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Timed artificial insemination early in the breeding season improves the reproductive performance of suckled beef cows

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ABSTRACT

The objective was to compare reproductive performance of breeding programs that used natural service (NS), AI after estrus detection (ED), and timed AI (TAI). In experiment 1, 597 suckled beef cows were randomly allocated to one of four groups. Cows in the TAI+NS group (N = 150) were bred by TAI at 11 days after the onset of the breeding season (BS). Bulls were placed with cows 10 days after TAI and remained together until the end of the 90-day BS. Cows in the TAI+ED+NS group (N = 148) received TAI, then AI based on ED for the next 45 days, and finally NS for the last 45 days of the BS. Cows in the ED+NS group (N = 147) received AI based on ED during the first 45 days of the BS, followed by NS for the last 45 days of the BS. Cows in the NS group (N = 149) were bred by NS for the entire 90-day BS. Cows in the ED+NS or NS groups had a decreased ($P < 0.001$) hazard of pregnancy compared with cows in the two groups bred by TAI at the onset of BS. Also, cows bred by TAI (TAI+NS = 92.7%; and TAI+ED+NS = 91.9%) had higher ($P < 0.01$) pregnancy rates at the end of the BS compared with cows not bred by TAI (ED+NS = 85.0%; NS = 83.2%). In experiment 2, 507 suckled beef cows were randomly assigned to one of two groups at the onset of a 90-day BS. The NS group (N = 255) received only NS during the entire BS, and the TAI+NS group (N = 252) received TAI at the onset of the BS, followed by NS until the end of BS. Cows in the TAI+NS group had 63% higher hazard of pregnancy ($P < 0.001$) compared with cows in the NS group, and reduced the median days to pregnancy by 44 (11 vs. 55 days). However, there was no difference ($P = 0.31$) in proportion of pregnant cows at the end of the BS (TAI+NS = 77.0% vs. NS = 71.0%). Therefore, incorporation of TAI programs early in the BS increased reproductive performance of suckled beef cows.

1. Introduction

The use of a defined breeding season (BS) is a common reproductive management strategy in beef cattle. This approach is used to facilitate calving and calf management, and to allow calving and breeding during optimal climatic conditions and forage availability. In tropical countries, it is common to breed during the spring and summer months (October to February) when there is higher availability of forage. Consequently, calving occurs in the spring (August to December) when it is drier, which results in lower parasite and infectious disease challenges for calves.

For pasture-based systems, high pregnancy rates in the beginning of the BS are critical for herd profitability. Cows that become pregnant earlier in the BS will calve earlier in the next calving season, with additional time to recover

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before the next BS, thereby improving the probability of re-establishing pregnancy and reducing the risk of involuntary culling [1]. Furthermore, calves born early in the calving season would be heavier at weaning, improving profitability [2,3].

In tropical climates, most of the beef cattle herds are composed of *Bos indicus* or crosses between *Bos indicus* and *Bos taurus*. It is noteworthy that *Bos indicus* cattle have a longer gestation than *Bos taurus* cattle (293 vs. 282 days) [4], and a longer postpartum anestrus when kept on pasture [4,5]. Delays in resumption of cyclicity are associated with an increased interval from calving to conception, reduced pregnancy rates, and economic losses [6]. To maintain a 365-day calving interval and to improve production efficiency, *Bos indicus* cows must conceive, on average, by 72 days postpartum. Therefore, reproductive programs for beef herds under pasture conditions should focus on increased pregnancy rates at the beginning of the BS.

Artificial insemination (AI) promotes genetic and economic gains through the use of genetically superior bulls. Implementation of AI programs based on estrus detection in suckled beef herds is hampered by postpartum anestrus, estrus detection (ED) failure, large farms, many animals per lot, and labor costs [6]. Timed AI (TAI) programs allow insemination of cows regardless of cyclic status and might eliminate the need for ED. These programs also provide a systematic approach to the use of AI, facilitating its use in beef herds [6,7]. Timed AI programs allow insemination of all cows at the beginning of the BS; therefore, it is reasonable to hypothesize that it increases the proportion of pregnant cows early in the BS and consequently the overall proportion of cows pregnant the end of the BS. Although there are limited data for beef cows, there are numerous reports in dairy cows that support our hypothesis [8–10].

The objective of the present study was to evaluate the use of TAI on reproductive performance of suckled beef cows under pasture conditions. In experiment 1, reproductive performance of suckled beef cows under various reproductive strategies (using TAI, ED, and natural service [NS]) were evaluated during a 90-day BS. In experiment 2, the use of TAI at the onset of the BS, followed by NS, was compared with only NS throughout the entire 90-day BS.

2. Materials and methods

2.1. Experiment 1. Various breeding strategies in suckled beef cows

2.1.1. Cows and management

All procedures were approved by the University of Sao Paulo Institutional Animal Care and Use Committee (Number 2426/2011). This experiment was conducted at a commercial beef farm located in Ribas do Rio Pardo, MS, Brazil during the 2004 to 2005 spring/summer (October to December) 90-day BS. A total of 597 suckled Nelore (*Bos indicus*) beef cows were enrolled. Cows were maintained on *Brachiaria brizantha* or *Braquiaria decumbens* with *ad libitum* access to water and mineral supplement. Cows were pastured together until onset of the BS. At onset of the BS, each experimental group was put in neighboring pastures with similar forage quality and availability.

2.1.2. General reproductive management

Suckled beef cows between 55 and 75 days postpartum were randomly assigned to one of four experimental groups (TAI+NS, TAI+ED+NS, ED+NS, NS). Cows in the TAI+NS (N = 150) and TAI+ED+NS (N = 148) were enrolled in the TAI protocol at the onset of the BS (Day 0; Fig. 1). The TAI protocol consisted of insertion of an ear implant containing 3.0 mg of norgestomet plus 3.0 mg norgestomet im, and 5.0 mg estradiol valerate (Crestar, Intervet-Schering Plough, Boxmeer, Netherlands) on Day 0. On Day 9, the implant was removed and cows were given 400 IU im equine chorionic gonadotropin (eCG; Folligon, Intervet-Schering Plough). At 52 to 56 hours after implant removal, cows were bred by TAI and were concurrently given 100 μg of GnRH (Fertagyl, Intervet-Schering Plough) [11]. Bulls were introduced to cows in the TAI+NS group 10 days after TAI. Cows in the TAI+ED+NS received TAI as described, then were observed for estrus twice daily, with AI 12 hours after ED during the first 45 days of the BS, followed by NS until the end of BS. Cows in the ED+NS (N = 147) group were observed for estrus twice daily and AI was performed 12 hours after ED during the first 45 days of the BS, followed by NS until the end of the BS. Cows in the NS group (N = 149) were exposed to bulls from Days 0 to 90 of the BS.

2.1.3. Management of bulls

A total of 28 Nelore bulls, aged 3 to 5 years, were maintained in grazing conditions with *ad libitum* access to water and mineral supplementation. Bulls were tested and confirmed free of brucellosis and tuberculosis. Every bull underwent a breeding soundness evaluation 30 days before the onset of the BS, following the guidelines of the Brazilian College of Animal Reproduction [12]. Bulls were not used for NS during this prebreeding period. The breeding soundness evaluation included a physical examination, testicular evaluation, measurement of scrotal circumference, collection of a semen sample by electroejaculation, and evaluation of sperm motility and morphology. Bulls were selected based on general health aspect, absence of any abnormality of the reproductive system, and a spermiogram exceeding the minimum requirements of the Brazilian College of Animal Reproduction, namely 70% progressive sperm motility, category 3 for sperm vigor, and a maximum of 30% total abnormal sperm cells [12]. Only bulls classified as potential satisfactory breeders were used.

Semen was collected from the bulls via electroejaculation and placed in a prewarmed, graded, conical plastic tube, protected (by a polystyrene cover) from light, cold shock, and rapid temperature changes. Immediately after collection, semen was maintained in a water bath at 37 °C, and the proportion of progressively motile sperm (0–100%) was assessed. For this, a small drop of semen was placed on a prewarmed slide, covered with a cover slip, and examined with a bright-field microscope (magnification ×400; Olympus DX50, Olympus Corporation, Tokyo, Japan) with a heated stage. The proportion of sperm that were progressively motile was estimated in increments of 5%. Concurrently, an aliquot was fixed in buffered isotonic