

# Estrous Synchronization and Fixed-Time Artificial Insemination<sup>1</sup>

Vitor R. G. Mercadante, Darren D. Henry, Francine M. Ciriaco, Pedro L. P. Fontes, Nicky Oosthuizen, and G. Cliff Lamb<sup>2</sup>

The economic success of beef cow-calf operations depends on the production of one healthy calf per cow per year. To achieve this goal, cow-calf producers need to overcome several obstacles related to the cow, bull, and offspring. Over the last four decades, several advances in reproductive biotechnologies, such as artificial insemination (AI), synchronization of estrus, and fixed-time AI (TAI), have allowed producers to improve the genetic traits of their cattle and shorten the lengths of both the breeding season and subsequent calving season, which can lead to increased overall profitability of cow-calf production systems. Nonetheless, adoption of these technologies by beef cattle producers is often slow and largely dependent on certain key factors:

1. Limited frequency of handling cattle and
2. Elimination of detection of estrus by employing TAI.

Approximately 8% of beef operations in the United States utilize AI as a reproductive management tool; that said, approximately 72% of all pregnancies in dairy females are the result of AI (Lamb et al. 2010). When asked about their reluctance to utilize AI, over 53% of operations cited labor concerns or complicated estrous synchronization protocols as primary reasons for not implementing this reproductive technology (Johnson et al. 2011).

Advances in reproductive biotechnologies and enhanced understanding of the dynamics of the bovine estrous cycle have made possible the development of protocols to manipulate the estrous cycle and control ovulation using natural and/or artificially synthesized hormones. During the past decade, TAI protocols that eliminate the need for detecting estrus and yield satisfactory pregnancy rates have been developed, although additional research needs to be done in *Bos indicus*-based cattle, or cattle of zebu origin. Most of these TAI protocols rely on the use of exogenous progesterone, gonadotropin-releasing hormone (GnRH)-induced ovulation, and luteolysis via administration of prostaglandin F<sub>2α</sub> (PGF<sub>2α</sub>).

Extensive research has been performed and is still being conducted by several research groups to enhance the understanding of physiological processes involved in the estrous cycle and to increase the fertility and pregnancy success of TAI protocols. In an effort to combine expertise in reproductive physiology and estrous synchronization and encourage research cooperation across the United States, the Beef Reproduction Task Force (BRTF) was formed in 2002. The BRTF is a multi-state team of reproductive physiology experts from seven universities across the United States (<http://beefrepro.unl.edu/>). The objectives of the BRTF are:

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2. Vitor R. G. Mercadante, assistant professor, Department of Animal and Poultry Sciences, Virginia Tech, Blacksburg, VA 24061; Darren D. Henry, PhD candidate; Francine M. Ciriaco, PhD student; Pedro L. P. Fontes, Master's student; Nicky Oosthuizen, Master's student; and G. Cliff Lamb, professor, Department of Animal Sciences, North Florida Research and Education Center; UF/IFAS Extension, Marianna, FL 32446.

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- To improve the understanding of the physiological processes of the estrous cycle, the procedures available to synchronize estrus and ovulation, and the proper application of these systems
- To improve the understanding of methods used to assess male fertility and how it affects the success of AI programs (Johnson et al. 2011)

Every year, the BRTF releases an updated chart of recommended estrous synchronization and TAI protocols that have been tested and are proven to be effective for beef cows and heifers, including different protocols for *Bos taurus*- (European or English) and *Bos indicus*-based cattle (Figure 1 and Figure 2). These charts are excellent sources of information and serve as guidelines for beef producers and industry leaders in the United States.

The success of TAI programs can be affected by several factors, including postpartum anestrus, days postpartum, parity, and body condition score (BCS). Postpartum anestrus is a major contributor to infertility in cattle. The resumption of the estrous cycle earlier in the postpartum period increases the number of estrous cycles and the chances for a cow to become pregnant during the breeding season. Reducing the postpartum interval may be accomplished by managing pre- and postpartum nutrition, BCS, disease through an active herd health program, and suckling interaction between cow and calf. The effects of days postpartum and parity on TAI pregnancy rates in suckled beef cows have been previously shown, with improved fertility in multiparous cows even when days postpartum amounted to more than 50. Body condition score during the peripartum period also affects fertility. It has been shown that a single unit increase in BCS, especially from poor BCS to adequate BCS, resulted in a 23 percentage point increase in the proportion of cows pregnant to a TAI (Lamb et al. 2010). In addition, cows calving in poor BCS experience longer intervals to the first postpartum estrus compared to cows calving in moderate to good BCS.

A review of several studies of more than 3,000 suckled beef cows showed that, regardless of parity, estrous cycle activity increased from 9% at 30 or fewer days to a peak of 70% between 81 and 90 days postpartum. Furthermore, as BCS increased from 3.5 or less to 6.0 or greater (on a 1 to 9 scale), the percentage of cows cycling increased in a linear way by 18% for each unit increase in BCS. In addition, pregnancy rates were greater in cows that calved during the first seven weeks of the calving season despite a lower overall BCS than those of later calving cows. The most desirable pregnancy outcomes indicated in the review were noted in older, early calving cows with better BCS, while

the poorest outcomes were in primiparous, late calving cows with the lowest BCS (Stevenson et al. 2015).

In an analysis that investigated the incorporation of TAI followed by clean-up breeding, or the use of natural service bulls after an initial artificial insemination, compared to natural mating in a cow-calf production setting, 84% of cows exposed to TAI subsequently weaned a calf compared to 78% of cows in the natural mating group. Calving distribution also differed. The mean calving day from initiation of the calving season was 26.8 days for cows exposed to TAI and 31.3 days for cows that engaged in natural mating. According to these data, more calves are weaned per cow exposed when synchronization and TAI are utilized, and these calves may also be older at weaning, which presents the opportunity for them to gain more weight. This increase in weaning weight may have the greatest potential to offset the cost of synchronization and TAI systems and improve the genetics of the herd.

Further gains in beef production efficiency require new insights into the physiological mechanisms controlling various aspects of reproduction and calf growth as well as beef producers' adoption of technologies and management systems. It is clear that the incorporation of TAI protocols into beef production systems yields many benefits, such as subsequent improvements in efficiency and profitability of beef cattle operations.

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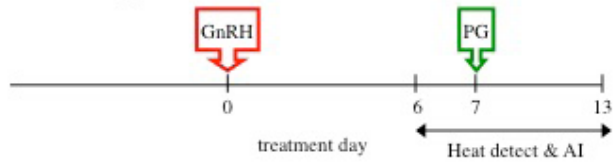
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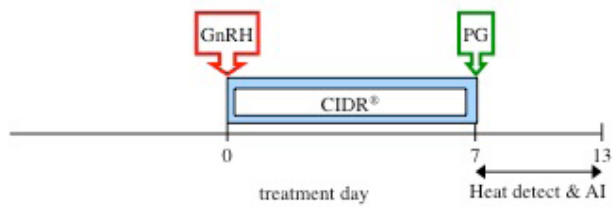
# BEEF COW PROTOCOLS - 2016

## HEAT DETECTION

### Select Synch

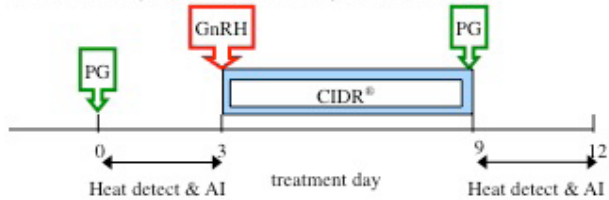


### Select Synch + CIDR®



### 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)

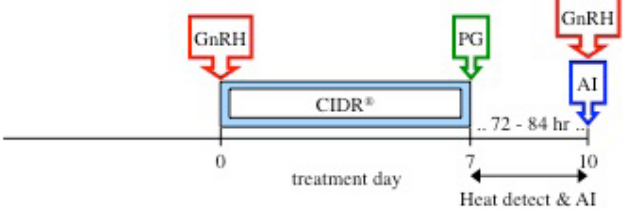
### Select Synch & TAI

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



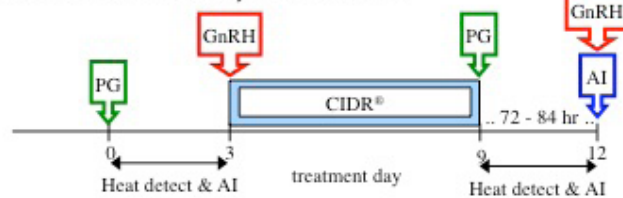
### Select Synch + CIDR® & TAI

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

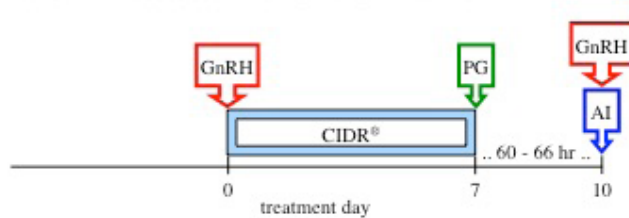
Heat detect & AI days 0 to 3. Administer CIDR to non-responders & heat detect and AI days 9 to 12. TAI non-responders 72 – 84 hr after CIDR removal with GnRH at AI. Protocol may be used in heifers.



## FIXED-TIME AI (TAI)\*

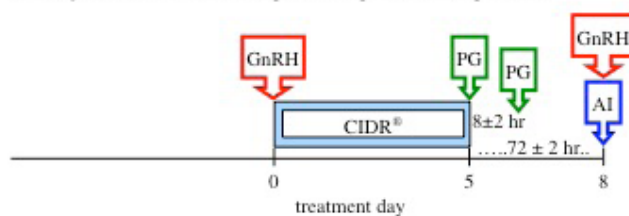
### 7-day CO-Synch + CIDR®

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.

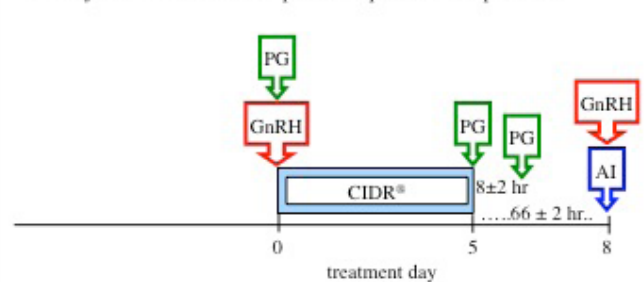


## FIXED-TIME AI (TAI)\*

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®, GONABreed®
- PG: estroPLAN®, Estrumate®, In-Synch®, Lutalyse®, ProstaMate®

Approved 8-16-2015

Beef Reproduction Task Force

Figure 1. Beef Reproduction Task Force chart of recommended estrous synchronization and TAI protocols for beef cows.

Credits: Beef Reproduction Task Force

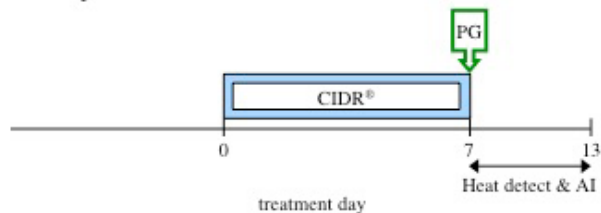
# BEEF HEIFER PROTOCOLS - 2016

## HEAT DETECTION

### 1 Shot PG



### 7-day CIDR®-PG



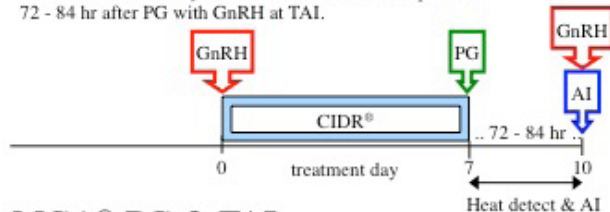
### MGA®-PG



## HEAT DETECT & TIME AI (TAI)

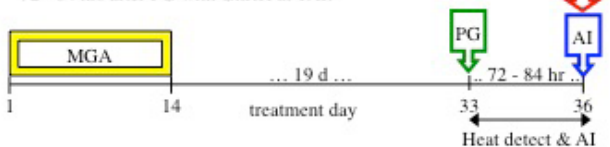
### Select Synch + CIDR® & TAI

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



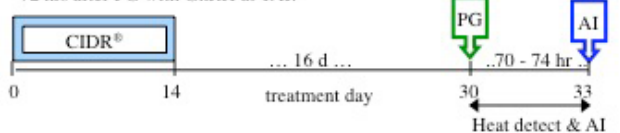
### MGA®-PG & TAI

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.

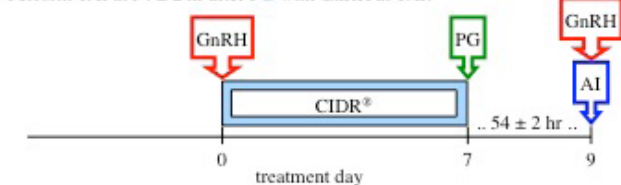


## FIXED-TIME AI (TAI)\*

### Short-term Protocols

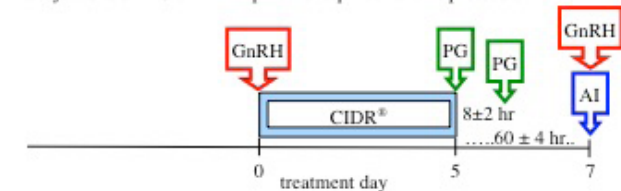
#### 7-day CO-Synch + CIDR®

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®, GONABreed®
- PG estroPLAN®, Estrumate®, In-Synch®, Lutalyse®, ProstaMate®

Approved 8-16-2015

Beef Reproduction Task Force

Figure 2. Beef Reproduction Task Force chart of recommended estrous synchronization and TAI protocols for beef heifers. Credits: Beef Reproduction Task Force