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IMPACTS OF ESTROUS SYNCHRONIZATION ON COWHERD PERFORMANCE

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INTRODUCTION

Estrous synchronization and artificial insemination (AI) are reproductive management tools that have been available to beef producers for over 40 years. Synchronization of the estrous cycle has the potential to shorten the calving season, increase calf uniformity, and enhance the possibilities for utilizing AI. Artificial insemination allows producers the opportunity to infuse superior genetics into their operations at costs far below the cost of purchasing a herd sire of similar standards. These tools remain the most important and widely applicable reproductive biotechnologies available for beef cattle operations (Seidel, 1995). However, beef producers have been slow to utilize or adopt these technologies into their production systems.

Several factors, especially during early development of estrus synchronization programs, may have contributed to the poor adoption rates. Initial programs failed to address the primary obstacle in synchronization of estrus, which was to overcome puberty or postpartum anestrus. Additionally, these programs failed to manage follicular waves, resulting in more days during the synchronized period in which detection of estrus was necessary. This ultimately precluded fixed-time AI with acceptable pregnancy rates. More recent developments focused on both corpus luteum and follicle control in convenient and economical protocols to synchronize ovulation. These developments facilitated fixed-time AI (TAI) use, and should result in increased adoption of these important management practices (Patterson et al., 2003). Current research has focused on the development of methods that effectively synchronize estrous in postpartum beef cows and replacement beef heifers by decreasing the period of time over which estrous detection is required, thus facilitating the use of TAI (Lamb et al., 2001, 2006, Larson et al., 2006). This new generation of estrus synchronization protocols uses two strategies which are key factors for implementation by producers because they: 1) minimize the number and frequency of handling cattle through a cattle-handling facility; and 2) eliminate detection of estrus by employing TAI.

Producers receiving all the necessary, applicable information packaged to include, but not limited to, protocol administration, economic implications, and genetic improvements to the cowherd are more apt to implement these tools into their management systems and achieve positive outcomes as a result. Without timely transfer of this technology within the United States, our research products and technology will be more effectively utilized in foreign countries competing with the United States to produce and market

high quality, uniform beef products. The recent development of estrous synchronization protocols for TAI in beef cows has the potential to alter reproductive performance in numerous herds.

ECONOMICS OF ESTRUS SYNCHRONIZATION

Recently we performed an experiment using partial budget analysis to determine the economic outcome of estrus synchronization and TAI in commercial cow/calf production (Rodgers et al., 2012). Suckled beef cows ($n = 1,197$) from 8 locations were assigned randomly within each location to 1 of 2 treatment groups: 1) cows were inseminated artificially after synchronization of ovulation using the 7-day CO-Synch + CIDR protocol (TAI; $n = 582$); and 2) cows were exposed to natural service (NS) without estrus synchronization (Control; $n = 615$). Within each herd, cows from both treatments were maintained together in similar pastures and were exposed to bulls 12 h after the last cow in the TAI treatment was inseminated. Overall, the percentage of cows exposed to treatments that subsequently weaned a calf was greater for TAI (84%) than Control (78%) cows. In addition, survival analysis demonstrated that cumulative calving distribution differed between the TAI and Control treatments (Figure 1). Weaning weights per cow exposed to treatments were greater for cows in the TAI treatment (425 lb) than those cows in the Control treatment (387 lb). Overall, increased returns plus decreased costs (\$82.32), minus decreased returns plus increased costs (\$33.18) resulted in a \$49.14 advantage per exposed cow in the TAI treatment compared to the Control treatment (Table 1). Location greatly influenced weaned calf weights, which may have been a result of differing management, nutrition, genetic selection, production goals, and environment. We concluded that estrus synchronization and TAI had a positive economic impact on subsequent weaning weights of exposed cows.

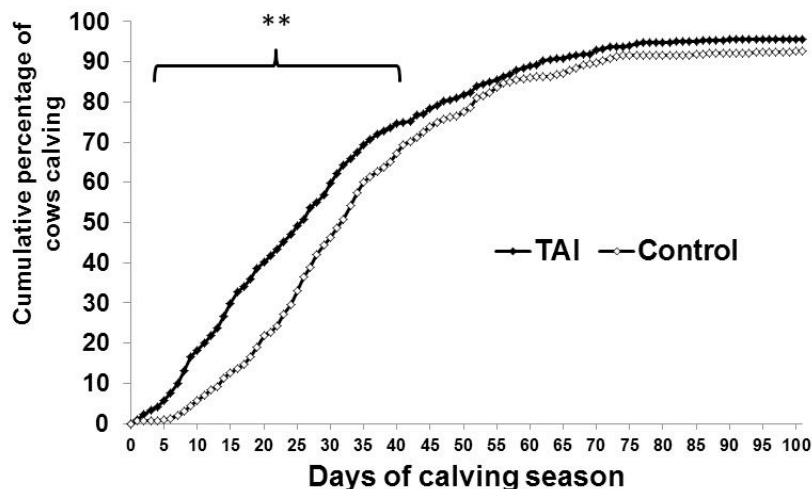


Figure 1. Survival analysis of the percentage of cows calving by day during the calving season. ** Cumulative calving percentage differs ($P < 0.05$) between TAI and Control

Table 1. Partial budget analysis for cows exposed to estrous synchronization followed by natural service compared to cows exposed only to natural service (expressed in US dollars; Rodgers et al., 2012)¹

Item	Increased returns ²	Decrease d costs ³	Decrease d returns ⁴	Increased costs ^{5,6}	Gain or loss	Net additional costs ⁷	Additional weight, kg ⁸	Breakeven price ⁹
Herd sensitivity analysis:								
1	45.71	42.81	0	33.18	55.34	-9.63		
2	31.19	21.41	0	33.18	19.42	11.77	4.43	67.26
3	56.74	48.93	0	33.18	72.49	-15.75		
4	123.15	48.93	0	33.18	138.90	-15.75		
5	-10.49	37.46	0	33.18	-6.21	-4.28		
6	44.64	24.79	0	33.18	36.25	8.39	3.15	47.94
7	30.65	32.74	0	33.18	30.21	0.44	0.17	2.51
8	55.12	24.79	0	33.18	46.73	8.39	3.15	47.94
Overall ¹⁰	47.09	35.23	0	33.18	49.14	-2.05		

¹All returns and costs based on a weaning weight of exposed cows.

²Additional weight attributed to estrous synchronization (ES) and fixed-time artificial insemination (TAI) per weaning weight of exposed cows × selling price (\$121.00/45.5 kg).

³Annual NS bull costs: annual operating costs: grazing and supplemental feed (\$365.00), veterinary medicine (\$40.00), annual ownership costs: depreciation (\$557.00), interest cost (\$151.00), death loss (\$33.00); purchase price (\$3270.00).

⁴Decreased returns attributed to fewer NS bulls to be culled are included as a negative value in the decreased costs calculation.

⁵Labor hours (0.41 h) per ES/TAI cow at \$10.00 per hour.

⁶Supplies: Prostaglandin = \$2.07/dose, CIDR = \$8.76, GnRH = \$2.00/dose × 2 doses, Miscellaneous. \$0.25, Semen \$14.00/unit.

⁷Net additional costs as increased costs minus decreased costs.

⁸Additional weight per exposed cow to cover net additional costs at \$121 per 45.5 kg (only in situations where additional costs were noted).

⁹Overall breakeven prices (\$ per 45.5 kg) to cover additional costs with additional 17.5 kg pounds weaned per cow exposed to treatment.

¹⁰Calculated using a bull to cow ratio of 1:17.

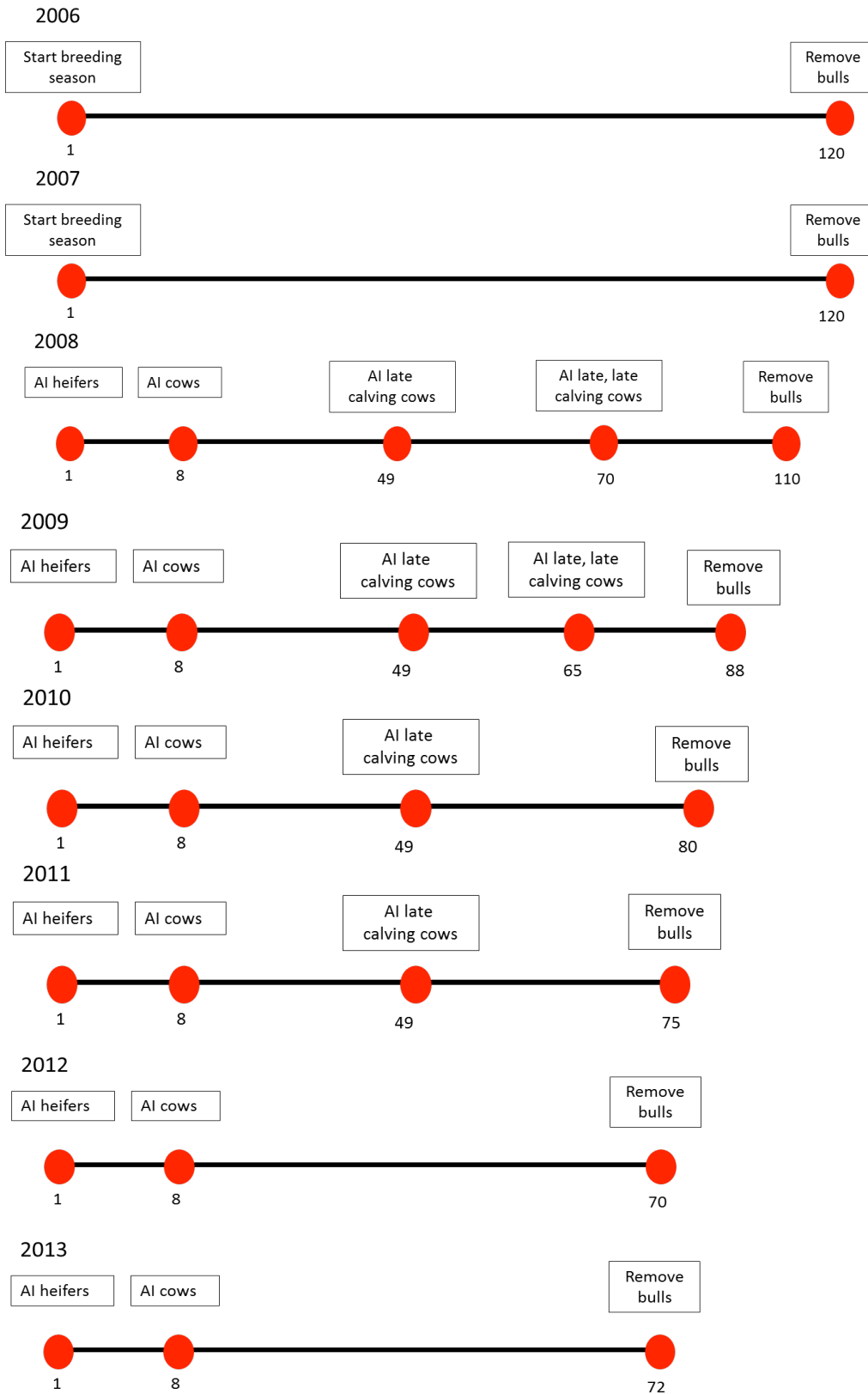


Figure 2. Overview of breeding season length and artificial inseminations schedule from 2006 to 2013

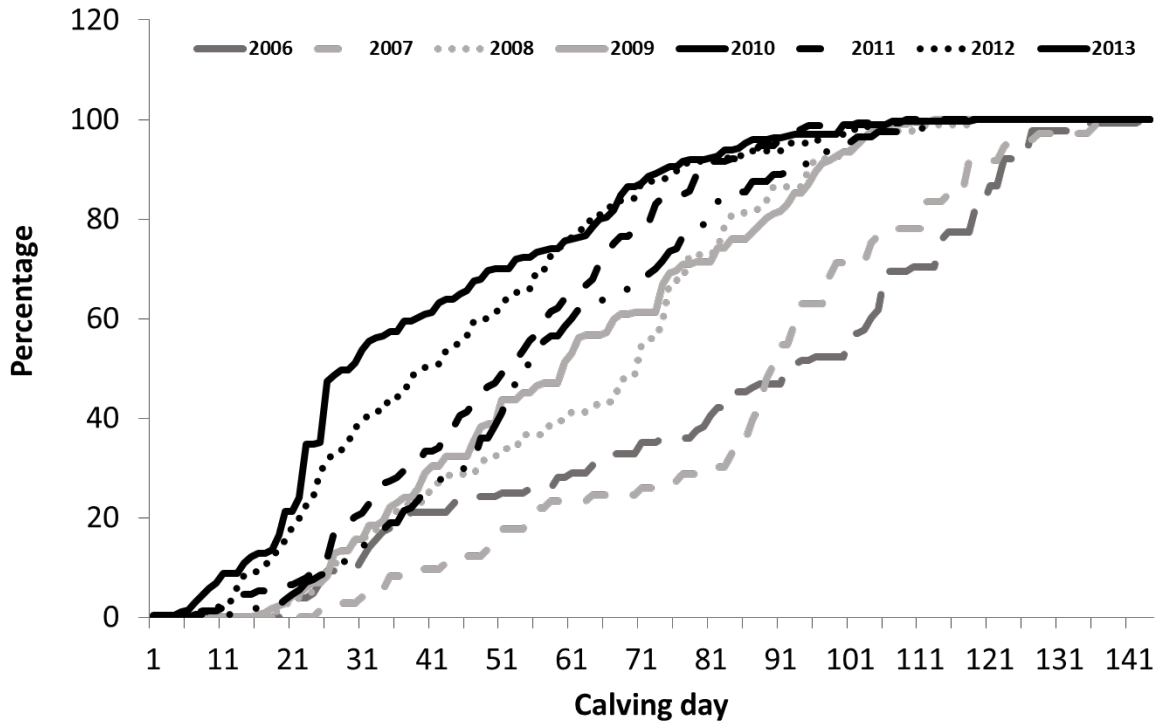


Figure 2. Cumulative calving by year for two years (2006 and 2007) prior to introducing TAI and five years (2008 to 2013) after introducing TAI.

Table 2. 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 , \$	0	0	\$87	\$99	\$109	\$135	\$166	\$169
Per herd increase in value ^c , \$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 \$2.00/lb

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

WHAT PREGNANCY RATES SHOULD I EXPECT WHEN INITIALLY IMPLEMENTING AN AI PROGRAM?

In most cases, using a fixed-time AI program will yield greater pregnancy rates than heat detection systems because every female will have a chance to become pregnant. Producers should consider fixed-time AI 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.

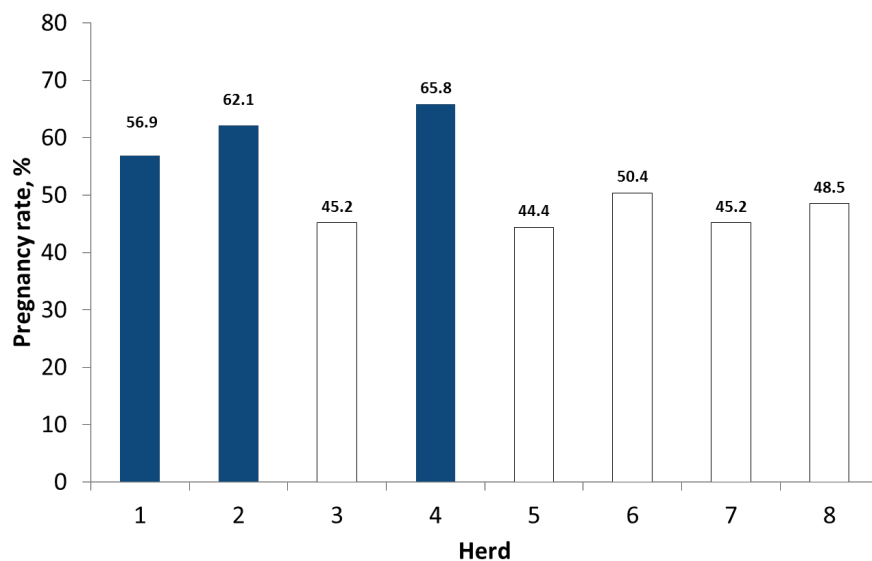


Figure 4. Pregnancy rates among 8 herds synchronized with the same fixed-time AI protocol. Filled bars represent herds that had been previously exposed to estrus synchronization and AI for at least eight years.

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.

