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EFFECT OF BODY CONDITION, SEASON OF ESTROUS INDUCTION AND FIXED TIME ARTIFICIAL INSEMINATION ON CALVING RATE OF LOCAL THRABAM CATTLE IN BHUTAN

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ABSTRACT: Response and calving rates of local *Thrabam* heifers and cows artificially inseminated in induced estrous (heat) was assessed. A total of 298 animals in three Agro-Ecological Zones of Samtse (Tading) and Tsirang (Barsong & Sergethang) were inseminated on induced estrous and followed up till animals calved. Results indicated that calving rate was 12.08% when inseminated on induced estrous (n=36/298) as compared to 37.5% (n=6/16) when animals were inseminated in natural estrous. Further, *Thrabam* cows/heifers with average Body Condition Score (BCS) of 2.8 (n=41) had significantly higher response to hormonal treatment, conception and calving (p<0.000) than animals with BCS less than 2.4 indicating good health/better plane of nutrition are prerequisite for birth of more calves when inseminated on induced estrous. Besides, estrous induction/ estrous synchronization with hormonal treatment (TRIU-B) and insemination during winter produced less calves (14.2% calving) than estrous induced and inseminated in summer (31.5% calving) in same cattle type. This indicates that seasonal variation of environmental condition alters conception/calving. Hence, Artificial Insemination of cattle on induced estrous in Bhutanese environment will be more conducive in summer when weather is favorable for adequate access to green forages by animals. *Thrabam* synchronized and inseminated during same season had lower conception than exotic dairy breeds (Jersey & Jersey cross). Study concludes that estrous induced in animals using hormonal drugs does not necessarily result in conception even when animals are inseminated by skilled Technicians. Hence, selection of dairy cattle with optimum body condition score, cattle breed/type, choosing of right season of the year for inducing estrous and insemination is necessary for better outcome of such interventions.

Keywords: Artificial insemination; calving rate; induced estrous; local *Thrabam* cattle.

1. INTRODUCTION

Bhutan has over 317,451 heads of cattle of which about 39% (119121 heads) is improved breed with *Bos taurus* inheritance (DoL 2017) and rest are local breeds and crosses. Local *Thrabam* cattle (Bos indicus) reared by farmers has low productivity. It has lower reproductive efficiency including longer age at puberty/first calving and long inter-calving period (Tamang & Perkins 2014). Breed improvement effort along with good management is fundamental to improve production which can offer significant promise in reducing poverty and malnutrition in the world (Hemme & Otte 2010). Genetic up-gradation through artificial insemination with quality frozen semen can improve reproductive efficiency of this cattle type therefore can improve productivity and make dairy farming profitable. To address the issue of high reproductive inefficiency of local cattle types, treatment of infertile animals with hormonal preparation to minimize reproductive waste is tried (Tshering 2018). This is aimed at inducing estrous in non-cycling/ infertile female to bring into production through timed artificial insemination applying technologies successfully applied in developed world. In Australia where animals are healthy with good body condition, mass estrous synchronization and fix time Artificial Insemination is reported to improve reproductive performance; produce good number of desired types progenies (Lamb et al. 2001). Although such effort optimized time and resources use by shortening the calving interval and increasing the uniformity of the calf crop in developed countries, it is not known whether similar intervention in harsh

Bhutanese farming environment, where most animals underfed can bring about substantial benefits to farmers. Hence, efficiency and effectiveness of estrous synchronization/ estrous induction and artificial insemination to bring more animals into production was assessed with the following objectives: to determine the response rate (start of cycling in anestrous cows), conception rate/calving rates of *Thrabam* cows/heifer inseminated during estrous induced through hormonal treatment and understand various underlying factors hindering effectiveness of the program.

2. MATERIALS AND METHODS

2.1 Selection of study site and data collection

Areas having adequate breedable local *Thrabam* cattle were selected covering three Agro-Ecological Zones (AEZs). The sites identified were: Tading geog (sub-district) in Samtse and Barsong and Sergithang geogs in Tsirang Dzongkhag (district) (Table 1).

Table 1: Dzongkhag/geogs selected for study in different Agro-ecological Zones (AEZs)

Dzongkhag	Geog	Agro-Ecological Zone	Altitude (masl)	Temp 0C (mean)	Rainfall (mm)	Female population (*Thrabam*)
Tsirang	Barsong	Dry Sub-tropical	1200-1800	17	850- 980	275
Tsirang	Sergithang	Humid Sub-tropical	600-1200	19.7	950-1200	265
Samtse	Tading	Wet Sub-Tropical	150-600	24	1500- 4000	1234

2.2 Pre-selection of breedable females

Breedable females at the test sites were selected at Tading geog of Samtse dzongkhag, Sergethang and Barsong geogs of Tsirang dzongkhag of Bhutan from October to December 2017 through consultative process with local leader and extension agents.

2.3 Mating/insemination with four sire lines

Mating scheme was designed dividing breedable females into four groups to receive almost equal doses of semen of four Thai Holstein Friesian (THF) sire lines (poppular, push, pound and puzzle) provided by Dairy Promotion Organization, Thailand.

2.4 Body Condition Scoring

Body condition scoring to evaluate fatness or thinness according to a five-point scale (PSU 2018) was applied. A score of 1 was considered a very thin cow with poor access to quality nutrition, while 5 denotes an excessively fat cow with access of nutrition and 2.5 to 3 is considered an average body condition.

2.5 Estrous induction and fixed time Artificial Insemination (AI)

Estrous was induced in a total of 298 pre-selected local *Thrabam* cows/heifers using intra-vaginal insert (TRIU-B with 1380mg Progesterone) plus Gonadotropin Releasing Hormone (GnRH)-0.0084 mg I/M. In total 153 inseminations done at Tading geog, Samtse, 74 at Barsong geog and 71 at Sergithang geog, Tsirang from December 2017 to January, 2018. Progesterone vaginal implant was inserted on Day 0 (zero), and along with it GnRH was administered. The insert was removed on Day 7 (seven) in all animals as per schedule. Animals were inseminated 48-52 hours after removal of the inserts as per standard practice/protocol.

2.6 Follow up and data recording

Follow-up was done after one year (November 2018 to January 2019) and progenies born were ear tagged using National Bovine Identification Number (NBIN), calves body weight estimated and recorded in National Cattle Information System (NCIS). The data available were compared with similar intervention carried out in other dzongkhags viz., Tsirang, Sarpang and Samdrup Jongkhar.

2.7 Data analysis

Inferential data was analyzed using Minitab Version- 18 and descriptive data were analyzed using MS Excel. Field observation was described.

3. RESULTS AND DISCUSSIONS

3.1 Response rate to hormonal treatment

Over 91% (n=270) of animal treated with vaginal hormonal insert responded and manifested estrous signs and remaining 9% (n=28) either did not respond or vaginal inserts were prematurely removed accidentally.

3.2 Calving rate

Over 298 cows/heifers were inseminated both in natural and induced estrous with almost equal doses of frozen semen from four Thai Holstein Friesian sire lines. A total of 42 progenies (19 male and 23 female) were born and registered. The overall AI success rate accounted to 14.1% (Table 2).

Among the progenies born recorded above (Table 2), six calves were born from 16 inseminations in natural estrous, which accounts to AI success rate of 37.5%, and is equivalent to the national average of 37% (NDRDC 2017). However, it was only 12.08% in induced estrous

Table 2: Summary of AI done, progeny born and AI success rate

Location	Particulars	THF Bulls used for AI and Progeny born recorded				
		Push (C5008)	Puzzle (C5009)	Pound(C4908)	Poppular (C4902)	Total
Tading, Samtse	AI	41	37	29	36	153
	Progeny born	4	6	4	3	17
Barsong, Tsirang	AI	20	19	23	12	74
	Progeny born	3	1	8	2	14
Sergithang, Tsirang	AI	16	19	16	20	71
	Progeny born	2	3	3	3	11
Total AI		77	75	68	68	298
Total Progeny born		9	10	15	8	42
AI success rate by bull (%)		11.7	13.3	22.1	11.8	14.1

(n=36/298) indicating that insemination in induced estrous in *Thrabam* cattle may not be cost effective.

Among sire line used Pound has higher number of progenies (Table 2), but Chi Square Test revealed no significant association (p>0.05) between the four sire lines used hinting that all sire lines tested is equally good. Similar study on effectiveness of inducing estrous with Prostaglandin (PGF2α) and insemination during natural oestrus in Ethopia noted higher conception rate in natural estrous (32.07%) as compared to synchronization result of 26.88% (Tewodros et al. 2005). Besides, many other authors have reported a decrease in pregnancy rates when small follicles were induced to ovulate following fixed-time AI in both heifers and cows (CIDR Protocol – Lamb et al. 2001; CO-Synch protocol – Perry et al. 2001).

3.3 Body condition score and calving rate

Body Condition Score (BCS) is determined by nutrient intake that influences health of the animals. It has direct bearing on response rate to hormonal drugs and calving rate. In a sampled population, animal with average BCS of 2.8 (n=41) had significantly higher response to hormonal treatment, conception and calving (p<0.000) when inseminated during induced estrous. Animals with BCS of below 2.4 (n=28) had poor response rate and even if it responded, conception rate and calving remained poor. This finding is supported by Mania et al. (2008) who reported that Zebu cattle (Bos indicus) with BCS 2.5 to 3, exhibited medium follicles (p<0.001) than cows with BCS 1 and 2 indicating that incidences of cycling and pregnancy is positively correlated with BCS. Further, research has shown an increase in pregnancy rates with a flushing effect on cattle bred on increasing plane of nutrition than cattle bred on a declining plane of nutrition (Bethany 2013). These findings are further confirmed through study on endocrine and ovarian changes in *Bos indicus* heifers by Rhodes et al. (1996). Their study reported that nutritionally induced anestrous through reduced dietary intake of animals had significantly lower mean concentrations of Luteinizing Hormone (LH) than animals in ad-libitum dietary intake. Insufficient circulating LH to stimulate maturation of the ovulatory follicle and hindering release of ovum results in un-ovulatory estrous.

3.4 Season of estrous induction and calving rate

Induction of estrous in animals with intra-vaginal implant and artificial insemination done in late autumn and winter had low conception rate (14.2%). However, animals synchronized in late spring and summer of 2018 in similar environment of Sarpang, Tsirang and Samdrup Jongkhar resulted in 31.5% conception rate (n=19). Harsh weather condition and scarcity of fodder during winter is likely to affect health and reproduction of animals in Bhutan. This finding is consistent with Gwazdauskas (1985) who reported that seasonal variation of environment, nutrition, and management alters estrous cycle and conception rates are reduced under stress of heat and cold. Hence, if synchronization and AI is timed in winter when fodder shortage is acute and animals are struggling to adjust to cold winter days, conception rate/calving rate is likely to be low.

3.5 Breed type and calving/conception rate

In present study local *Thrabam* cattle synchronized and inseminated had very low conception rate (14.1%) as compared to 48% in Jersey cattle through similar intervention at similar time (Rai et al. 2019). Studies have also found that estrous induction and AI in cows with *Bos indicus* influenced genetics is a challenge with low conception rates (Hierset al. 2003) and is often disappointing (Saldarriaga et al. 2005). This suggests that cattle with *Bos taurus* gene could be targeted for estrous synchronization and fixed time AI for better outcome of such interventions. Nevertheless, though many animals have not conceived, estrous induction/synchronization with hormonal treatment is believed to have brought many anestrous Bos indicus cattle to regular cycle (Sanyasi pers. comm. 2018). Similarly, Sá Filhoa et al. (2011) supplemented the view that exogenous estradiol

use can display better ovarian responses in Bos indicus cows.

4. CONCLUSION & RECOMMENDATIONS

An animal's nutritional status is usually assessed on changes in its live weight and body condition. The animal with body condition score above 2.5 in village herd has higher response and calving rate. In contrary, animal with body condition score below 2.4 either does not respond to treatment or conception will be low. In order to make judicious use of expensive hormone to treat infertility and induce estrous, animal in poor health should be excluded until plane of nutrition improves and animals regain their body condition. Owing to low level of circulating Luteinizing Hormone (required to induce ovulation), estrous induced in weak/underfed animals using hormonal drugs does not necessarily result in conception even when animals are inseminated by skilled Technician. Hence, selection of dairy farmers with healthy cattle, breed types for estrous induction/estrous synchronization is crucial for better success rate. Timing of estrous induction and insemination during summer when animals have access to better nutrition can result in better conception rate/calving rate than in winter. Hence, mass estrous induction in lean season especially during winter (when fodder scarcity is obvious) needs to be avoided. Conception rate of local cattle when inseminated in induced estrous is highly discouraging but animals inseminated in natural estrous conception rate is better even during winter. Hence, it is recommended to inseminate local *Thrabam* cattle preferably in natural estrous.

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