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## Sire Distribution of Calves in a Beef Herd with Use of Fixed Time Artificial Insemination Followed by Immediate Bull Exposure for Natural Service in Cows and Heifers

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## **Cover Page Footnote**

We appreciate Rezac Land and Livestock for providing all the cattle and breeding supplies for this project.

## **Authors**

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*A.R. Hartman, E.D. McCabe, D.R. Jacobs, K.E. Fike, and D.M. Grieger*

### Abstract

Use of fixed time (FT) artificial insemination (AI) followed by immediate exposure of females to bulls for natural service can be a useful management strategy for commercial cow-calf producers to limit labor and time related to bull turnout and increase pregnancy rates earlier in the breeding season. Considering influence of bull fertility and time to and length of estrus in females, expectations for outcomes in natural service sire versus AI sire parentage is relatively unknown. Our objective was to determine the relative percentages of calves sired by either a natural service or FTAI sire within the same estrous period. In two consecutive years, heifers and cows were synchronized and inseminated using the 7-day CO-Synch + controlled internal drug release (CIDR) FTAI protocol. All females were inseminated by one AI technician using one sire for heifers and a different sire for cows. Females were exposed to natural service bulls immediately after insemination. After calving, DNA was collected from a random subset of calves born in the first 21 days of the calving season for parentage analysis (calves born from heifers in Year 1 = 59 and in Year 2 = 82; calves born from cows in Year 1 = 89, Year 2 = 102). The percentage of calves sired by AI and natural service was determined following parentage verification. In Year 1, for calves born from heifers in the first 21 days of the calving season, 5.1% ( $n = 3/59$ ) were sired by natural service. For calves born from cows, 14.6% ( $n = 13/89$ ) were sired by natural service. In Year 2, for calves born from heifers, 9.8% ( $n = 8/82$ ) were sired by natural service, whereas 20.6% of calves born from cows ( $n = 21/102$ ) were sired by natural service. If commercial producers use FTAI followed by immediate bull exposure the proportion of calves sired by natural service bulls may be greater in cows than heifers.

### Introduction

Development of fixed time artificial insemination (FTAI) protocols has provided beef producers with tools to harness genetic improvement benefits from the use of AI sires, economic benefits from cows calving earlier in the subsequent calving season, while eliminating the need for estrus detection (Lamb et al., 2016; Lamb and Mercadante, 2016).

Fixed time AI followed by immediate exposure of females to bulls for natural service can be a beneficial management strategy for cow-calf producers. It has the potential to limit labor and time related to bull turnout, as well as to increase proportion of females becoming pregnant early in the breeding season. When natural service sires are exposed to females immediately after FTAI, potential variations in bull fertility, time to estrus onset, and length of estrus in females likely will influence whether the female conceives to the AI sire or natural service sire. Expectations for outcomes in natural service sire versus AI sire parentage are relatively unknown. Our objective was to determine the relative percentages of calves sired by either natural service sires or FTAI sires within the same estrous period when natural service sires are exposed to females immediately after FTAI.

## Experimental Procedures

During the spring breeding seasons in two consecutive years at a ranch in Kansas, commercial Angus cows and heifers from a single producer were part of an FTAI program then immediately were exposed to bulls for natural service. In Year 1, cows ranged from two to five years of age and averaged 2.6 years. In Year 2, cows ranged from two to six years of age and averaged 3.2 years of age. Heifers were approximately 15 months of age at insemination in both years.

In both years, cows and heifers were synchronized using the 7-day CO-Synch + CIDR FTAI protocol. Heifers were artificially inseminated approximately 52-56 hours, and cows approximately 60-66 hours, following the removal of the CIDR and prostaglandin injections. The same AI technician inseminated all females in both years. The FTAI procedure used a single Angus sire for heifers and a different single Angus sire for cows. Different Angus AI sires were used in Year 1 and Year 2, but a single sire was used within a single year for both heifers and cows. All females were exposed to natural service sires immediately following insemination.

All natural service sires passed a breeding soundness exam before exposure to females. Natural service sires ranged in age from one to five years. Bull to female ratios were kept between 1:30 and 1:15 based on sire ages. Natural service bulls remained with the females for the 90-day breeding season. Pregnancy detection was performed via rectal palpation 60 days after bull removal, and all open cows and heifers were culled.

At calving, all calves born in the first 21 days of the calving season were weighed, tagged, and any color markings recorded. Calves born in these first 21 days received a tag with a different color for ease of identification at DNA collection.

To determine the proportion of calves sired by the FTAI sire and natural service sires, blood was collected from a subset of calves born in the first 21 days of the calving season (Year 1: calves born from heifers  $n = 59$ ; calves born from cows  $n = 89$ . Year 2: calves born from heifers  $n = 82$ ; calves born from cows  $n = 102$ ). SeekSire (Neogen) parentage testing was used to determine percentage of calves from this subset born in the first 21 days of the calving season that were sired by AI or natural service bulls.

## Results and Discussion

In Year 1, among calves born from heifers, the actual percentage sired by natural service was 5.1% ( $n = 3/59$ ). Among calves born from cows, the actual percentage sired by

natural service was 14.6% (n = 13/89). In Year 2, among calves born from heifers, the actual percentage sired by natural service was 9.8% (n = 8/82). Among calves born from cows, the actual percentage sired by natural service was 20.6% (n = 21/102). The percentage of calves born from natural service sires in Year 1 was less than in Year 2 for both cows and heifers, see Figure 1 and Figure 2. Although natural service sires sired varying percentages of calves, it is unknown if those calves were additional pregnancies early in the breeding season or if other factors influenced fertilization and resulted in fewer AI-sired calves. Other literature has shown increased pregnancy rates with FTAI along with immediate exposure to natural service sires in heifers when compared to natural service alone (Kasimanickam et al., 2021), and increases in conception rate with AI compared to natural service in indigenous cows (Washaya et al., 2019). These studies, however, did not assess parentage of calves to determine if they were sired by an AI sire or natural service sire. Similarly, Gutierrez et al. (2014) demonstrated increased breeding season pregnancy rates in heifers when using AI and natural service sires compared to natural service sires alone, and Sa Filho et al. (2013) demonstrated this same concept in cows.

## Implications

If commercial producers use FTAI followed by immediate bull exposure in heifers, natural service sires may sire 5 to 10% of calves born early in the calving season. In cows, producers may expect 15 to 20% of calves born early in the calving season to be sired by natural service. These data provide estimates of the parentage of calves from AI and natural service sires with use of FTAI followed by immediate bull exposure. This strategy can reduce time and additional steps related to bull turnout and increase pregnancies earlier in the breeding season.

## Acknowledgments

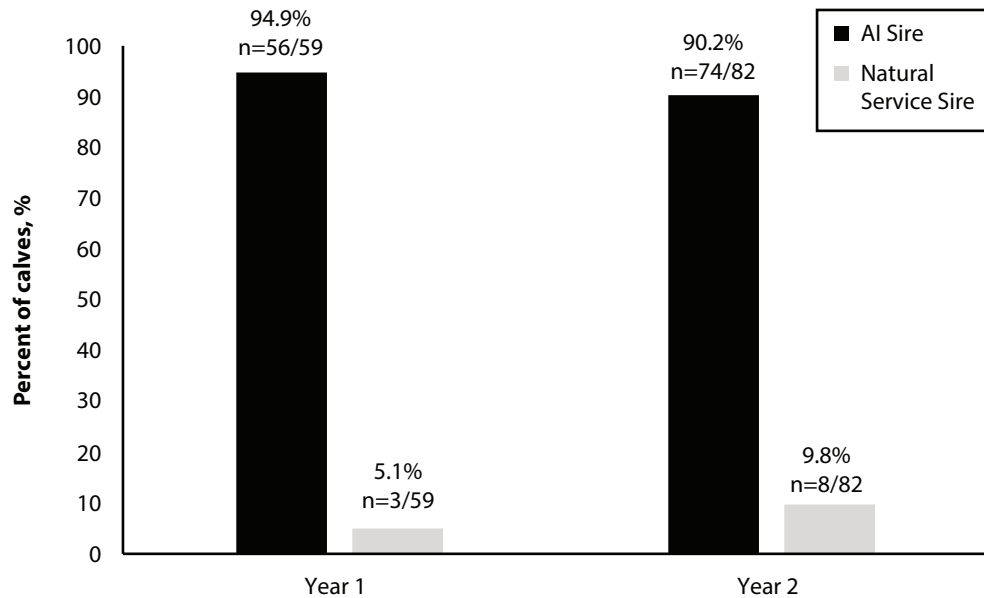
We appreciate Rezac Land and Livestock for providing all the cattle and breeding supplies for this project.

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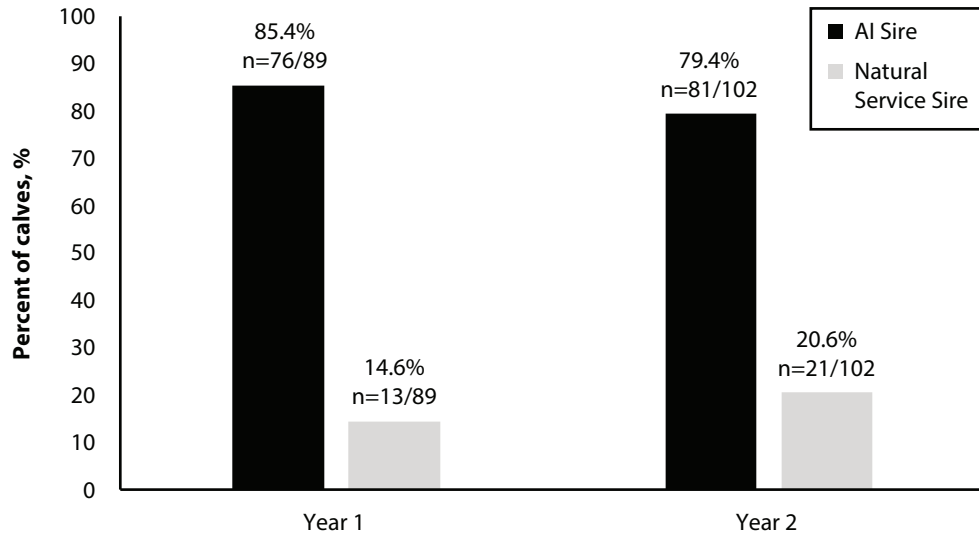
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**Figure 1. Percentage of calves born to heifers in the first 21 days of the calving season sired by AI and natural service sires<sup>1</sup>**

<sup>1</sup>Comparison of percentage of calves sired by AI sires compared to those sired by natural service sires born to heifers bred following a 7-day CO-Synch + CIDR fixed time AI protocol and immediate bull exposure in a two-year study.



**Figure 2. Percentage of calves born to cows in the first 21 days of the calving season sired by AI and natural service sires<sup>1</sup>**

<sup>1</sup>Comparison of percentage of calves sired by AI sires compared to those sired by natural service sires born to cows bred following a 7-day CO-Synch + CIDR fixed time AI protocol and immediate bull exposure in a two-year study.