Comparison of two timed artificial insemination system schemes to synchronize estrus and ovulation in Nellore cattle

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ABSTRACT

The aim of this study was to evaluate the reproductive performance of 411 Nellore cows (198 nulliparous, 80 primiparous, and 133 multiparous) submitted to the 5dCO-Synch + P4 or 7dEB + P4 systems. The 5dCO-Synch + P4 system consisted of insertion of an intravaginal progesterone (P4) insert and 100 μg of GnRH (intramuscularly [i.m.]) on Day 0. On Day 5, the P4 insert was removed, and two doses of 25 mg of PGF$_{2\alpha}$ (i.m.) were administered 6 hours apart. Cows not detected in estrus until 55 hours after insert removal received 100 μg of GnRH i.m. 17 hours later (i.e., 72 hours after P4 removal). The 7dEB + P4 system consisted of insertion of a P4 insert and 2 mg of estradiol benzoate (i.m.) on Day 0. On Day 7, the P4 insert was removed and 25 mg of PGF$_{2\alpha}$, 0.6 mg of estradiol cypionate, and 300 IU of eCG were administered i.m. In both systems, artificial insemination (AI) was performed according to estrus detection (i.e., cows detected in estrus until 55 hours after insert removal were inseminated at 55 hours and cows detected in estrus later or those not detected in estrus were inseminated at 72 hours). Estrus-detection risk was greater (P < 0.05) in 7dEB + P4 (80.4%) than 5dCO-Synch + P4 system (36.4%). Progesterone concentration 10 days after AI was greater (P < 0.05) in 7dEB + P4 than 5dCO-Synch + P4 system in primiparous and multiparous but did not differ between systems in nulliparous cows. Pregnancy per AI was greater (P < 0.05) in 7dEB + P4 (49.7%) than 5dCO-Synch + P4 (35.4%) system. Primiparous had lower estrus-detection risk (25.0%), ovulation risk (76.6%), and pregnancy per AI (28.7%) than multiparous or nulliparous cows. In conclusion, reproductive performance was reduced with the 5dCO-Synch + P4 in comparison with the 7dEB + P4 system in Nellore cows. Moreover, the reproductive traits observed for primiparous cows indicate that more attention is required when timed AI programs are started early after calving.

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1. Introduction

Artificial insemination (AI) is the main method for genetic improvement of commercial beef herds. However, the use of AI on a large scale in beef cattle is somewhat impractical because of difficulties in detecting estrus in cows that are grazing large pastures. Adequate detection of estrus requires much labor and time to watch cows, gather and sort calves before AI, and often does not match typical working hours. Furthermore, lack of detectable estrous behavior may occur, especially in Bos indicus cows [1]. Thus, synchronizing ovulation with hormonal treatments and

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using fixed-time AI is an efficient method to improve reproductive efficiency and genetic merit of commercial beef herds [2].

The 5dCO-Synch compared with the 7dCO-Synch system decreases the time the dominant follicle is under the influence of circulating progesterone (P4) by 2 days, which could potentially increase follicle steroidogenesis and, therefore, pregnancy per AI (P/AI) [3,4]. Younger follicles have more steroidogenic capacity compared with older follicles [5]. In addition, this system allows for a longer proestrus. For example, Bridges et al. [4], using a short system (P4 for 5 days), reported that an increase in 12 hours between luteolysis ($PGF_{2\alpha}$ treatment and P4 removal) and AI increased P/AI in about 15% points in comparison with a longer system (P4 for 7 days).

In South America, the most common system used in beef cattle uses P4 and estradiol benzoate (EB) to synchronize emergence of a new follicular wave and estradiol cypionate (EC) to synchronize ovulation at the end of the system. Moreover, eCG is used to increase the percentage of cows ovulating to a timed AI system [2]. No studies have applied the 5d system in Nellore cows under tropical conditions, and it is not known if this system may increase P/AI in Nellore cows as suggested in Angus cows [4]. Therefore, the aim of this study was to evaluate the reproductive performance of nulliparous, primiparous, and multiparous Nellore cows submitted to the 5dCO-Synch + P4 in comparison with the well-established 7dEB + P4 system for *Bos indicus* cattle.

2. Materials and methods

The Animal Care and Use Committee from the University of São Paulo approved all procedures with animals. The experiment was carried out at the Experimental Station Hildegard Georgina Von Pritzelwiltz, in Londrina, PR, Brazil.

Four hundred eleven Nellore cows were stratified in two systems according to parity (nulliparous [n = 198], primiparous [n = 80], and multiparous [n = 133]). All primiparous and multiparous had a calf during the experiment. Days postpartum, age, cyclicity (primiparous and multiparous cows), body weight, and body condition score (BCS) were collected at the beginning of the protocol and from them females in each parity were sorted between systems (Table 1). To access cyclicity of cows, ultrasound examination of the ovaries was done once at the beginning of the protocol and cows were considered cycling when CL was present. In nulliparous cows, cyclicity evaluation was

done the same way; however, only nulliparous with CL were used afterward.

For the 7dEB + P4 system, cows received an intravaginal P4 insert (CIDR; Zoetis, São Paulo, Brazil) and 2 mg EB i.m. (Estrogin; Biofarm, Jaboticabal, Brazil) on Day 0. On Day 7, P4 insert was removed, and 25 mg of $PGF_{2\alpha}$ (Lutalyse; Zoetis), 0.6 mg of EC (ECP; Zoetis), and 300 IU of eCG (Folligon; MSD, São Paulo, Brasil) were administered i.m. (Fig. 1). For the 5dCO-Synch + P4 system, cows received an intravaginal P4 insert (CIDR) and 100 μg of GnRH i.m. (Fertagyl; Intervet, Cruzeiro, Brazil) on Day 0. On Day 5, P4 insert was removed and two treatments of 25 mg $PGF_{2\alpha}$ i.m. were given (Lutalyse) 6 hours apart. Cows that did not show estrus until 55 hours after removal of P4 insert received 100 μg of GnRH at 72 hours to induce ovulation and were inseminated immediately after GnRH treatment.

Every cow received an estrus-detection patch (Estrotect; IVP Brasil, São Paulo, Brazil) at the time of P4 insert removal. Cows were observed for estrus twice a day (AM and PM) until 80 hours after P4 insert removal. Cows were considered in estrus if more than half of the estrus-detection patch (Estrotect) coating was removed.

For both systems, when cows were detected in estrus by 55 hours after removal of the P4 insert they were inseminated at 55 hours, whereas the remaining cows were inseminated at 72 hours (Fig. 1).

Ovulation risk was estimated by measuring circulating P4 concentration at 10 days after AI. Cows were considered not ovulating to the system if circulating P4 concentration was less than 1 ng/mL. Progesterone concentration was
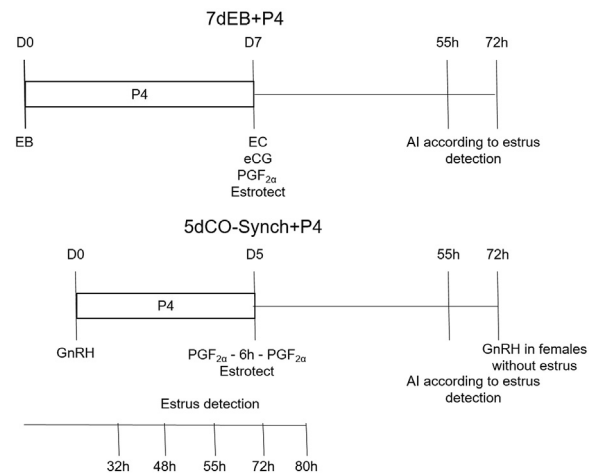
Table 1
Characterization of cows at the beginning of systems.

Parity	n	DPP (d)	Age (y)	CL (%)	BW (kg)	BCS (1–5)
Nulliparous	198		2.1 ± 0.01	100	342 ± 2	
Primiparous	80	39 ± 0.5	3.9 ± 0.03	0	391 ± 3	2.7 ± 0.01
Multiparous	133	39 ± 0.5	7.5 ± 0.20	23	448 ± 4	2.8 ± 0.02

All the variables (mean ± SE) shown in this table were collected at the beginning of systems and all multiparous and primiparous had a calf.
Abbreviations: BW, body weight; BCS, body condition score; CL, percentage of cows with corpus luteum; DPP, days postpartum; N, number.

Fig. 1. Scheme of systems. 7dEB + P4 system, Day 0, cows received progesterone (P4) insert and 2 mg of estradiol benzoate (EB); Day 7, P4 insert was removed and cows received 25 mg of $PGF_{2\alpha}$, 0.6 mg of EC, and 300 IU of eCG. 5dCO-Synch + P4 system, Day 0, cows received P4 insert and 100 μg of GnRH; Day 5, P4 insert was removed and cows received two doses of 25 mg of $PGF_{2\alpha}$ with 6 hours apart. Cows not expressing estrus until 55 hours received 100 μg of GnRH at 72 hours. All cows were fitted with estrus-detection patches (Estrotect) when P4 inserts were removed to aid in detecting estrus. Estrus detection was evaluated at 32, 48, 55, 72, and 80 hours after P4 insert removal. Artificial insemination was performed according to estrus detection, and cows in estrus until 55 hours were submitted to AI at this point. Cows in estrus at 72 hours or those not expressing estrus were submitted to AI at 72 hours. AI, artificial insemination; EC, estradiol cypionate.