Effect of cow parity and synchronization method with PGF2α on conception rates of *Bos indicus* cows in Cameroon

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Abstract The objective of this work was to evaluate the effect of two synchronization methods with prostaglandins F2α (PGF2α) on heifers and multiparous cows. Fourty-three *Bos indicus* cows (white and Red Fulani) were divided into four groups in a two-by-two factorial structure, parity x method of synchronization. The synchronization methods consisted of a two-dose regime which involved injection of animals on day 0 with PGF2α (Lutalyse) at 5 ml per cow intramuscularly. On day 11, the injection was repeated at the same dosage. On day 14 (72 h after the second injection), a fixed-time artificial insemination (AI) was done. On day 15 (96 h after the second injection), a second insemination was done. The one-and-a-half-dose regime consisted of an injection similar to the first treatment mentioned above on day 0. Thereafter, cows were observed for heat, and anyone showing heat was inseminated. A second dose was given on day 11 to all animals not having shown any heat. A fixed-time AI was done on days 14 and 15. Blood samples were collected on the day 0 of insemination for each cow while day 11 and day 21 after insemination. Progesterone was analysed by means of standard ELISA progesterone kits to determine its profiles after insemination. Results show no evidence of the effect of treatments on conception rates ($P>0.05$). Similarly, heifers and multiparous cows had similar conception rates ($P>0.05$). Between 3 weeks and 3 months of pregnancy, there was a loss of embryos of 28 % in heifers and 20 % in multiparous cows, but the difference between the two groups was not significant ($P>0.05$). It recommended that farmers do not synchronize animals with poor body condition score (BCS). They should also monitor weight gains of heifers, remove them from the herd when they have been mixed with young growing bulls and put them in a breeding herd. The two-dose regime is better to be used in areas where the inseminator cannot easily be available.

Keywords Cameroon · Cattle · Oestrus · Progesterone · Synchronization

Introduction

Reproductive efficiency is a key factor in dairy production. It affects the efficiency of milk production in the herd because of its influence on the calving to service interval, calving pattern, length of lactation and culling rate (Roche. et al. 1992). Synchronization programs have become standard components in the current breeding management of cows in the dairy herds of most dairy industries. Many are based on protocols that allow timed inseminations (TAI) so as to circumvent the practical difficulties associated with oestrus detection (Macmillan 2010). In the Western Highlands of Cameroon, intercalving interval has been long, reaching often 24 months both in native and Holstein cows. This long period is due to many factors that primarily include the unavailability of a breeding bull when a cow comes to oestrus. Artificial insemination can greatly contribute to solving this problem. Farms

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in the Western Highlands of Cameroon are quite isolated from each other and from IRAD artificial insemination (AI) centre from where comes the inseminator. Moreover, many zero grazing dairy farms only have one or two dairy cows. In order to reduce costs of travelling long distances to farms for an insemination of only one cow and reducing mistakes due to wrong oestrus detection, synchronization of oestrus will be of great help. Detection of oestrus is even more difficult in tropical breeds (Muruvi et al. 2001). These breeds tend to exhibit silent heats or to have short periods of oestrus that are easily missed (Mukasa-Mugerwa 1989). Synchronization will help to plan breeding and increase AI usage with chilled semen produced at the centre. The aim of this work is to evaluate the effect of two synchronization methods with prostaglandins F2α (PGF2α) on heifers and multiparous cows.

Materials and methods

Eighty cows of the on-station herd were palpated per rectum for assessment of reproductive status (pregnancy and ovarian activity). Cow identity was recorded including parity, weight and body condition scoring (BCS). Cows were of *Bos indicus* local breeds (white and Red Fulani). Pregnant cows were discarded. Hormone treatment consisted of a two-dose regime injection of animals on day 0 with prostaglandins F2α (Lutalyse) at 5 ml per cow intramuscularly. On day 11, the injection was repeated at the same dosage. On day 14 (72 h after the second injection), a fixed-time AI was done. On day 15 (96 h after the second injection), a second insemination was done. The one-and-a-half-dose regime consisted of an injection similar to the first treatment mentioned above on day 0. Thereafter, cows were observed for heat, and anyone showing heat was inseminated. A second dose was given on day 11 to all animals not having shown any heat. A fixed-time AI was done on days 14 and 15. Semen used for insemination was collected from a Holstein bull, processed and chilled at the Bambui AI station. This would help to assess synchronization regime more adapted to local conditions.

Blood sampling and analysis

Blood samples were collected on the day 0 of insemination for each cow while day 11 and day 21 after insemination. The samples were centrifuged, and the serum was kept in the freezer at −20 °C until ELISA progesterone analysis to determine non-pregnancy rate. Progesterone was analysed by means of standard ELISA progesterone kits from Clinpro International Co. LLC. (Union City, USA, CA 94587, EH-511). The minimum detectable level of progesterone in the assay was 0.05 ng/ml (Clin Prointl, 2005). Intra-assay precision varied from 2.4 to 7.1 %, while inter assay precision varied from 2.6 to 12.6 %. The assay could detect progesterone levels of up to 50 ng/ml above in which there is a need of a diluent. The low control had values ranging from 3.5 to 7.5 ng/ml, and the high control had 20 to 39.5 ng/ml.

It was considered that samples with P4 over 3 ng/ml during the first 3 weeks of AI were indicative of luteal activity and therefore conception. At 3 months after the first insemination, cows were palpated per rectum to confirm pregnancy. BCS was done using the 1 to 5 scale (Edmonson et al., 1989).

Statistical analysis

The cows were divided into four groups in a two-by-two factorial structure, parity x method of synchronization. The parity aspect had two factors: mutiparous cows and heifers. The synchronization methods consisted of a two-dose regime and one-and-a-half-dose regime. The chi-square analysis in SAS was used to test differences among factors considered in this experiment.

Results and discussions

The two-dose regime had slightly better conception rates (52 %). In Tchad, the success rate was 30 % (Zeuh et al., 2014), but there was no evidence that these were different from the one-and-a-half-dose regime (48 %; $P>0.05$). These results are similar to those obtained by Tenhagen et al., (2005) where conception rates to first service were between 49 and 66 %. Muruvi et al. (2001) also had a 50 % conception rate at first service after two injections with PGF2α. The difference between the two regimes could have come from the quality of oestrus detection after the first injection in the one-and-a-half-dose regime which seems to have been acceptable in this trial. Then better synchronization of follicular waves with two injections as well. Although some heats may even have been missed after the first injection, cows may have probably had a corpus luteum (CL) that was to be regressed after the second injection. The injection of PGF2α causes immediate regression of the CL after about day 5 of the oestrous cycle progesterone concentrations decline rapidly to basal concentrations within 24 h; LH pulse frequency increases, causing a significant increase in oestradiol from the dominant follicle and the induction of oestrus and ovulation. PGF2α-only-based systems are now gaining in popularity, particularly in dairy herds, where oestrus detection rates are low and progesterone-based treatments are not registered (Diskin et al. 2002). There is a great variability in oestrus when protaglandins alone are used because of the fact that cows at the latter stage of luteinazation respond better that those at the early phase. This difference is probably minimized by the second insemination at 96 h after the second injection.

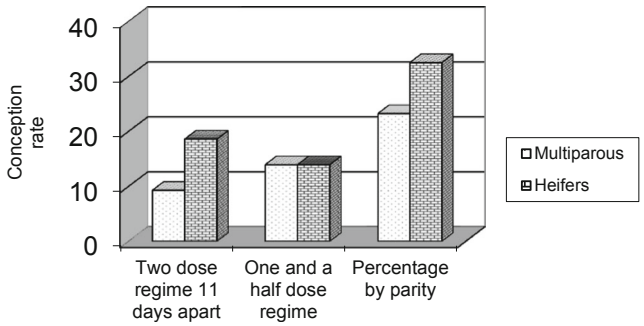

Fig. 1 Conception rate by parity

The lack of evidence in the difference in conception rates in both treatments shows that both methods could be used efficiently. If the inseminator can be available for several days in a village, one-and-a-half-dose regime will be adopted. Cows coming on heat after the first injection of PGF2α will be inseminated. The remainders will be treated 11 days after the first injection and treated as the two-dose regime. This will save money from the potential use of the hormone for the second injection. In the Western Highlands of Cameroon, most dairy farmers do not own breeding bulls. If the inseminator cannot be available whenever the cow is on heat, then the two-dose regime with fixed-time AI will be recommended. Such a scheme has the advantage to synchronize both the CL and follicular waves to inseminate cows at a fixed time. It increases the submission rate of cows for insemination and attenuates deficiencies associated with detection of oestrus (Xu et al., 1997; Stevenson et al. 1999).

Muruvi et al. (2001) also found no difference in three groups of cows synchronized with PGF2α. They confirmed that only the cows cycling at the beginning of the experiments ovulated.

It is generally accepted that fertility, in terms of conception rates, of the cyclic heifer after prostaglandin treatment is not impaired compared with untreated control animals inseminated at a natural oestrus (Macmillan and Day 1982). Heifers in this work had similar conception rates to multiparous ($P>0.05$; Fig. 1), although Peters and Ball (1995) reported that heifers show a better response to oestrus synchronization with protaglandins compared to cows. The heifers here were bred at 24 to 36 months above the physiological age of puberty of 16 months (Bayemi 1999). The low forage content of Cameroonian forages does not usually allow heifers to attend the reproductive weight early enough (200 to 250 kg). Yet, there can be much variation in the weight gains of these heifers, thus some of them cycling earlier than expected by farmers. Often, farmers with improved management would group heifers and young bulls in a specific herd waiting for the appropriate breeding time. Heavier animals will miss several breeding opportunities. It would be good for the farmers to monitor weight change and breed individual heifers as soon as they reach the recommended weight for the traditional cows. On the other hand, there is a risk for cycling heifers to be accidentally bred by growing bulls if they remain in the same herd.

Table 2 Pregnancy rates of cows at 3 weeks and 3 months after insemination

	Number of cows pregnant at 3 weeks	Number of cows pregnant at 3 months	Percentage loss of potential embryos (%)
Multiparous	10	8	20
Heifers	18	13	28

Conception rates were similar in all groups of body condition scores ($P>0.05$; Table 1). However, it seems that cows with low BCS had poorer conception rates. The number of animals in this group may have been small explaining the lack of statistical significance as poor body condition in beef cows results in large follicles with less oestrogen biosynthetic activity in vitro (Prado et al. 1990). Estrous expression is depressed in early postpartum cows in negative energy balance (Westwood et al. 2002).

Haresign (1980) already showed that cows have a critical BCS at mating below which conception rates are reduced if the animals are still in negative energy balance. Final development of follicles is inhibited by negative energy balance (Chamberlain and Wilkinson 1996). Even if the animals with poor BCS conceive, they may lose their embryos. This was shown with nearly a third of embryos lost in multiparous cows. This will be a financial loss in the semen and hormone used. It will be recommended that farmers only synchronize animals with BCS 2 and above. Waldmann

Table 1 Conception rate of each treatment by BCS

	BCS				
	1.5	2	2.5	3.5	Percentage
T1 (two-dose regime) multiparous	0	8.7	0	8.7	39
T2 (one-and-a-half-dose regime) multiparous	4.35	0	13.04	4.35	
T3 (two-dose regime) heifers	4.35	17.39	13.04	0	61
T4 (one-and-a-half-dose regime) heifers	0	8.7	8.7	8.7	
Total	8.70	34.78	34.78	21.74	

et al. (2006) found that cows that underwent late embryonic mortality had smaller ovulatory follicles than cows successfully maintaining a pregnancy (Table 2). These results suggest that follicle size in cows undergoing timed insemination after synchronization by PGF might affect late embryonic loss.

Conflict of interest The authors declare that they have no conflict of interest.

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