

The 30-Day Game Changer: Improving Reproductive Efficiency and Profitability of Beef Herds

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Introduction

Beef producers need cows to become pregnant, deliver healthy calves, and wean productive calves in order to make their operations economically viable. The failure of breeding females to become pregnant directly impacts the economic viability of every beef operation, yet few producers realize how infertility impacts their individual operations. Australian cattle producers have noticed unprecedented increases in the value of calves, replacement heifers, and cull cows and bulls. Therefore, every live calf that is produced and marketed has significant value to beef operations. The positive cash flow in the beef industry provides an ideal opportunity to incorporate reproductive technologies that previously may not have been viable. To maximize profitability in beef operations, producers depend on the production of one healthy calf per cow per year. Incorporating reproductive technologies enhances the opportunity to increase the financial and biological components that contribute to profitability of beef operations.

Use of estrus synchronization (ES) and artificial insemination (AI)

Artificial insemination is not a new technology. The developmental research that preceded our modern techniques dates back to Russia in the late 1800s and early 1900s. For beef producers a major opportunity exists to increase the genetic potential of their herd through the use of AI. With AI, the most genetically superior sires are available to a large number of producers rather than being confined to the cows that are on a single pasture. In addition, the accuracy of predicting performance of offspring of young sires with no progeny (typical of most natural service sires) is less than that of sires with a large number of offspring (typical of "proven" AI sires). One of the primary advantages of using AI is that semen from sires with high accuracy are far superior to most natural service sires available. High accuracy of proven AI sires allow producers more confidence that the advertised performance and phenotypic characteristics of offspring will be realized, compared with offspring from low accuracy natural service sires. The risk of unexpected performance is greater when using low accuracy natural service sires. In addition, improving the accuracy of sire breeding value predictions may increase the overall rate of genetic change on beef operations and improved rate of genetic change can lead to subsequent improvements in overall profitability.

Synchronizing the estrous cycle with the use of exogenous (administered by injection or insert/implant and/or cuemate to the cow) hormones has been developed and incorporated into beef production systems primarily to facilitate the use of AI for more than 40 years. A primary factor limiting the use of AI is the labor required to perform AI and to detect estrus in females and ensure they are inseminated at the appropriate time. It is now possible to expect to achieve pregnancy from AI in more than 50% of the herd during the first week of the breeding season. The success of ES in increasing the proportion of pregnancies derived from AI will increase the

rate of genetic improvement through mating with genetically superior AI sires. However, other benefits have become evident including the potential to alter the calving season and increase uniformity of calves. Estrus synchronization protocols, particularly those which include a progestin, may induce cyclicity in non-cyclic females. These mentioned advantages to utilize ES have enhanced its use in beef operations and is usually used in conjunction with AI. One such improvement that is underutilized by beef producers is the use of fixed-time artificial insemination (FTAI). Fixed-time artificial insemination is frequently overlooked because many beef cattle producers feel like they need to know how to artificially inseminate cows. However, the technology has improved and now cattle producers can inseminate all of their cows or heifers on a single day at the same time. The development of FTAI has 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.

The success of FTAI 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 FTAI 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. In addition, cows calving in poor BCS experience longer intervals to the first postpartum estrus compared to cows calving in moderate to good BCS.

What should I expect from my AI program?

Before discussing what you should expect from an AI program, it is important to understand a few definitions that are frequently used when talking about the success of a program, but often misinterpreted. These definitions are:

- 1) Synchronization rate:** defined as the percentage of females detected in heat compared to the number of females synchronized.
- 2) Conception rate:** defined as the percentage of females pregnant compared to the number of females detected in heat.
- 3) Pregnancy rate:** defined as the percentage of females pregnant compared to the total number of females synchronized.

For example, if a producer synchronizes 100 females and detects 75 females in heat and inseminates those 75 cows, and ends up with 50 pregnancies. The synchronization rate would be 75% (75 females in heat compared to 100 total females synchronized), the conception rate would be 67% (50 females pregnant compared to 75 females inseminated), and the pregnancy rate would be 50% (50 females pregnant compared to 100 females synchronized).

Determining how successful your synchronization and AI program is will help you identify the pitfalls and correct them, you can't administer what you don't measure. Essentially, synchronization rate is important if you use an estrus synchronization system that requires heat detection. The more females you detect in heat will result in more females to inseminate and potentially become pregnant to AI. Conception rate is somewhat meaningless to the success of an AI program, but frequently used by producers when sharing how successful they were. The primary issue with conception rate is that you do not take into account females that were synchronized and that were not detected in heat. Therefore, pregnancy rate is a far better assessment of the success of their AI program than conception rate. However, keep in mind that generally pregnancy rates will be lower than conception rates unless a fixed-time AI program is used or every female is detected in heat.

Selecting an estrus synchronization (ES) and FTAI protocol

There are many protocols from which to choose. Many of these protocols work; however, as indicated previously the success of the protocol likely relies more heavily on the management and fertility of the herd rather than the specific protocol selected. Therefore, the most simply protocols recommended are below for cows and heifers.

For cows: Essentially the most simple of all protocols that consistently provides the best success is the 7-day CO-Synch + CIDR protocol (Figure 1) is the primary protocol recommended for cows. In cows the FTAI should occur at between 60 and 66 hours after CIDR removal. Producers may have had experience with administering Pregnenol (the trade name for equine chorionic gonadotropin) at the time of CIDR removal, but this may only be effective in females that are not cycling at the start of the breeding season. In addition, use of Pregnenol should be monitored, since field reports have noted an increasing in twinning rates. In general GnRH would be preferred over Cidriol at FTAI, since ovulation tends to be more uniform with GnRH than Cidriol.

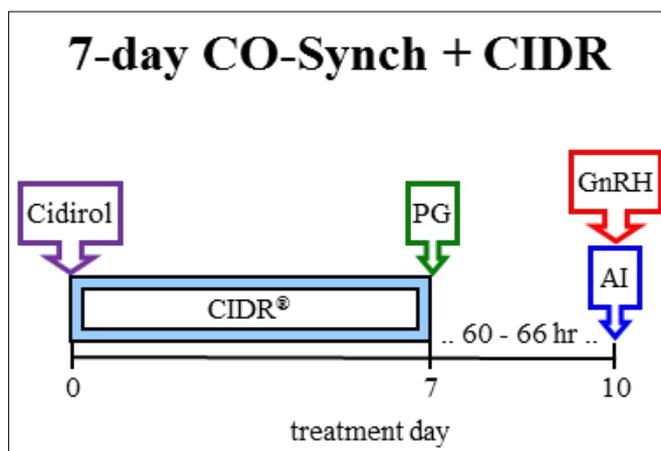


Figure 1. The 7-day CO-Synch + CIDR protocol for cows

For heifers: As with cows, the most simple of all protocols that consistently provides the best success is the 7-day CO-Synch + CIDR protocol (Figure 2), which is likely the most utilized of heifer protocols. However, producers using this protocol should note the difference in the interval from CIDR removal to FTAI. For heifers the FTAI should occur at between 52 and 56 hours after CIDR removal. Producers should not consider using Pregnenol in beef heifers. There is no data to indicate that Pregnenol enhances pregnancy rates in heifers. The drawback of this system in heifers is that on occasion the short-term systems, such as this, result in poor pregnancy rates if heifers are not developed correctly. Therefore, an alternative long-term system called the 14-day CIDR-PG (Figure 3) protocol, which is recommended if cattle producers can plan for more than one month in advance. This protocol provides an opportunity to 'kick-start' heifers to start cycling and allows heifers to have one estrous cycle prior to AI.

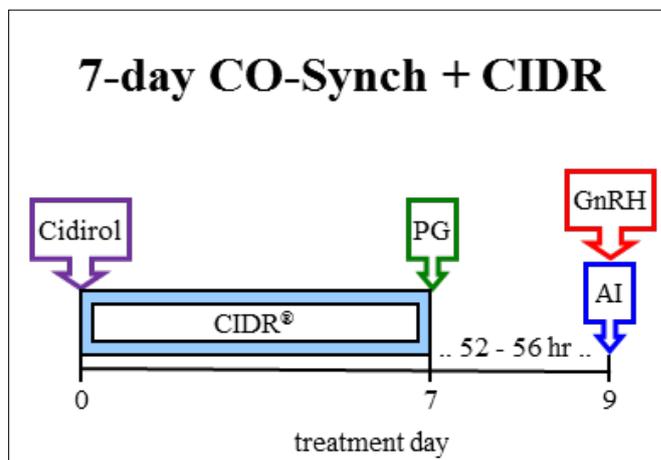


Figure 2. The 7-day CO-Synch + CIDR protocol for heifers

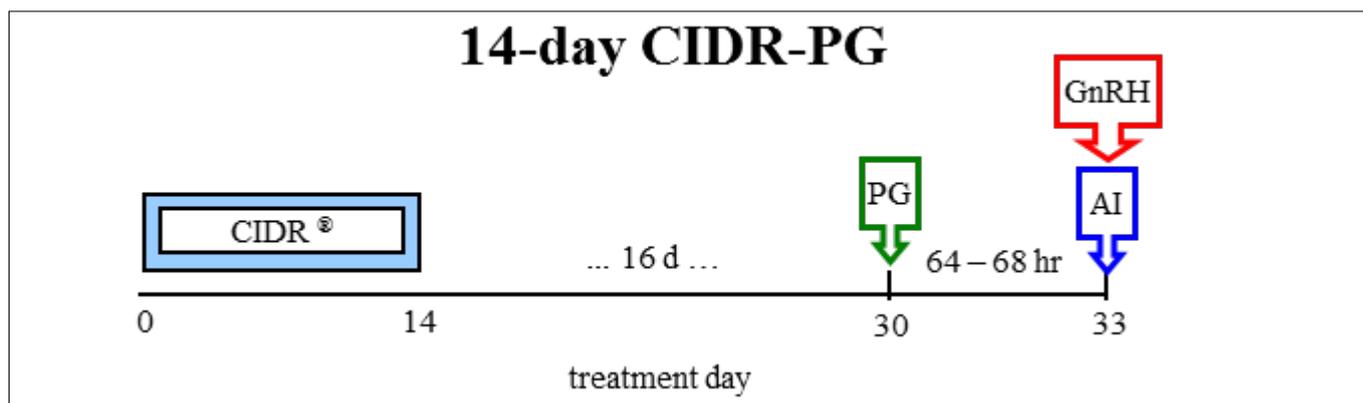


Figure 3. The 7-day CO-Synch + CIDR protocol for heifers

If I implement an AI program what pregnancy rates should I expect?

In most cases, using a FTAI program will yield greater pregnancy rates than heat detection systems because every female will have a chance to become pregnant. Producers should consider FTAI as an option, especially if time and labor are potential pitfalls to implementing an AI program. Fixed-time AI will help reduce the time and labor associated with the AI system and all females can be inseminated on the same day. Producers who synchronize and AI for the first time should not expect to obtain similar pregnancy rates to producers who have implemented an AI program for one or more years. Frequently, synchronization and AI is oversold and first-time users have unrealistic expectations of what they should expect for pregnancy rates. From our experience, we know that the advantages of implementing a synchronization and AI program go further than simply obtaining good pregnancy rates.

In a recent study performed at multiple locations using the same estrus synchronization system the pregnancy rates ranged from 44.4% to 65.8% (Figure 4). After evaluating each of these operations for multiple factors (such as age, body condition score, days postpartum, etc.) that may have affected pregnancy rates, the primary factor that appeared to have the largest impact on success was whether the herd had been previously exposed to estrus synchronization and AI or not. The three herds that had previously been exposed to estrus synchronization and AI for eight or more years had pregnancy rates of 56.9% to 65.8%, whereas those herds that had not previously been exposed to estrus synchronization and AI had pregnancy rates ranging from 44.4% to 50.4%. Therefore, obtaining pregnancy rates that may be deemed good or acceptable may require a long-term commitment rather than expecting excellent results from the start.

Long-term impacts of implementing an ES and AI program

Frequently when introducing an estrus synchronization and an AI program the cattle breeder's focus is on pregnancy

rates to the AI, but the impacts are far greater than simply focusing on pregnancy rates. In fact, the primary focus should be on the changes to calving distribution, economic impacts, and other positive indicators of fertility. In a long-term study at the University of Florida North Florida Research and Education Center located in Marianna, FL we introduced the utilization of multiple technologies on the subsequent value of the calf crop. This case study was conducted during the spring 2008 to spring 2013 breeding seasons, in a cow/calf operation consisting of 300 cows. Prior to the 2008 the breeding season the herd exposed to a 120 day breeding season. The goal was to reduce the breeding season to 70 days within 4 years. To do this, it was decided, in 2008, that all females in the operation would be exposed to the following criteria:

1. replacement heifer must become pregnant during the first 25 days of the breeding season;
2. every cow will be exposed to ES and TAI;
3. a cow must produce a live calf every year and calve without assistance or she was culled;
4. every cow must provide the resources for the genetic potential of the calves and each calf she produces must be genetically capable of performing;
5. every cow must maintain body condition score without requiring supplemental feeding;
6. any cow with an undesirable temperament or disposition was culled.

As a result of incorporating multiple reproductive management practices, the breeding season was reduced from 120 to 70 days and almost all cows calve prior to initiation of the breeding season and are exposed to a single TAI at the initiation of the breeding season. The net result is a more compact calving season that has increased the value of calves (in current US dollars) by \$169 per calf or an annual increase in calf value for the 300 head operation of \$50,700 per year (Table 1).

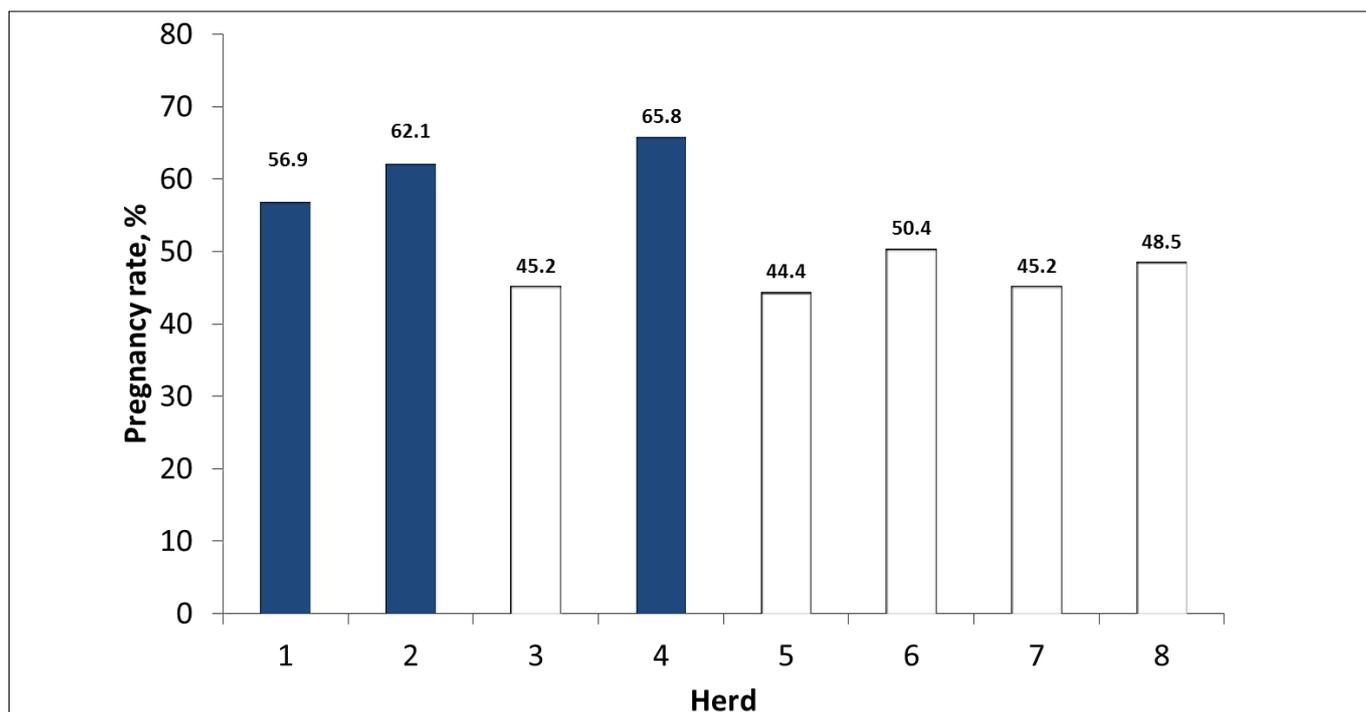


Figure 4. Pregnancy rates among 8 herds synchronized with the same fixed-time AI protocol. Filled bars represent herds that had been previously exposed to estrus synchronization and AI for at least eight years.

Table 1. Breeding season characteristics and change in calf value by incorporating a TAI program into the NFREC Beef herd

Item	Year							
	2006	2007	2008	2009	2010	2011	2012	2013
Overall PR, %	81	86	84	86	82	94	92	93
Mean calving day ^a	79.2	80.9	59.2	56.2	53.7	47.2	39.5	38.7
Breeding season length, d	120	120	110	88	80	75	70	72
Difference from 2006/2007	0	0	21.7	24.7	27.2	33.7	41.4	42.2
Per calf increase in value ^b , US\$	0	0	\$87	\$99	\$109	\$135	\$166	\$169
Per herd increase in value ^c , US\$1,000	0	0	\$26	\$30	\$33	\$40	\$50	\$51

^a Mean calving day from initiation of the calving season

^b Increase calf value based on increased weaning weight compared to 2006/2007 mean calving day with 500 lb calf valued at US\$2.00/lb

^c Increase calf value based on 300 head cow herd.

To 'get started right' producers should consider all of the benefits of estrus synchronization and AI rather than simply focusing on pregnancy rates to AI. A long-term commitment means that there may be breeding seasons that pregnancy rates are less than what might be expected, but committing to such a program will yield significant benefits. For the herd in the above example, pregnancy rates to AI have ranged from 39% to 56% during the five years that cows have been exposed to AI. If we had changed course when pregnancy rates were low we may have lost the more important metrics that affect the productivity of our operation, such as overall breeding season pregnancy rates, breeding season length, and increased calf value.

Keys to simplifying and having success in an AI program – take home messages:

- Well-managed (nutrition, herd health, and animal handling) herds tend to have greater success
- Ensure cattle are on an increasing plane of nutrition
- Allow an AI expert assist in bulls and ES protocol selection
- Be sure facilities are suitable for restraining cattle for injections, inserting vaginal inserts, and performing AI
- Commit the time to focus on the AI project
- Keep things simple by using a system with only three yardings
- Utilize FTAI. Herds with success with heat detection are the same herds that have success with FTAI.
- Use an experienced artificial insemination technician
- Consider using semen from bulls with high accuracy for specific traits of interest
- Stick to a program for several years, success comes with time



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