)	1,103	697 ^c	14.5 ^b	11.4 ^b	166 ^b	76 ^c
4 Cycling (follicular phase)	494	733 ^c	14.7 ^b	11.7 ^c	172 ^c	83 ^d
3 Cycling (luteal phase)	728	755 ^d	14.7 ^c	11.7 ^c	172 ^c	86 ^d

^{a,b,c,d}Numbers with different superscripts within a column differ (P<0.05). Patterson and Bullock, 2000.

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addition, some heifers actually began lactation. Conception rates and pregnancy rates were comparable for the two groups.

Patterson walked attendees through a large study comparing the 14-day MGA feeding program to the 14-day CIDR-PG protocol. Results concluded that estrous response and synchrony of estrus were significantly improved among heifers assigned to the 14-day CIDR-PG protocol. Pre-synchronization with a 14-day CIDR followed 16 days later with PG provides an effective alternative for the use in synchronizing estrus in replacement heifers. There were no differences between treatments for synchronized conception or pregnancy rates.

Patterson also discussed a multi-state CIDR trial by Cliff Lamb et al. (2006) comparing heat detection vs. TAI and various timing for administration of PG, GnRH and breeding. GnRH at CIDR insertion did not improve pregnancy rates after TAI and did not alter the percentage of heifers detected in estrus or the distribution of estrus after PG. Patterson noted that a combination of detecting

estrus and AI before cleanup AI enhanced pregnancy rates over TAI.

A Missouri study compared a seven-day CO-Synch + CIDR insertion to 14-day CIDR with GnRH between CIDR removal and PG. Essentially, the longer-term protocol outperformed the shorter protocol when heifers were time-bred.

Administration of GnRH following CIDR removal in the CIDR Select protocol is not required to facilitate synchrony of estrus, Patterson said.

Comparing the protocols in TAI systems, pregnancy rates tended to be higher for 14-day CIDR-PG compared to CIDR Select-treated heifers. Final pregnancy rates didn't differ.

Synchronization protocols for heifers recommended by the Beef Reproduction Task Force are listed in Fig. 1.

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Control of

Timed AI protocols for cows offer advantages in management, calving distribution and economics.

by *Kelli Fulkerson, 2012 intern, & Shauna Rose Hermel, editor*

In outlining estrous synchronization protocols for cows, Cliff Lamb, University of Florida North Florida Research and Education Center, focused on those protocols designed for use with fixed-time artificial insemination (TAI). The comfort level with using these programs without heat detection has increased, he told those in attendance at the 2012 Applied Reproductive Strategies in Beef Cattle (ARSBC) symposium in Sioux Falls, S.D. "I would almost bet that 60% to 70% of the people who use estrous synchronization right now utilize fixed-time artificial insemination."

Lamb said he always refers people to

Fig. 1: Heifer estrous synchronization protocols recommended by the Beef Reproduction Task Force, as approved Dec. 6, 2012

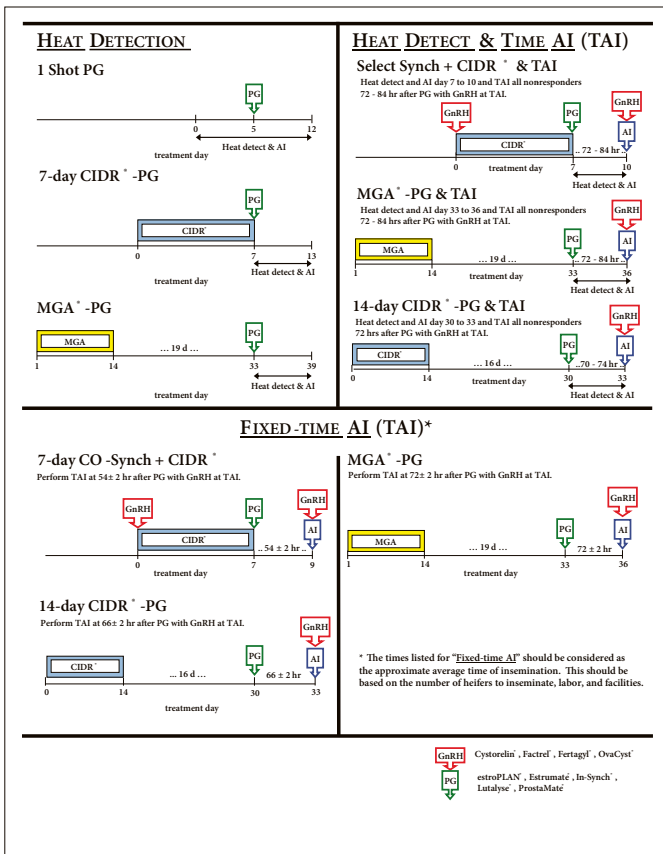
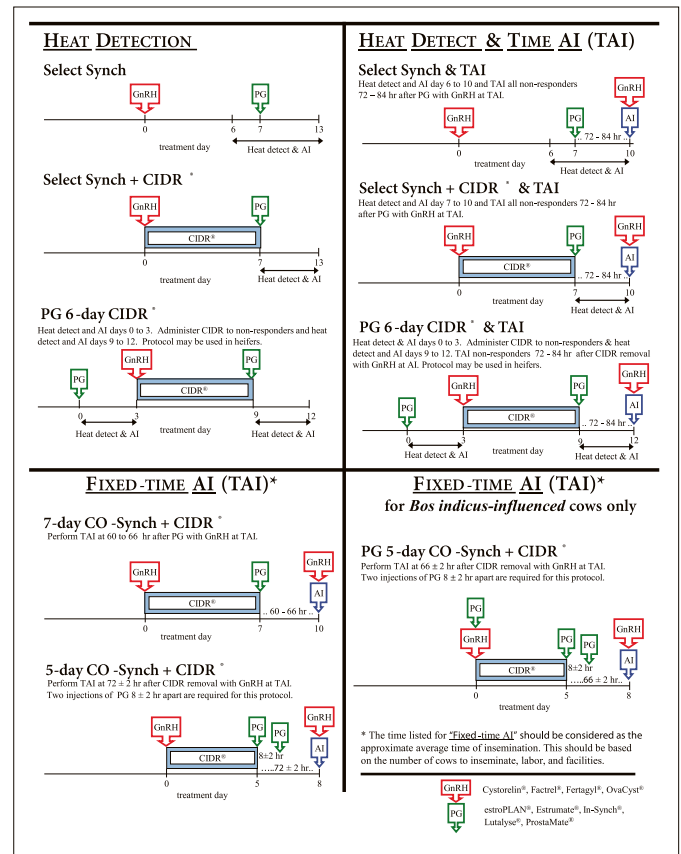


Fig. 2: Beef cow estrous synchronization protocols recommended by the Beef Reproduction Task Force, as approved Dec. 6, 2012



Estrus in Cows

the protocols recommended by the Beef Reproduction Task Force. The task force regularly reviews protocol options and publishes a two-page flier that on one side lists recommended synchronization protocols for cows and on the other lists recommended protocols for heifers. Some of the protocols do include heat detection (see Figs. 1 and 2).

In evaluating estrous synchronization protocols, Lamb reviewed three definitions:

- ▶ **Synchronization rate:** Percentage of females detected in estrus compared to total number synchronized.
- ▶ **Conception rate:** Percentage of females pregnant compared to number of females that are inseminated.
- ▶ **Pregnancy rate:** Percentage of females pregnant to total number of females that are synchronized.

Lamb asked attendees to imagine they synchronized 100 cows, then detected 75 of those cows in heat. This meant their synchronization rate was 75% ($75 \div 100$). If breeding those 75 cows resulted in 50 pregnancies, the conception rate would be 67% ($50 \div 67$).

“That’s usually what most people go to the coffee shop about,” said Lamb, emphasizing, however, that this is not the true pregnancy rate as it forgets about the cows that weren’t detected in heat or that weren’t bred.

Pregnancy rate, he explained, is the percentage of females that become pregnant compared to the total number of females that were synchronized. In the example of 100 females synchronized, 50 became

pregnant, resulting in a 50% pregnancy rate ($50 \div 100$).

“If you truly want to evaluate the success of the system in your own operation, utilize pregnancy rates and don’t utilize conception rate,” Lamb said. “You can still go to the coffee shop and boast about your pregnancies, but when you get home, take a real look at it.”

Lamb used Fig. 3 to illustrate why he prefers to rely on TAI rather than heat detection. Timed AI on cows regularly achieves pregnancy rates of 58%. To accomplish the same success breeding on heat detection, you’d have to detect heat in 90% of your cows and get a 65% conception rate.

The protocols

The two protocols that Lamb recommended for fixed-time AI for cows were the seven-day CO-Synch + CIDR® and the five-day CO-Synch + CIDR systems.

Lamb explained that the seven-day system requires an injection of gonadotropin-releasing hormone (GnRH) as CIDRs are inserted. After seven days, an injection of prostaglandin (PG) is administered as CIDRs are pulled. Sixty to 66 hours later, the cows are given another shot of GnRH as they are AIed. Essentially, you handle the cows three times.

“The great thing about a timed-AI protocol is you can plan three months from now what day you want to AI your cows and at what time you want to do that, because there is no heat detection here at all,” Lamb said.

The five-day system is very similar, he explained. You give an injection of GnRH



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when you insert the CIDRs. You pull the CIDRs five days later, giving an injection of PG. Eight hours later, run the cows through the chute again and give a second injection of PG. AI the cows 72 hours after pulling the CIDRs. At breeding, give an injection of GnRH.

Each system has its drawbacks, said Lamb. However, the overall impact of TAI is much greater than the few potential risks.

When questions arose as to a decrease in percentage coming in heat in the first 21 days after a TAI breeding compared to the following 21 days, researchers conducted a study in which cows were synchronized but not bred. Return rates during the next 21 days were normal, indicating it was not a case of the protocol “messing up” the cows’ heat cycles. Factors that might be playing a role, Lamb explained, include embryonic loss during the first 21 days and whether bulls were ready to handle synchronized returns.

Economically, Lamb said, using TAI results in calves born earlier in the season on average, higher overall pregnancy rates, higher weaning rates and heavier weaning weights (per cow bred). Put into an economic model that assumed a bull price of \$3,250 per bull, a salvage bull price of \$75 per hundredweight, bull maintenance costs of \$365 per year, 7% interest, selling price of \$121 per cwt. for 550-lb. steer calves, semen cost of \$13 per dose and a reduction in the required bull-to cow ration of 1:17 to 1:34, Lamb estimated an advantage of \$49.14 per cow exposed to TAI.

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Fig. 3: Effect of synchronization rate on pregnancy rates

