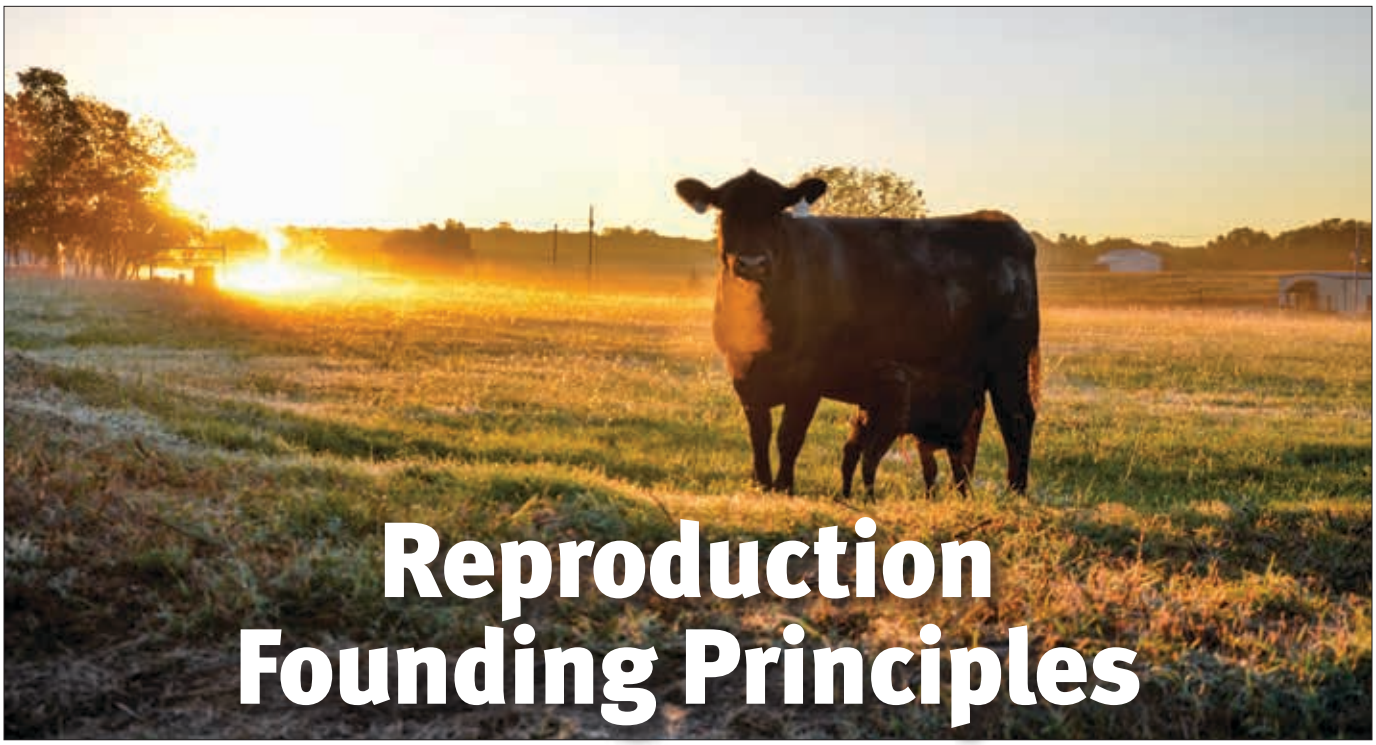

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Reproduction Founding Principles

Greater pregnancy outcomes achievable with greater understanding of the physiology of the estrous cycle, most recent advancement in synchronized AI protocols reduces GnRH use.

*by **Shauna Rose Hermel,** editor, & **Troy Smith,** field editor*

In an opening presentation to the Applied Reproductive Strategies in Beef Cattle (ARSBC) symposium hosted Aug. 29-30 in Manhattan, Kan., Kansas State University (K-State) animal scientist Jeffrey Stevenson talked about the physiology of the estrous cycle. He said the application of artificial insemination (AI) in beef breeding herds has become much more practical due to advancements in timed-AI (TAI) programs. However, Stevenson also noted that an understanding of the limitations of methods used to control the estrous cycle leads to more uniform and consistent pregnancy outcomes.

According to Stevenson, once the bovine female reaches puberty, she begins to experience estrous cycles — each being approximately 21-22 days in length — which continue unless interrupted by pregnancy. The cyclicity of estrous is attributed to repeated changes in the development of ovarian follicles, ovulation (release of an ovum or egg) and formation of a corpus luteum (CL) — all of which are controlled by the interactions of various hormones.

Ovulation generally occurs 24-30 hours after the onset of estrus, that period during the cycle when the female is receptive to mating.

The CL is a temporary aggregation of cells that forms at the site of a follicle after ovulation has occurred. It is maintained only if a pregnancy is established. However, while still present in a non-pregnant female, the CL secretes progesterone, which inhibits expression of estrus and ovulation.

"Estrous synchronization is largely about managing the CL," stated Stevenson, explaining how synchronization programs involve administration of prostaglandin products, which induce regression of the CL and the subsequent removal of the influence of progesterone. Synchronization programs also call for administration of GnRH (gonadotropin-releasing hormone) to trigger a surge of luteinizing hormone, produced by the pituitary gland, which then stimulates ovulation to occur in about 30 hours.

Stevenson referenced the popular 7-day CO-Synch + CIDR® (controlled internal drug-release device) synchronization

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PHOTOS BY TROY SMITH

►Application of artificial insemination in beef breeding herds has become much more practical due to advancements in timed-AI programs and greater understanding of the limitations of methods used to control the estrous cycle, said K-State animal scientist Jeff Stevenson.

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protocol, which is initiated with administration of GnRH and application of the CIDR device on Day 0. The CIDR is removed on Day 7 and prostaglandin is administered. Insemination occurs 60-66 hours later, at which time a second GnRH dose is administered. Ovulation response to GnRH occurs nearly every time if CL regression occurs successfully, making the protocol practical for most beef cattle operations.

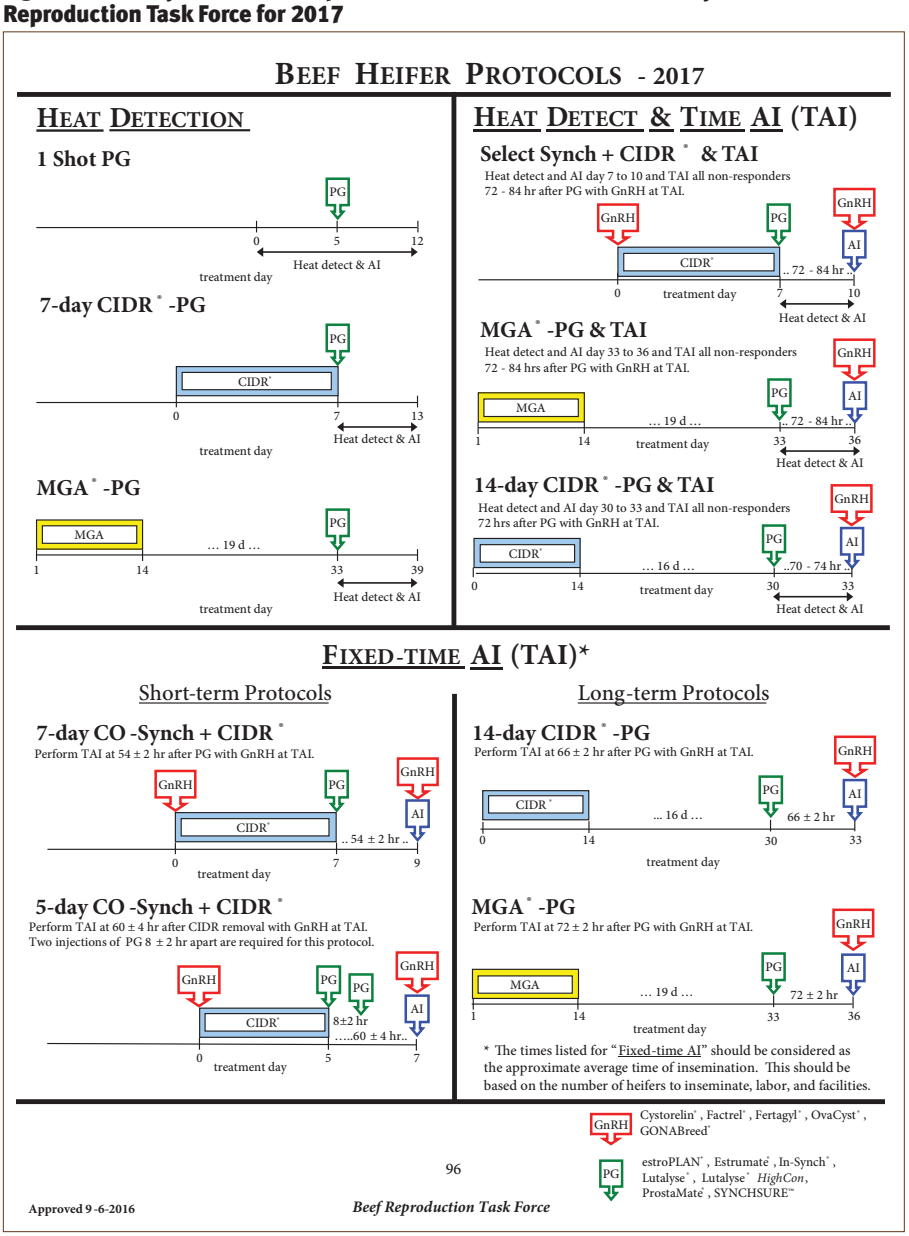
Stevenson suggested that results might be even better if the second dose of GnRH were administered approximately 16 hours prior to insemination, since that sequence more closely mimics what occurs at spontaneous estrus.

"Administering GnRH-2 (second dose) approximately 16 hours before AI allows for ovulation to occur 8 to 14 hours after sperm have formed a reservoir at the utero-tubal junction. This timing matches nicely what occurs naturally when cows come into heat spontaneously and ovulate in response to their own estradiol-GnRH-LH signals," explained Stevenson.

Additional study is warranted, according to Stevenson, regarding the timing of the second GnRH dose, relative to the time of AI. To be practical, improvement in pregnancy outcome must outweigh time and handling costs.

— by Troy Smith

Fig. 1: Estrous synchronization protocols for heifers recommended by the Beef Reproduction Task Force for 2017



Split-time protocols offer savings

Producers can save labor and expense with their synchronized time-AI program if they use a split-time AI approach, said David Patterson, state beef extension specialist and professor of animal science at the University of Missouri (MU)–Columbia.

One of the more recent advancements has been the evolution of split-time AI protocols evaluated by Jordan Thomas, a doctoral candidate advised by David Patterson within MU's Division of Animal Science.

Patterson shared the evolution of protocols to synchronize estrus, providing an overview of the advancement in products and technologies since the 1950s. Included were brief discussions of current protocols recommended by the Beef Reproduction Task Force for use in synchronizing estrus in beef heifers and mature cows (see "Beef Heifer Protocols — 2017" and "Beef Cow Protocols — 2017," page 168).

One of the more recent advancements has been the evolution of split-time AI (STAI) protocols evaluated by Jordan Thomas, a doctoral candidate advised by Patterson within MU's Division of Animal Science.

With the initial goal of trying to improve pregnancy rates using sexed semen in a fixed-time AI program, Thomas evaluated whether pregnancy rates among cows subjected to fixed-time AI (FTAI) could be improved by delaying the timing of AI on those cows that had not exhibited heat by the standard AI time. The thought was that this would better align the window of sperm fertility with the timing of GnRH-induced ovulations.

Using the 7-day CO-Synch + CIDR

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protocol, cows exhibiting estrus were inseminated according to the FTAI schedule, while those not exhibiting heat were inseminated 20-24 hours later. All cows were administered GnRH at 66 hours. Better overall pregnancy rates were achieved.

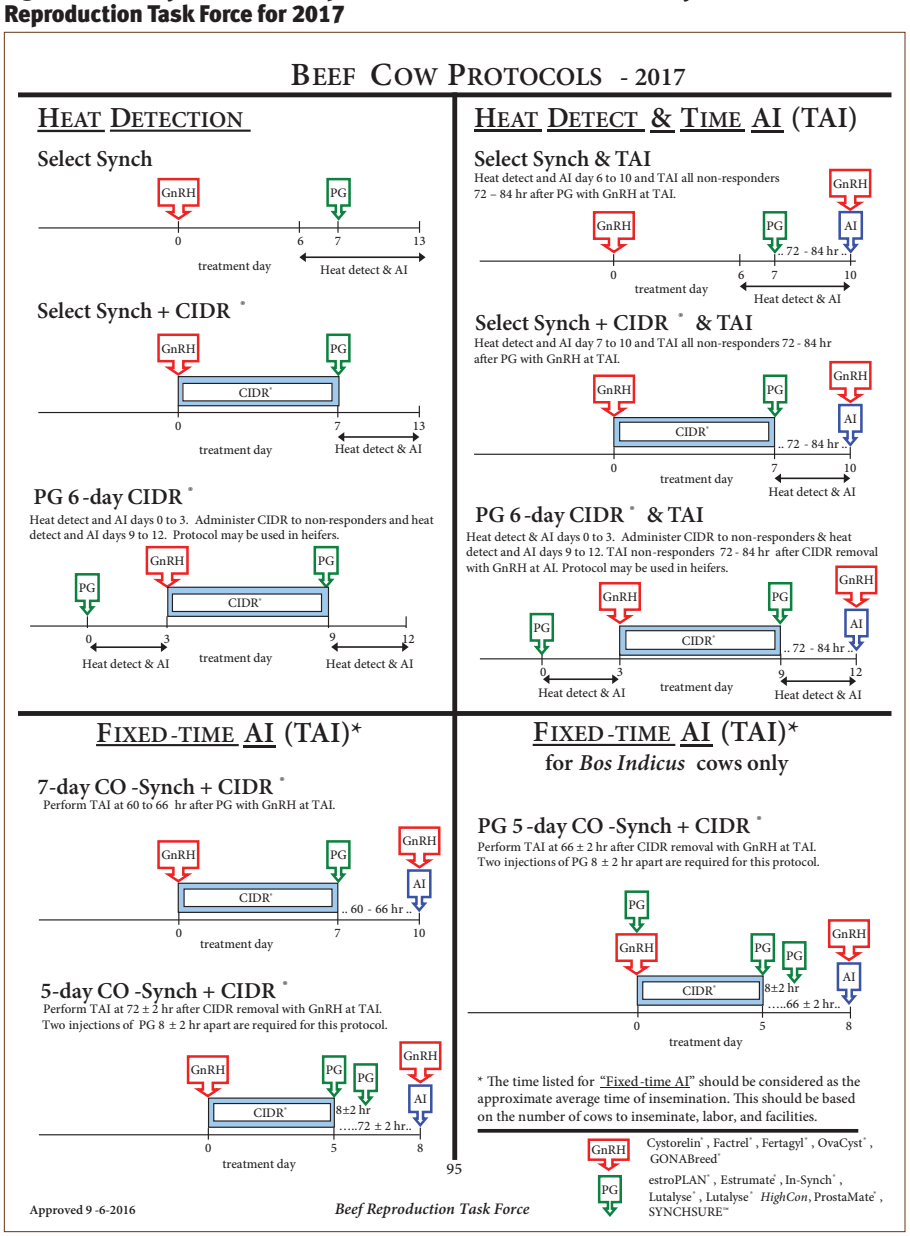
In subsequent trials Thomas evaluated the STAI protocol using conventional semen to breed heifers following administration of the 14-day CIDR-PG protocol and then thirdly using conventional semen to breed mature cows with the 7-day Co-Synch + CIDR protocol.

The take-home messages from Thomas's work, Patterson said, include:

- Split-time AI increased pregnancy rates by 34% among nonestrous cows inseminated with sex-sorted semen.
- Split-time AI increased pregnancy rates by 15% among nonestrous heifers using conventional semen.
- No significant improvement in pregnancy rates was observed with split-time AI using conventional semen in nonestrous cows.

A series of three follow-up studies conducted by Brianne Bishop at MU showed that it is not necessary to administer GnRH to heifers or cows that express estrus up to 66 or 90 hours after prostaglandin following administration of the 14-day CIDR-PG protocol in heifers or the 7-day CO-Synch + CIDR protocol in cows. GnRH may be administered concurrent with AI for heifers or cows that fail to express estrus prior to 90 hours, which minimizes use of GnRH and results in a greater overall estrous response in cows.

Fig. 2: Estrous synchronization protocols for cows recommended by the Beef Reproduction Task Force for 2017



►The University of Missouri's David Patterson shared the evolution of estrous synchronization protocols, culminating in split-time artificial insemination protocols for heifers and cows.

Patterson said Bishop's research showed that the higher pregnancy response rates to STAI vs. FTAI were due primarily to higher estrous response rates rather than the timing of insemination relative to GnRH-induced ovulations.

The split-time approach affords beef producers the opportunity to increase pregnancy rates resulting from AI.

For more details of Stevenson's and Patterson's presentations, refer to their PowerPoints and proceedings posted to the Newsroom at *www.appliedreprostrategies.com*, which features comprehensive coverage of the symposium. Compiled by the *Angus Journal* editorial team, the site is made possible through sponsorship by the Beef Reproduction Task Force. To access video of the presentations, visit the Beef Reproduction Task Force page on Facebook.

Hosted by the Task Force and Kansas State University Research & Extension, the 2017 ARSBC Symposium was convened Aug. 29-30 in Manhattan, Kan. Next year's symposium will be Aug. 29-30 in Ruidoso, N.M.

— by Shauna Rose Hermel