



Factors affecting first service non-return rate of crossbred bulls in Bangladesh condition

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ABSTRACT

This study was conducted to identify the factors that affect first service non-return rate (NNR) at 56 days after artificial insemination (AI) in Bangladesh condition. Five crossbred bulls from AI center of Bangladesh Agricultural University were used in this study. A total of 1650 cows were inseminated by 2 inseminators. The overall NNR for 5 bulls was 82.9% (72.9 to 87.5%). The highest NNR (87.5%) was observed in a Red Chittagong bull, which is significantly higher than that of Holstein-Friesian (H-F) × Local (L). Cows which were more than 12.5 years old revealed a significantly lower NNR than younger animals. The non-return rate did not vary significantly between the breeds of cows; however, the highest NNR (91.0%) was found in indigenous zebu cows than crossbred cows (H-F × L and Sahiwal × L) (82.4 to 82.9%). Multiparous cows showed lower NNR in comparison to nulliparous and primiparous cows; but this differences did not vary significantly. The cows showed significantly higher NNR (90.9%) when insemination was given during winter than cows which received insemination in summer (NNR 78.0%). The low environmental temperature (<20°C; OR=2.864) was favorable for higher NNR than hot weather (>25°C). It is concluded that, individual bull, older and multiparous cows, summer and hot weather negatively affect first service non-return rate in Bangladesh condition.

Key words: Bangladesh condition, Crossbred bulls, Non-return rate

Failure of cows to become pregnant and the need for repeated AI are common causes of frustration and economic loss of the dairy farmers (Stevenson *et al.* 1990). To make an AI program an economic success, sires with inadequate fertility must be identified and removed (Shaha *et al.* 2008). A national program for crossing local cattle with exotic breeds by AI has been practised in Bangladesh since 1950 (Ahmad and Islam 1987).

Reproductive efficiency of AI bulls is usually measured by the NNR in cows. It is affected by the fertility of the cow herself and of the bull, skill of inseminator, and also by the season and environmental temperatures at insemination and thereafter (Reurink *et al.* 1990). In our previous study, we reported that NNR is related to semen quality parameters of the bulls (Rabidas *et al.* 2012). There is no precise report available to measure NNR in crossbred cows in Bangladesh with consideration of various risk factors like efficiency of inseminators, seasons, age of cows and climatological data.

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This study was, therefore, performed to know the effects of individual bull, cow factors (age, breeds and parity) and environmental factors (seasons, temperature) and skill of inseminators on NNR in Bangladesh condition.

MATERIALS AND METHODS

Bulls: Chilled semen from 5 healthy vaccinated, dewormed and sexually matured crossbred bulls from AI Center of Bangladesh Agricultural University, Mymensingh were included in the study (Table 1).

Table 1. Brief description of bulls used at AI center

Bull ID No.	Types of the bulls	Age (years)	BCS (1 to 5 scale)	Body weight (kg)	Scrotal circumference (cm)
131	H-F × L	4.5	4.0	495	30
143	Sahiwal × L	3.5	4.0	450	28
122	Sindhi × L	5.5	4.0	561	32
63	Red Chittagong	4.0	3.5	350	26
92	Red Chittagong	3.0	3.5	345	26

L, local.

Insemination: Inseminations of cows were done at 12–18 h of onset of estrus. Cows showing any abnormal genital discharge or having any abnormalities in genital organs on

rectal palpation at the time of AI were excluded from the experiment.

Data collection: Data for individual insemination records were collected from the record of University AI center. Data including the bull whose semen used, date of insemination, age, breed and parity of the cows, name of inseminator, season of inseminations performed and where applicable, the dates on which cows were presented for insemination after return to estrus by 56 days after insemination were recorded. The data of the environmental temperatures were collected from the meteorological center of the University during the experimental period.

Calculation of non-return rate: Non-return rate was calculated by the formula given below:

$$\text{NNR} = \frac{\text{Total no. of cows inseminated} - \text{No. of cows returned to estrus}}{\text{Total no. of cows inseminated}} \times 100\%$$

Statistical analysis: Data were entered in a Microsoft excel work book and exported to SPSS 10.0 version for analysis of descriptive statistics. Multiple logistic regression analysis was done to find out the effects of individual bull, age, breed and parity of cows, seasons and environmental temperature at which insemination was made and skill of inseminator on NRR.

RESULTS AND DISCUSSION

Non-return rate of crossbred bulls: A total of 1650 cows were inseminated, of which 282 cows were presented for second inseminations. Non-return rates for each bull are presented in Table 2. Highest NRR was found in bull number 92.

Table 2. Non-return rate of 5 bulls

Bull ID	No. of cows inseminated	No. of cows represented for insemination	NRR (%)
131	266	72	72.9
143	500	70	86.0
122	544	80	85.2
63	260	50	80.7
92	80	10	87.5
Pooled	1650	282	82.9

Table 3. Logistic regression model of bulls' genotype on non-return rate in cows

Bulls' ID	Category	Frequency	NRR (%)	OR (CI)	P-value
131	H-F × L	265	72.9	0.374 (0.183–0.7630)	0.007
143	Sahiwal × L	499	86.0	0.793 (0.392–1.606)	0.520
122	Sindhi × L	541	85.2	0.747 (0.371–1.505)	0.415
63	RCC	259	80.7	0.537 (0.259–1.110)	0.093
92	RCC	86	87.5	1	-

OR, odds ratio; CI, confidence interval.

Effect of individual bulls on NNR: Red Chittagong bull (number 92) achieved highest NNR (87.5%), which is significantly higher in comparison to that of H-F × L bull (OR=0.374, P<0.01) (Table 3). Moreover, Sahiwal × L bull (86.0%) achieved higher NRR than Sindhi × L (85.2%) and H-F × L bulls (72.9%), which is in agreement with the findings of Paul *et al.* (2011), who reported that pregnancy rate was higher in Sahiwal × L bull than Sindhi × L and H-F × L bulls. The variation of non-return rate among the bulls might be due to semen quality of individual bulls, such that the bulls with semen of higher motility and viability and lower proportion of morphologically abnormal sperm had higher NRR. Sarder (2006) similarly reported that the highest NNR (83.1%) was associated with high quality semen and the lowest (70.1%) with poor quality bull semen in the Rajshahi district of Bangladesh. However, correlation of semen quality with the non-return rate of respective bulls is not studied in this experiment.

Effects of cow related factors on NNR: The effect of age of cows on non-return rate is shown in Table 4. There is a significant (P<0.05) effect of age of the cows on NRR, such that cows which were more than 12.5 years old had a substantially poorer NRR than did younger animals, which agrees with results of Jansen and Lagerweij (1987). Young cows show better performance than older cows, probably because there is no stress owing to production, which influences the fertility status. Younger cows have also not sustained the progressive incremental damage to the uterus that seems to be the consequence of repeated calving. It was remarkable that there was no reduction in fertility until cows had reached such an advanced age; many studies of cows in temperate zones or in intensive production systems showed that fertility decreases much earlier – typically by as young as 7-year-old (Spalding *et al.* 1974).

The non-return rate did not vary statistically (P>0.05) with the breeds of cows; however, the highest NNR (91.0%) was found in local indigenous zebu cows than crossbred cows (H-F × L and Sahiwal × L) (82.4 to 82.9%). The result is supported with the finding of Paul *et al.* (2011), who reported that the local indigenous cattle showed higher pregnancy rate than crossbred cows.

Multiparous cows showed lower non-return rate in comparison to nulliparous (OR=1.071) and primiparous cows (OR=1.1.90); but this differences did not vary statistically,

Table 4. Logistic regression model for cow factors associated with the non-return rate

Variable	Category	Frequency	NRR (%)	OR (CI)	P-value
Age (year) of cows	2.5 to 5.0	971	83.0	4.921 (1.568–15.447)	0.006
	>5.0 to 7.5	488	82.1	4.609 (1.452–14.631)	0.010
	>7.5 to 10.0	122	78.7	7.133 (2.036–24.997)	0.002
	>10.0 to 12.5	57	82.4	4.700 (1.254–17.621)	0.022
	>12.5 to 15.0	12	50.0	1	
Breeds of cows	H-F × L	1223	82.4	0.622 (0.217–1.783)	0.376
	Sahiwal × L	393	82.9	0.712 (0.242–2.092)	0.537
	Local	34	91.0	1	-
Parity	Nulliparous	449	82.4	1.071 (0.751–1.529)	0.704
	Primiparous	825	83.8	1.190 (0.865–1.683)	0.285
	Multiparous	376	81.4	1	

Table 5. Logistic regression model of environmental factors associated with the non-return rate in cows

Variable	Category	Frequency	NRR (%)	OR (CI)	P-value
Seasons	Rainy	482	79.9	1.129 (0.841–1.514)	0.420
	Winter	552	90.9	2.757 (1.952–3.895)	0.000
	Summer	616	78.1	1	
Temperature	<20 °C	597	90.0	2.864 (2.045–4.010)	0.000
	20–25 °C	449	79.9	1.143 (0.848–1.542)	0.380
	>25 °C	604	77.6	1	
Inseminator	A	1200	82.8	0.959 (0.718–1.282)	0.799
	B	450	84.0	1	-

P>0.05 (Table 4). Similar results were observed by Quintela *et al.* (2004) and Khan (2008), who reported that pregnancy rate was gradually decreased with increase of parity.

Effects of environmental factors on NRR: Seasons in which inseminations were performed had a significant ($P<0.001$) effect on NRR (Table 5). The highest NRR (90.9%) was observed during winter while lowest non-return rate (78.0%) was observed in summer. Most literature derived from AI programmes outside the temperate zone, showed that NRR is highest in the cooler seasons and lowest during the hotter seasons. Hot humid season had a greater adverse effect on NRR. There are undoubtedly contributions of both cows and bulls to this phenomenon. Cows, particularly those ones that originated in temperate latitudes have reduced pregnancy rates and increased embryonic mortality rates during high environmental temperature.

The low environmental temperature ($<20^{\circ}\text{C}$; OR=2.864, $P<0.001$) is favourable for significant higher non-return rate in comparison to hot weather ($>25^{\circ}\text{C}$). Ricardo *et al.* (2004) reported that the pregnancy rate (25.4%) in cattle was markedly affected by heat stress (29°C). It is reported that small ovarian follicles are susceptible to heat stress (Badinga *et al.* 1993, Wolfenson *et al.* 1995). Delayed effects of heat stress on follicular steroidogenic capacity (Roth *et al.* 2001) and follicular dynamics, as well as on oocyte quality and embryo development (Roth *et al.* 1999) could be responsible for the lower fertility of cows in higher environmental temperature.

The non-return rate did not significantly vary (82.8 vs 84.0%) with the inseminators (Table 5). There is no significant effect of AI technician on NRR in the present study.

In conclusions, our results stated that NRR at 56 days after first insemination is influenced by the individual bulls, age and parity of the inseminated cows, season and environmental temperature of AI performed.

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