

Managing Reproduction



PHOTO BY ALLYSON STANEK FROM 2013 NIAA/ANGUS JOURNAL PHOTO CONTEST

Symposium, speakers offer keys to successful estrus synchronization and AI.

by **Kasey Brown**, associate editor; **Paige Nelson & Troy Smith**, field editors

We keep hearing that to meet the needs of the 9 billion souls expected to inhabit this planet by 2050, beef production efficiency must improve. According to South Dakota State University (SDSU) animal scientist George Perry, beef currently represents 22% of the world's meat production. To continue providing their current share of the supply, beef producers must double production in the next 35 years. It seems like a daunting task. To meet it, increasing numbers of cow-calf producers are considering use of estrus synchronization and artificial insemination (AI) to hasten genetic improvement of their herds.

35 Keys to Success Reproductive Efficiency

Speaking during the Applied Reproductive Strategies in Beef Cattle (ARSBC) symposium last fall in Stillwater, Okla., Perry called synchronized AI a powerful tool for genetic improvement. He warned, however, that producers must consider whether they are really ready to implement a synchronization protocol, by reviewing their herds' reproductive performance for the past few years.

"Has the pregnancy rate at the end of a 60- to 85-day breeding season been 85% or better?" asked Perry. "If it has, then you need to evaluate whether your heifers



PHOTOS BY TROY SMITH

► "Data shows that heifers with reproductive tract scores of 4 and 5 achieve higher conception rates and are likely to stay in the herd longer," explained George Perry.

and cows are good candidates for an estrus synchronization and AI program."

Discussing criteria for evaluating the suitability of heifers, Perry said replacement

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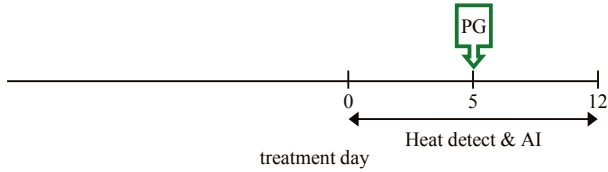
Reproductive Strategies

Fig. 1: Estrus-synchronization protocols for heifers recommended by the Beef Reproduction Task Force for 2015

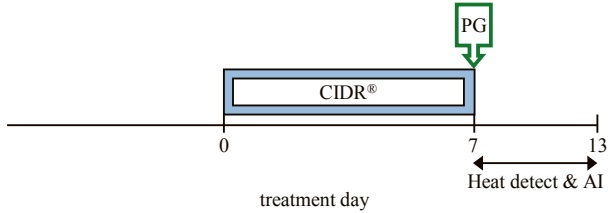
BEEF HEIFER PROTOCOLS - 2015

HEAT DETECTION

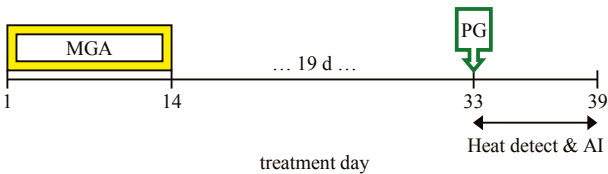
1 Shot PG



7-day CIDR®-PG



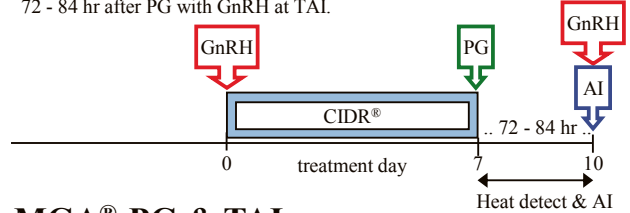
MGA®-PG



HEAT DETECT & TIME AI (TAI)

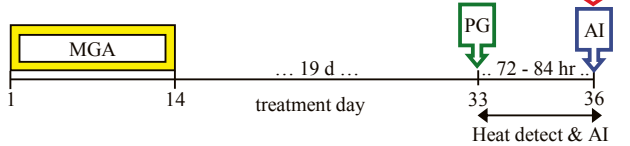
Select Synch + CIDR® & TAI

Heat detect and AI day 7 to 10 and TAI all non-responders 72 - 84 hr after PG with GnRH at TAI.



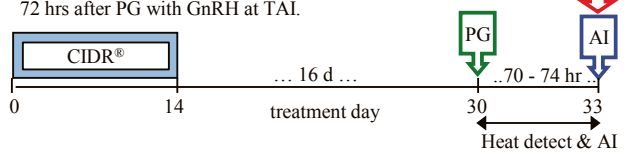
MGA®-PG & TAI

Heat detect and AI day 33 to 36 and TAI all non-responders 72 - 84 hrs after PG with GnRH at TAI.



14-day CIDR®-PG & TAI

Heat detect and AI day 30 to 33 and TAI all non-responders 72 hrs after PG with GnRH at TAI.

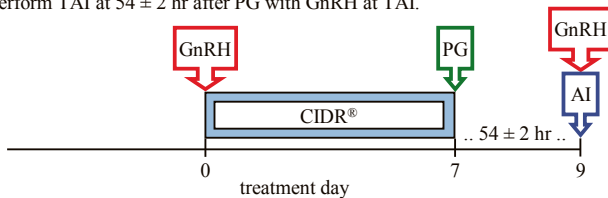


FIXED-TIME AI (TAI)*

Short-term Protocols

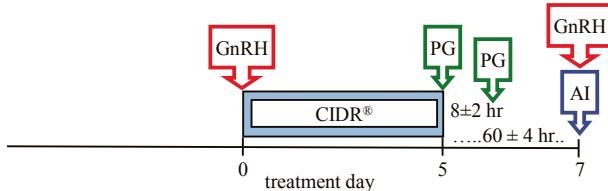
7-day CO-Synch + CIDR®

Perform TAI at 54 ± 2 hr after PG with GnRH at TAI.



5-day CO-Synch + CIDR®

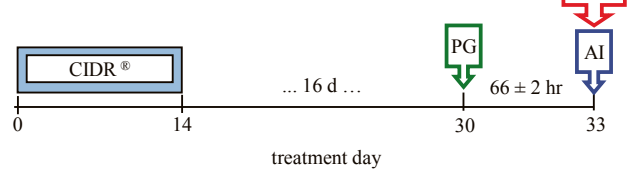
Perform TAI at 60 ± 4 hr after CIDR removal with GnRH at TAI. Two injections of PG 8 ± 2 hr apart are required for this protocol.



Long-term Protocols

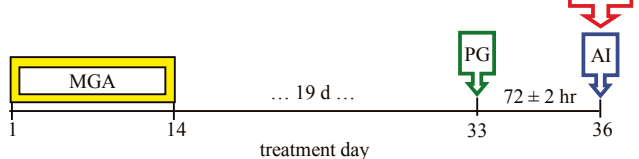
14-day CIDR®-PG

Perform TAI at 66 ± 2 hr after PG with GnRH at TAI.



MGA®-PG

Perform TAI at 72 ± 2 hr after PG with GnRH at TAI.



* The times listed for "Fixed-time AI" should be considered as the approximate average time of insemination. This should be based on the number of heifers to inseminate, labor, and facilities.

GnRH Cystorelin®, Factrel®, Fertagyl®, OvaCyst®
 PG estroPLAN®, Estrumate®, In-Synch®, Lutalyse®, ProstaMate®

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candidates should not have received growth-promoting implants. Producers must consider how they can have heifers developed to an appropriate breeding weight. Additionally, a minimum of 50% of heifers should have reached puberty and begun normal estrous cycles. Perry said sexual maturity can be determined through reproductive tract scoring performed four to six weeks prior to breeding.

“Data show that heifers with reproductive tract scores of 4 and 5 achieve higher conception rates and are likely to stay in the herd longer,” explained Perry.

Body condition is an important consideration when evaluating the suitability of mature cows for estrus synchronization. Perry said body condition score (BCS) at the time of calving should be 5 or greater, since cows calving in poor condition typically experience a longer postpartum period of anestrus before they start cycling again. Cows that experience calving difficulty may also exhibit a longer postpartum interval.

Perry said timing of vaccinations may also affect the success of synchronization and AI. He recommended that heifers be vaccinated early and no boosters be given within 30 days prior to breeding time, especially when using a modified-live virus (MLV) vaccine. Similarly, cows should not be vaccinated within 30 days prior to breeding.



► “The estrous cycle doesn’t operate the way it does simply by chance. The components of the estrous cycle are there to maximize the probability of pregnancy,” said Mike Smith.

Noting that multiple synchronization protocols have been developed and used successfully, Perry said the key is compliance with the protocol. Use all products correctly by delivering correct dosages at the prescribed time. Similarly, insemination must be administered correctly and at the correct time.

Perry emphasized the importance of maintaining proper nutrition following breeding. A sudden change of diet can cause stress leading to embryonic loss. For example, heifers that had been drylotted and fed a ration up until breeding time, and have little or no grazing experience, should not be turned out to grass immediately after breeding.

Trucking recently inseminated females to another location also can induce stress that may cause embryo mortality. Perry said the greatest risk to embryo survival exists from Day 5 to Day 42 following insemination. He recommended shipping cows immediately after insemination, or waiting until after Day 45. However, some risk remains until after 60 days.

According to Perry, genetic improvement through AI has become more practical through advancements in synchronization protocols, but success hinges on good management.

— by Troy Smith

Timing is everything

Whether using an estrus-synchronization protocol for the first time or the 50th, success rests on the foundation of proper hormone dose — the cornerstone being correct timing. Mike Smith, professor of reproductive physiology at the University of Missouri–Columbia, said successful estrus synchronization can happen when producers better understand the reproductive cycle and how hormones work.

“The textbook tells us the estrous cycle is about 21 days, but we really know it can vary from 17 to 24 days and still be absolutely normal,” Smith said.

He explained this means when producers use a fixed-time artificial insemination (FTAI) estrus-synchronization protocol, the second breeding would be spread out over a week’s time. The reason for this variance in cycle length is because cattle have either two or three follicular waves. Those with two waves cycle every 17–20 days, three-wave cattle cycle every 21–24 days.

Showing estrus/heat commonly lasts 12–18 hours; however, that, too, varies from less than eight hours to greater than 30 hours. Ovulation of the oocyte will occur about 30 hours after the start of estrus.

Smith emphasized the importance of estrus detection.

“Remember, pregnancy rate is a function of estrus detection rate and conception rate. Anything that reduces estrus detection rate will reduce pregnancy rate,” he stated.

The estrous cycle consists of three phases:

- follicular;
- estrus; and
- luteal.

There are two major ovarian structures that are critical for regulating the estrous cycle, said Smith, the dominant follicle and the corpus luteum (CL). During the follicular phase a wave of follicles grow on the ovary.

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PHOTO BY SAMANTHA SCHERMER FROM 2012 NIAA/ANGUS JOURNAL PHOTO CONTEST

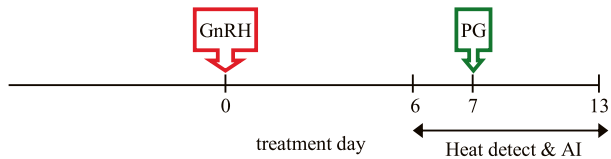
► Body condition is an important consideration when evaluating the suitability of mature cows for estrus synchronization. Perry said body condition score (BCS) at the time of calving should be 5 or greater, since cows calving in poor condition typically experience a longer postpartum period of anestrus before they start cycling again. Cows that experience calving difficulty may also exhibit a longer postpartum interval.

Fig. 2: Estrus-synchronization protocols for cows recommended by the Beef Reproduction Task Force for 2015

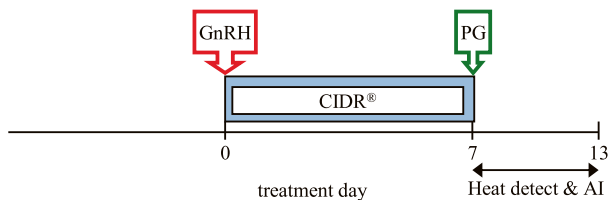
BEEF COW PROTOCOLS - 2015

HEAT DETECTION

Select Synch

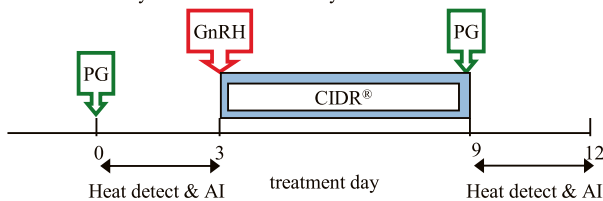


Select Synch + CIDR®



PG 6-day CIDR®

Heat detect and AI days 0 to 3. Administer CIDR to non-responders and heat detect and AI days 9 to 12. Protocol may be used in heifers.



HEAT DETECT & TIME AI (TAI)

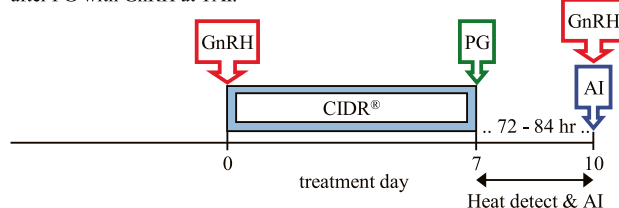
Select Synch & TAI

Heat detect and AI day 6 to 10 and TAI all non-responders 72 - 84 hr after PG with GnRH at TAI.



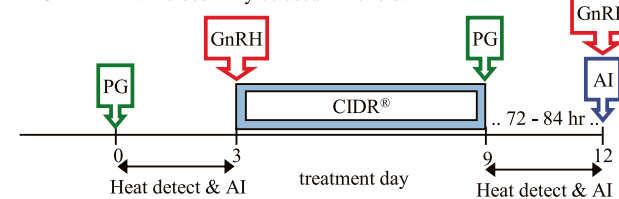
Select Synch + CIDR® & TAI

Heat detect and AI day 7 to 10 and TAI all non-responders 72 - 84 hr after PG with GnRH at TAI.



PG 6-day CIDR® & TAI

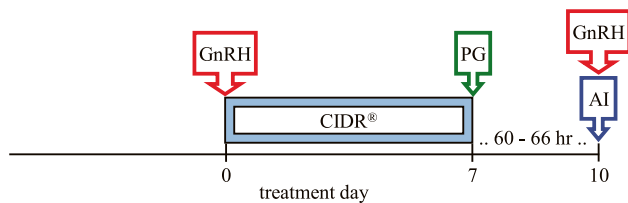
Heat detect & AI days 0 to 3. Administer CIDR to non-responders & heat detect and AI days 9 to 12. TAI non-responders 72 - 84 hr after CIDR removal with GnRH at AI. Protocol may be used in heifers.



FIXED-TIME AI (TAI)*

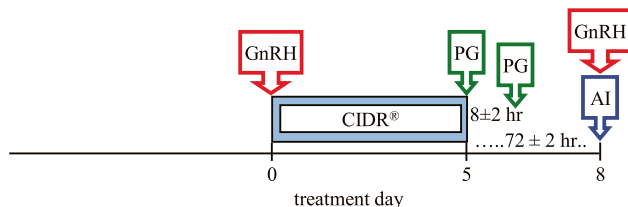
7-day CO-Synch + CIDR®

Perform TAI at 60 to 66 hr after PG with GnRH at TAI.



5-day CO-Synch + CIDR®

Perform TAI at 72 ± 2 hr after CIDR removal with GnRH at TAI. Two injections of PG 8 ± 2 hr apart are required for this protocol.

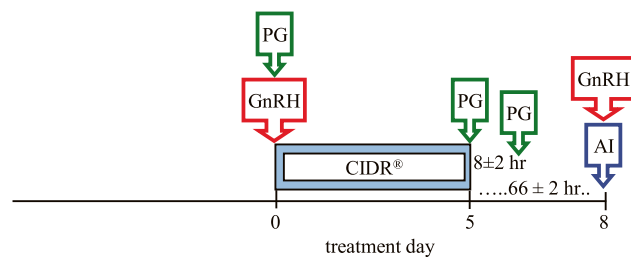


FIXED-TIME AI (TAI)*

for *Bos Indicus* cows only

PG 5-day CO-Synch + CIDR®

Perform TAI at 66 ± 2 hr after CIDR removal with GnRH at TAI. Two injections of PG 8 ± 2 hr apart are required for this protocol.



* The time listed for "Fixed-time AI" should be considered as the approximate average time of insemination. This should be based on the number of cows to inseminate, labor, and facilities.

- GnRH Cystorelin®, Factrel®, Fertagyl®, OvaCyst®
- PG estroPLAN®, Estrumate®, In-Synch®, Lutalyse®, ProstaMate®

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Eventually, one follicle is selected to become dominant. This will be the follicle to ovulate and produce estradiol (E_2), which brings the cow into heat.

After ovulation, in the luteal phase, E_2 levels decrease; the dominant follicle becomes a CL and secretes progesterone (P_4).

He explained that during high P_4 levels there is no estrus expression, until after the P_4 has been removed. This is why feeding melengestrol acetate (MGA) or using controlled internal drug release devices (CIDR®s) are part of many AI estrus-synchronization protocols.

In the absence of a fertilized embryo, said Smith, the uterus destroys the CL by releasing prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) and starting another wave of follicles. In the case of pregnancy, the embryo produces a protein that interferes with $PGF_{2\alpha}$, and the CL is maintained.

“It is essential to keep accurate records, so a pregnant cow is not injected with prostaglandin, causing her to abort,” said Smith.

Smith highlighted several functions of these hormones, along with other hormones involved in the reproductive cycle.

- ▶ Estradiol brings the cow into heat, causes the release of luteinizing hormone (LH), aids in the transportation of sperm and prepares the uterus for pregnancy.
- ▶ Progesterone prevents estrus and ovulation, and prepares the reproductive tract for pregnancy. It can be used to induce anestrous cattle to cycle.
- ▶ Prostaglandin $F_{2\alpha}$ causes the CL to regress in nonpregnant animals. In anestrous cattle it has no effect. It is only effective between days 6-16 of the estrous cycle.
- ▶ Luteinizing hormone (LH) lyses the dominant follicle causing ovulation.
- ▶ Follicle-stimulating hormone (FSH) initiates a new wave of follicles.
- ▶ Gonadotropin-releasing hormone (GnRH) controls secretion of LH and FSH. GnRH can be used to synch follicular waves.

“The estrous cycle doesn’t operate the way it does simply by chance. The components of the estrous cycle are there to maximize the probability of pregnancy,” said Smith.

To have a successful synchronization, Smith emphasized knowing four keys to the reproductive cycle.

First, high levels of P_4 must exist with a dominant follicle. If only low levels exist, the dominant follicle will become persistent and the oocyte will become aged.

Second, when preparing a cow to be bred,



▶ “A reproductive tract score is the most underutilized tool in reproductive management,” said Dave Patterson.

complete regression of the CL must take place. Sometimes the CL may regress only partially. Therefore, it is critical to give the correct dose of PGF at the correct time.

Third, there must be an appropriate increase in E_2 for pregnancy to occur.

Fourth, after a cow has ovulated and been inseminated, she must have an appropriate, rapid increase in P_4 .

Smith spoke during Wednesday’s ARSBC session focused on an overview of reproductive management. For more information, visit the Newsroom at www.appliedreprostrategies.com to view his PowerPoint or listen to his presentation.

— by Paige Nelson

Overview of protocols

There are plenty of challenges in the U.S. beef industry, but there are also opportunities, and Dave Patterson was quick to highlight a few. Reproductive technology works and is on the shelf ready to use.

Increasing domestic and global demand for high-quality beef are also opportunities, as are a host of marketing incentives that add value.

Time and labor are the biggest inhibitors of reproductive technology use, said the University of Missouri animal science professor. However, the benefits can outweigh the labor and time costs. Increased profits can result when more females in the herd calve in the first 21 days of the calving season. He said that high-production herds see 61% of the calves born by Day 21, 85% by Day 42 and 94% by Day 63.

Heifers that conceive earlier during their first breeding season stay in the herd longer and produce more pounds of beef throughout their lifetime, he added. However, cattlemen must manage their heifers correctly to achieve best reproductive results, reaching an optimal target weight by breeding season and making use of management tools such as reproductive tract scores (RTS), pelvic

measurements, estrus synchronization and calving-ease sire selection.

“A reproductive tract score is the most underutilized tool in reproductive management,” Patterson asserted. An RTS, scored from 1 to 5, with 5 being the best, scores cycling status, uterine horn tone and ovary development. Heifers should be evaluated for RTS four to six weeks before breeding or two weeks before synchronizing estrus. He recommended waiting to begin synchronization until at least 50% of your heifers have an RTS of 4 or 5.

When evaluating the success by RTS to fixed-time artificial insemination (FTAI) for 14,510 heifers from the Missouri Show-Me-Select Replacement Heifer Program, the pregnancy rate differed dramatically. Patterson explained that the group of heifers categorized with an RTS of 1 recorded a pregnancy rate of 10%. Those scored with an RTS 2 had a 32% pregnancy rate; those with an RTS 3, 46%; RTS 4, 50%; and RTS 5, 53%.

“Choosing a protocol for use in synchronizing heifers prior to fixed-time AI should include consideration of the pretreatment estrous-cyclicity status of heifers four to six weeks before breeding. Careful attention to protocol compliance, specifically product administration and timing of insemination are critical determinants of success,” he said.

For cows, he added, “Choosing a protocol for use in synchronizing beef cows should include consideration of the age of the cows, the average number of days postpartum at treatment administration and body condition.”

When considering a choice between the five-day and seven-day protocols, he said that both protocols work effectively in postpartum cows, with evidence of up to a 3% advantage for the five-day protocol. However, he cautioned that cattlemen should consider the increased labor and treatment costs associated with the five-day protocol.

— by Kasey Brown



Editor’s Note: Perry, Smith and Patterson spoke during Wednesday’s ARSBC session focused on reproductive management. Visit the Newsroom at www.appliedreprostrategies.com to view their PowerPoints, read their proceedings or listen to their presentations. Compiled by the Angus Journal editorial team, the site is made possible through sponsorship by the Beef Reproduction Task Force and provides comprehensive coverage of the symposium.