

# Utilization of Fixed-time Artificial Insemination (TAI) to Reduce Breeding Season Length and its Effects on Subsequent Calf Value: A Case Study

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## Synopsis

During an 8-yr period we evaluated the impacts of TAI to reduce the length of the breeding season and its effects on subsequent calving distribution, calf value, and pregnancy rates at the North Florida Research and Education Center in Marianna, FL. We conclude that exposing beef females to TAI and reducing the breeding season length from 120 d to 70 d altered calving distribution, increased breeding season pregnancy rates, and increased calf value.

## Summary

*The development of TAI protocols has resulted in the opportunity for increased application of AI in commercial cattle operations. However, the long-term production and economic impact of implementing a TAI protocol in beef cattle operations has not been evaluated. Therefore, during an 8-yr period we evaluated the impacts of TAI to reduce the length of the breeding season and its effects on subsequent calving distribution, calf value, and breeding season pregnancy rates. The North Florida Research and Education Center consists of a beef herd containing 300 cows of Angus, Brangus, and Braford breed origin. During the 2006 and 2007 breeding seasons, the cows were exposed to a 120 d breeding season (BS) by natural service. In 2008, and every subsequent BS to 2013, all females were exposed to TAI using either the 5-d or 7-d CO-Synch+CIDR protocols. Initially, calving season length resulted in cows being inseminated in 3 TAI groups (in 2008 and 2009), subsequently reduced to two TAI groups (in 2010 and 2011), and eventually to a single TAI group (in 2012 and 2013). Following the initial TAI for each group, females were detected for estrus and inseminated artificially after an observed estrus until d 23 after TAI. On d 23 after TAI, bulls were introduced and cows were naturally mated for the remainder of the breeding season. All bulls passed a breeding soundness examination prior to being introduced to cows. The breeding season length was reduced from 120 to 70 d between the 2008 and 2013 breeding seasons. Calving distribution and subsequent weaning performance were determined. Overall pregnancy rates increased from 81% and 86% in the 2006 and 2007 breeding seasons, respectively, to 94% and 93% in 2012 and 2013, respectively. Mean calving date from the first calf born during each calving season was reduced from 80.9 d in 2007 to 38.9 d in 2013. Utilizing a similar calf value across years of \$2.00/lb, the mean value per calf increased by \$86.8 per calf resulting from the 2008 breeding season to \$168.8 per calf resulting from the 2013 breeding season. We conclude that exposing beef females to TAI and reducing the breeding season length for six years altered calving distribution, increased breeding season pregnancy rates, and increased calf value.*

## Introduction

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 utilizing natural and/or artificially synthesized hormones.

Utilization of estrus or ovulation synchronization and fixed-timed artificial insemination (TAI) has facilitated the widespread utilization of artificial insemination (AI).

Currently only 7.6% of beef operations in the United States utilize AI as a reproductive management tool (NAHMS, 2009). When queried as to 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 (NAHMS, 2009). During the past decade, TAI protocols have been developed that eliminate detecting estrus and yield satisfactory pregnancy rates. The majority of these TAI protocols depend largely on the use of exogenous progesterone (P4), gonadotropin release hormone (GnRH) to induce ovulation, and luteolysis via administration of prostaglandin F<sub>2α</sub> (Lamb et al., 2010).

Possible outcomes from the combined use of estrous synchronization and TAI include shortened calving season, increased calf uniformity, earlier births during the calving season. Together, these technologies can greatly impact the economic viability of cow-calf systems by enhancing pounds of calf weaned per cow exposed (Rodgers et al., 2012). Therefore, our object was to evaluate the long-term production and economic impact of implementing estrous synchronization and TAI protocols at the North Florida Research and Education Center (NFREC).

### **Materials and Methods**

The NFREC consists of a beef herd containing 300 cows of Angus, Brangus, and Braford breed origin. During the 2006 and 2007 breeding seasons, the cows were exposed to a 120 d breeding season by natural service. In 2008, and every subsequent breeding season to 2013, all females were exposed to TAI using either the 5-d or 7-d CO-Synch+CIDR protocols with the goal of reducing the breeding season to 70 d, to expose every female in the herd to TAI, improve fertility and calf crop uniformity, and weaning weights. In order to achieve this, it was decided that all females in the operation were exposed to the following criteria:

- 1) Replacement heifers must become pregnant during the first 25 d of the breeding season.
- 2) Every cow will be exposed to estrous synchronization and TAI.
- 3) Each cow must produce a live calf every year and calve without assistance or they will be 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) No supplemental feeding was offered to cows that failed to maintain body condition.
- 6) Any cow with an undesirable temperament or disposition was culled.

Initially, calving season length resulted in cows being inseminated in 3 TAI groups (in the 2008 and 2009 breeding seasons), subsequently reduced to two TAI groups (in the 2010 and 2011 breeding seasons), and eventually to a single TAI group (in the 2012 and 2013 breeding seasons; Figure 1). Following the initial TAI for each group, females were detected for estrus and inseminated artificially after an observed estrus until d 23 after TAI. On d 23 after TAI, bulls were introduced and cows were naturally mated for the remainder of the breeding season. All bulls passed a breeding soundness examination prior to being introduced to females.

## **Results**

As a result of incorporating estrous synchronization and TAI, in addition to other reproductive management practices, the breeding season was reduced from 120 to 70 d in the course of 5 yrs. Furthermore, currently almost all cows calve prior to initiation of the subsequent breeding season and are exposed to a single TAI on the first day of the breeding season. The effect of utilizing estrous synchronization and TAI on calving distribution can be observed in Figure 2. In 2006 and 2007, before initiation of TAI program, it took 90 d for 50% of the calves to be born. In 2013, however, it took less than 30 d for 50% of the calves to be born. Mean calving date from the first calf born during each calving season was reduced from 80.9 d for the 2007 breeding season to 38.7 d for the 2013 breeding season. In addition, overall pregnancy rates, including AI and natural service, increased from 81% and 86% in the 2006 and 2007 breeding seasons, respectively, to 92% and 93% in 2012 and 2013, respectively (Table 1).

Assuming an average daily gain of 2.0 lb/d, a fixed calf value of \$2.00/lb across yrs, the mean value per calf increased by \$86.8 per calf resulting from the 2008 breeding season to \$168.8 per calf resulting from the 2013 season. Overall, the net result of a more compact calving season with increased value of calves (in current dollars) by \$168.8 per calf resulted in an increased net result of \$47,095.20 per yr for the 300 head herd and 94% pregnancy rate at the NFREC (Table 1).

## **Conclusion**

We conclude that exposing beef females to estrous synchronization and TAI, and reducing the breeding season length during a period of 6 yrs altered calving distribution, increased breeding season pregnancy rates, and increased calf value.

## **Acknowledgements**

Sincere appreciation is expressed to P. Folsom, M. Foran, O. Helms, D. Jones, C. Nowell, D. Thomas, and all interns at the NFREC for their assistance with data collection.

## **Literature Cited**

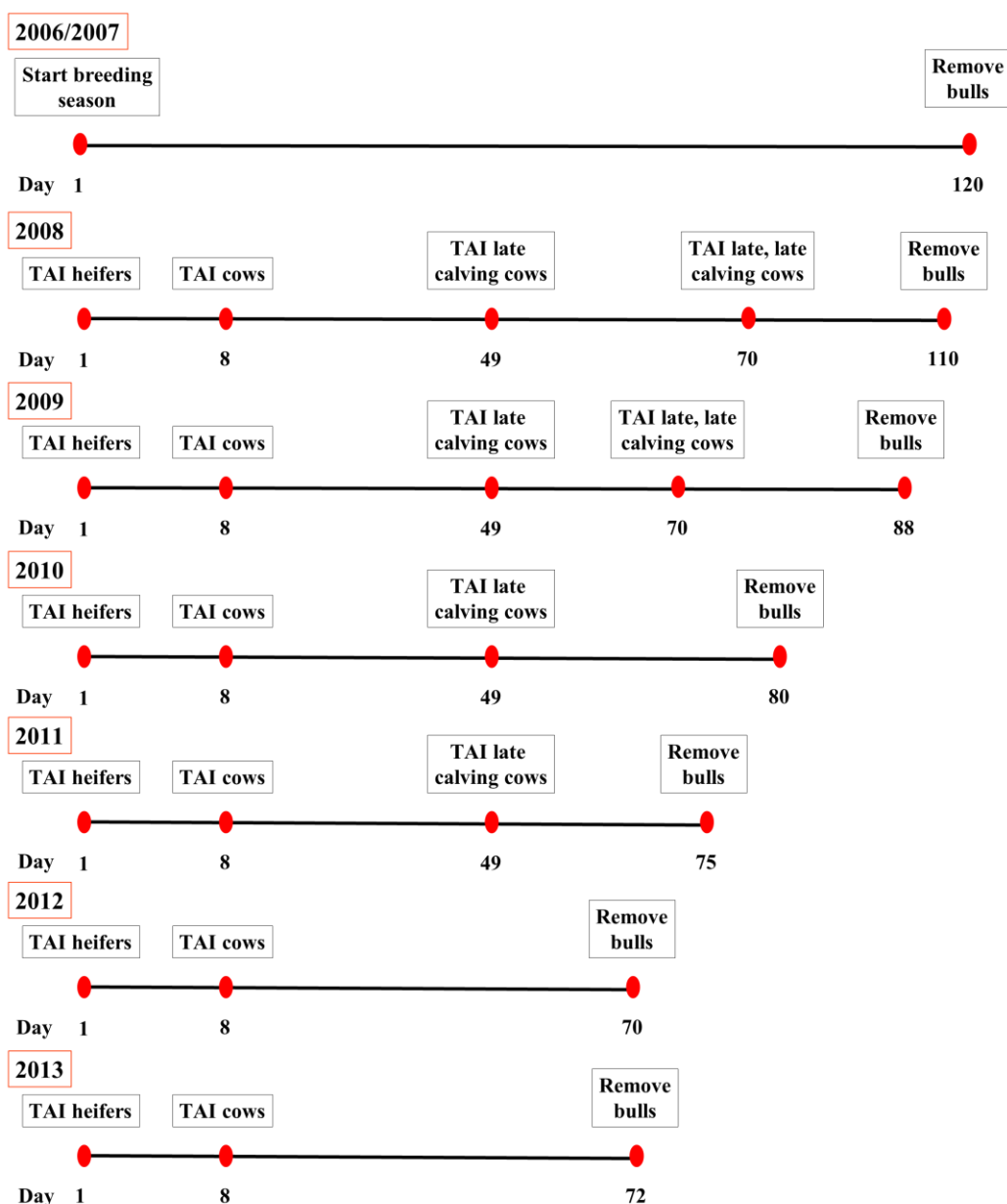
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**Table 1.** Breeding season length, final pregnancy rate, mean calving day, and change in calf value at weaning, after initiation of an estrous synchronization and TAI program at the North Florida Research and Education Center.

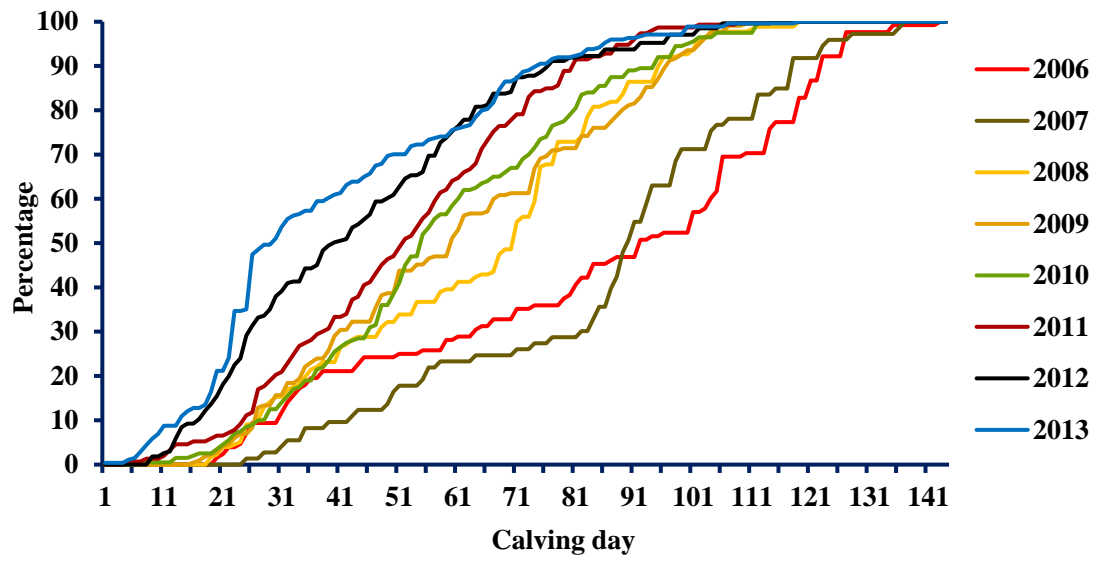
Year	2006	2007	2008	2009	2010	2011	2012	2013
Breeding season length, d	120	120	110	88	80	75	70	72
Pregnancy rate, %	81	86	84	86	82	94	92	93
Mean calving day	79.2	80.9	59.2	56.2	53.7	47.2	39.5	38.7
Difference from 2006/2007, d	0	0	21.7	24.7	27.2	33.7	41.4	42.2
Per calf increase in value, \$ <sup>1</sup>	0	0	86.8	98.8	108.8	134.8	165.6	168.8
Herd increase in value, \$1,000 <sup>2</sup>	0	0	21.9	25.5	26.8	38.1	45.8	47.1

<sup>1</sup>Assuming an average daily gain of 2 lb/d, a fixed calf value of \$2.00/lb

<sup>2</sup>Assuming the pregnancy rate within each yr and a 300 head herd



**Figure 1.** Timeline of events, and length of breeding seasons at the North Florida Research and Education Center from 2006 to 2013.



**Figure 2.** Cumulative calving percentage during each calving season at the North Florida Research and Education Center from 2006 to 2013.