Animal Reproduction Science 160 (2015) 105–111

Contents lists available at ScienceDirect

Animal Reproduction Science

journal homepage: www.elsevier.com/locate/anireprosci

# A field investigation of a modified intravaginal progesterone releasing device and oestradiol benzoate based ovulation synchronisation protocol designed for fixed-time artificial insemination of Brahman heifers

S.A.A. Edwards[a,b,*], G.B. Boe-Hansen[a], N. Satake[a], K. Chandra[c], M.R. McGowan[a]

[a] School of Veterinary Science, The University of Queensland, Gatton, QLD, Australia
[b] Vetoquinol Australia, Brisbane, QLD, Australia
[c] Animal Science, Agri-Science Queensland, Department of Agriculture, Fisheries and Forestry, Dutton Park, Brisbane, QLD, Australia

ARTICLE INFO

*Article history:*
Received 23 September 2014
Received in revised form 8 June 2015
Accepted 31 July 2015
Available online 5 August 2015

*Keywords:*
*Bos indicus*
Brahman
Progesterone
Fixed-time artificial insemination
Ovulation synchronisation
Welfare

ABSTRACT

Pregnancy rates (PR) to fixed-time AI (FTAI) in Brahman heifers were compared after treatment with a traditional oestradiol-based protocol (OPO-8) or a modified protocol (OPO-6) where the duration of intravaginal progesterone releasing device (IPRD) was reduced from 8 to 6 days, and the interval from IPRD removal to oestradiol benzoate (ODB) was increased from 24 to 36 h. Rising 2 yo heifers on Farm A: ($n = 238$ and $n = 215$; two consecutive days AI); B ($n = 271$); and C ($n = 393$) were allocated to OPO-8 or OPO-6. An IPRD was inserted and 1 mg ODB i.m. on Day 0 for OPO-8 heifers and Day 2 for OPO-6 heifers. On Day 8, the IPRD was removed and 500 μg cloprostenol i.m. At 24 h, for OPO-8 heifers, and 36 h, for OPO-6 heifers, post IPRD removal all heifers received 1 mg ODB i.m. FTAI was conducted at 54 and 72 h post IPRD removal for OPO-8 and OPO-6 heifers. At Farm A, OPO-6 heifers, AI on the second day, the PR was 52.4% to FTAI ($P = 0.024$) compared to 36.8% for OPO-8 heifers. However, no differences were found between OPO-8 and OPO-6 protocols at Farm A (first day of AI) (39.9 vs. 35.7%), or Farms B (26.2 vs. 35.4%) and C (43.2% vs. 40.3%). Presence of a corpus luteum at IPRD insertion affected PR to FTAI (43.9% vs. 28.8%; $P < 0.001$). This study has shown that the modified ovulation synchronisation protocol OPO-6 may be a viable alternative to the OPO-8 protocol for FTAI in *B. indicus* heifers.



*Abbreviations:* IPRD, intravaginal progesterone releasing device; P4, progesterone; ODB, oestradiol benzoate; FTAI, fixed-time artificial insemination; PR, pregnancy rate; BCS, body condition score; CL, corpus luteum; GnRH, gonadotrophin releasing hormone; PGF2α, prostaglandin F2α; LW, Liveweight.

* Corresponding author at: Vetoquinol Australia, Unit 302.2, 6–12 Boronia Rd, Da Vinci Business Park, Brisbane Airport, Brisbane, QLD, Australia. Tel.: +61 1800 032 355; fax: +61 1800 648 460.

*E-mail addresses:* s.butler@uq.edu.au (S.A.A. Edwards), g.boehansen@uq.edu.au (G.B. Boe-Hansen), n.satake@uq.edu.au (N. Satake), kerri.dawson@daff.qld.gov.au (K. Chandra), m.mcgowan@uq.edu.au (M.R. McGowan).

http://dx.doi.org/10.1016/j.anireprosci.2015.07.011
0378-4320/

## 1. Introduction

Improvements in pregnancy rates (PR) to fixed-time artificial insemination (FTAI) have been associated with an increased length of the interval from intravaginal progesterone ($P_4$) releasing device (IPRD) removal to ovulation in gonadotrophin releasing hormone (GnRH) based ovulation synchronisation protocols in both heifers and cows (Bridges et al., 2008; Colazo and Ambrose, 2011). Current ovulation synchronisation protocols for FTAI in *Bos indicus* heifers involve treatment with oestradiol benzoate (ODB) an IPRD usually for 8 days, prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) and induction of ovulation with ODB 24 h after IPRD removal (Bo et al., 2003). With these protocols FTAI is recommended at 54 h after IPRD removal (Bo et al., 2003). Edwards et al. (2014) have recently investigated the impact on ovarian function of a modified ovulation synchronisation protocol in which the duration from IPRD removal to induction of ovulation with ODB was increased from 24 to 36 h, and the duration of IPRD insertion was reduced from 8 to 6 days. These modifications resulted in increases in the duration from IPRD removal to ovulation (approximately 13 h), the diameter of the dominant follicle at the time of FTAI and the proportion of heifers that ovulated. These are considered key indicators of the likelihood of conception after FTAI (Sá Filho et al., 2010a,b). However, the fertility of heifers after treatment with this modified ovulation synchronisation protocol and FTAI has not been investigated.

The timing of AI after use of the traditional oestradiol-based ovulation synchronisation protocols is problematic for northern Australian beef herds as the recommended time for FTAI is 54 h after the removal of the IPRD, which frequently means that FTAI is conducted around midday. The majority of northern herds are bred during the summer months to maintain an optimal calving window (MLA, 2006), and thus FTAI is commonly conducted when the temperature and humidity is maximal (Bureau of Meterology, 2014). An ovulation synchronisation protocol that permits FTAI at dawn or early morning, yet maintains practical timing for hormonal treatments, would enable insemination at the coolest time of the day and hence improve the welfare of heifers and personnel (Petherick, 2005) and potentially increase reproductive performance (Burns et al., 2010).

The objective of this study was to compare the pregnancy rate to FTAI of commercially managed Brahman heifers treated with a traditional oestradiol-based protocol and the modified protocol described by Edwards et al. (2014).

## 2. Materials and methods

### *2.1. Heifer selection and management*

The study was conducted during late spring to summer on three farms located across Queensland (QLD), Australia. Farm A (22°57′27.55″S, 149°25′39.68″E) and Farm B (23°33′42.42″S, 149°3′17.91″E) were located in central QLD and Farm C (20°12′27.25″S, 140°22′59.30″E) was located in north QLD. Ethical approval was granted by The University of QLD's Animal Ethics Committee—approval number: SVS/210/11/MLA. All animal husbandry practices were conducted in line with the model code of practice for the welfare of animals for cattle (Primary Industries Standing Committee, 2004). All animals used in the study were representative of replacement Brahman (*B. indicus*) heifers annually mated in northern Australia.

#### *2.1.1. Farm A*

All heifers at this farm were born and raised at the property. Heifers were managed in a 1500 ha paddock prior to the trial and a 90 ha paddock during the trial and grazed pastures that were primarily comprised of Buffel grass (*Cenchrus ciliaris*) and Rhodes grass (*Chloris gayana*). Animal handling facilities were equipped with water, hay feeders and shade and had appropriately fenced holding paddocks. Heifers did not experience withdrawal from feed or water throughout the study. Prior to the study, heifers were managed as two separate cohorts (Stud; $n = 160$ and Commercial; $n = 293$).

#### *2.1.2. Farm B*

All heifers at this farm were born and raised at the property. Heifers were managed in a 607 ha paddock prior to and during the trial and grazed pastures that were primarily comprised of Buffel grass (*C. ciliaris*). Animal handling facilities did not have water, hay feeders or shade, and as a consequence heifers experience durations (up to 12 h) when brought in for hormonal treatments and AI without feed or water. All heifers were managed as one cohort.

#### *2.1.3. Farm C*

Heifers at this farm were comprised of purchased yearlings (Purchased; $n = 156$) and born on the property (Homebred; $n = 343$) animals. Heifers were managed in a 365 ha paddock prior to the study and a 102 ha paddock during the study and grazed pastures that were primarily comprised of Mitchell grass (*Astrebla* spp.) and Blue grass (*Dichanthium sericium*). Animal handling facilities were equipped with water, hay feeders and shade and had appropriately fenced holding paddocks. Heifers did not experience withdrawal from feed or water throughout the study. All heifers were managed as one cohort.

### *2.2. Heifer allocation procedure*

At the commencement of the study at each farm (Day 0) all heifers were evaluated and allocated to treatment protocols as described by Butler et al. (2011). Briefly, each heifer underwent a reproductive exam by transrectal ultrasonography using a SonoSite M-Turbo ultrasound machine equipped with a L52X/10–5 mHz linear array transrectal transducer (SonoSite Inc., Bothel, WA, USA). The presence or absence of a corpus luteum (CL), as described by Kastelic et al. (1990), pregnancy status and any abnormalities of the genital tract were recorded. At the same time the body condition score (BCS; 1 to 5 (Jephcott and Norman, 2004)) and the liveweight (LW) of heifers were recorded. Heifers were rejected from the study if LW was <280 kg (Farm A: $n = 1$,