



## Factors affecting conception rates in AI bred buffaloes in field conditions

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### ABSTRACT

The objective of the study was to identify the factors affecting variation in conception rate of buffaloes inseminated by Murrah bulls' frozen semen under field conditions. Total of 18,396 insemination records pertaining to 11,793 buffaloes that were inseminated artificially at BAIF's field AI centers during the period of June 2010 to December 2014 in 3 states. Logistic regression analysis was used to compute the odds ratio and probability of conception rate. Records were classified according to agroclimatic zones, lactation order, season of insemination and body condition score. Agroclimatic zones, lactation order and body condition score showed significant variation. The overall conception rate was 48.01%. Conception rate of western plain zone of Uttar Pradesh was higher than other zones under study. Body condition score 3 was favourable where probability of conception was 0.51. Conception rate of first parity buffaloes was lower than other parities with the probability of 0.46. Conception rate increased in second parity with probability 0.52. Highest conception rate was found in fourth parity with probability 0.53. There was marginal difference between second to fifth parity. Season of insemination did not affect conception rate, however, the distribution of artificial inseminations was higher during the favourable season than that during lean-season. It could be inferred that the factors like agroclimatic zones, lactation order and body condition score should be considered while evaluating the conception rates in buffaloes.

**Key words:** Artificial insemination, Buffaloes, Conception rate, Logistic regression, Odds ratio

Fertility traits in buffaloes are affected by various environmental factors and seasonal breeding pattern. Since last five decades, artificial breeding in bovines was introduced in India for enhancing milk production potential of Indian cattle and buffaloes. The efforts yielded a significant rise in milk production from 17 million to 146.3 million tonnes of milk which put India firmly on the top in the world. Buffalo is considered as the major dairy animal and backbone of Indian dairy industry because they hold the major share of milk production. But to make dairying a successful business, the animals should not only be high producing, but also healthy with optimum reproductive performance and this is where conception rate holds its importance. Conception rate is directly associated with the production attribute and responsible for monitoring life time productivity of the individual animal. Conception is the first pre-requisite of an animal entering into the productive life. It determines directly to the total profitability of farm enterprises. Thus, to achieve the maximum profitability, it is very important to increase the conception rate up to maximum level. But failure of getting buffalo pregnant and the need of repeated inseminations are common causes of

frustration and economic loss of the dairy farmers (Stevenson *et al.* 1990). Fertility of female animal is regulated by genetic disposition and many environmental factors (Amir *et al.* 1982). The present study therefore focuses on non-genetic (environmental) factors namely agroclimatic zones, parity, body condition scores and season of insemination which might influence the AI conception rate in buffaloes reared under field conditions in India.

### MATERIAL AND METHODS

The data consisted of 18,396 insemination records pertaining to 11,793 buffaloes that were inseminated artificially at BAIF's field AI centers which provide door-step AI service at villages. The period covered was from June 2010 to December 2014. The available data were classified on the basis of agro climatic zones, body condition score, lactation order and season of breeding. Breeding season was classified into 2 categories as 'favourable' and 'lean' seasons based on the pattern of distribution of inseminations. Favourable season includes months from July to December, while lean-season includes months from January to June. The lactation sequence ranged from first to fifth. Body condition score (BCS) were categorized from 1 to 4, where BCS1 being physically poor and BCS4 being over-condition. Animals with BCS1 would have prominent hips, shoulders, backbone with all ribs clearly visible, recessed tail-head area and skeleton body outline. Animals

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of BCS2 meant almost similar conditions except ribs were faintly visible and tail head area slightly recessed. Animals with BCS3, were having good overall appearance with hip bones visible faintly, ribs not generally visible and well covered, tail and head areas not recessed and body outline almost smooth. An over-conditioned cow (BCS4) is smooth and boxy with bone structure hidden from sight or touch. Such animals have fat deposits (pones) around the tail head and on the pin bones. The number was an indicator of comparative body condition score in ascending order.

**Conception rate:** Conception rates (CR) were estimated from the proportion of pregnancies confirmed by the rectal palpation of the genital tract between 90 to 120 days of post-insemination among the total number of buffaloes inseminated artificially with frozen semen in a specified period of time. The conception rate was estimated by using the following formula:

$$\text{Conception rate (CR)} = \frac{\text{No. of buffaloes pregnant}}{\text{No. of buffaloes inseminated}} \times 100$$

Insemination dates were recorded using the electronic data loggers and stored in SQL server. For each buffalo, the conception rate (CR) was defined as pregnant or not.

**Statistical analysis:** Conception is a binary trait having only one of the two possibilities namely, success or failure. The most commonly used multiple analysis technique poses difficulty when the dependent variable has only two

outcomes viz. event occurring or not occurring. In such a data-set, the assumption of normal distribution and equality of variances are violated. However, logistic regression model is found to be a better choice (Dyke and Patterson 1952, Ron *et al.* 1984, Hosmer and Lemeshow 1989) and hence adopted in the present study. Thirunavukkarasu and Kathiravan (2006), Shamsuddin *et al.* (2013), Suresh Kumar and Pasupathy (2015) have used a binary logistic regression model for predicting the probability of conception rate in artificially inseminated bovines using various animal and management factors.

To investigate if differences in conception rate existed between different sub-classes of independent variables, a binary logistic regression model was constructed with conception rate as the dependent variable and the independent variables of interest were category of agroclimatic zones, body condition score, season of breeding and lactation order of buffalo. Interactions of interest were initially included in the analysis, however, these being statistically non-significant were omitted from the final model. All the data was analyzed in R-project for statistical computing software (version 3.2.2.)

## RESULTS AND DISCUSSION

The results of analysis of conception rate using multivariate logistic regression model is presented in Table 1. In the present study, the overall conception rate in

Table 1. Multivariate logistic regression model for conception rate

Variable	Means	No. of observations	Odds ratio	Relative probability [1]	Estimated conception rate [2] per cent
<i>Agroclimatic zones of the AI Centers**</i>					
Central plain of Uttar Pradesh	49.58	5530	1	0.5	49.58
Mid-western plain of Uttar Pradesh	46.83	2669	0.91	0.48	47.6
North-west alluvial plain of Bihar	48.95	2727	0.98	0.5	49.58
Scarcity zone of Maharashtra	46.18	5959	0.85	0.46	45.61
Western plain zone of Uttar Pradesh	49.83	1511	1.01	0.5	49.58
<i>Body condition score of buffaloes**</i>					
BCS 1 (Poor)	48.75	2714	0.93	0.48	47.18
BCS 2 (Thin)	46.64	9485	0.87	0.46	45.22
BCS 3 (Good)	50.31	3389	1.02	0.51	50.13
BCS 4 (Fat)	49.15	2808	1	0.5	49.15
<i>Parity/lactation order of buffaloes***</i>					
One (nullipara)	45.67	8562	0.85	0.46	45.09
Two	51.16	3520	1.07	0.52	50.97
Three	48.64	3719	0.99	0.5	49.01
Four	51.2	1836	1.12	0.53	51.95
Five	49.01	759	1	0.5	49.01
<i>Season of inseminations (NS)</i>					
Favourable season	48.21	11285	1	0.5	48.21
Lean season	47.7	7111	0.98	0.49	47.25

Significance codes: 0 '\*\*\*\*', 0.001 '\*\*\*', 0.01, NS, nonsignificant (probability<0.05). <sup>1</sup>The figure of 0.5 under relative probability indicates the reference figure for comparison with others as chosen by the Logit Regression Analysis method. The figures are odd ratio of Success (or Failure)/ Number of events, viz. Conceived (or Not Conceived)/ Number of AI. <sup>2</sup>Estimated conception rates are computed after substituting actual figure (LS mean) in place of First reference values, converting the rest of the odds ratios accordingly and multiplying by 100.

buffaloes was observed to be 48.01%, which was noticeably higher than most of the other reports. Central Institute of Research on Buffalo reported 45.75 and 40% conception rates on Murrah and Nilli-Ravi buffalo herds, respectively, and similar observations were reported by Zicarelli *et al.* (1997) (42.5–51.1%) and Guangsheng *et al.* (2013) (45.31%) lower rates are reported by Anzar *et al.* (2003) (31.30%), Sarkar *et al.* (2005) (33.19%) in Murrah buffalo, while Guangsheng *et al.* (2013) reported higher conception rate (52.08%) in Nilli Ravi buffalo.

*Effect of agroclimatic zone:* The conception rates were significantly different between agroclimatic zones. The probability of getting buffalo pregnant in mid-western plain of Uttar Pradesh, north-west alluvial plain of Bihar and scarcity zone of Maharashtra state was found to be comparatively lower whereas the western plain zone of Uttar Pradesh had higher probability than that of central plain of Uttar Pradesh with conception rate of 49.58%. While conception rate in scarcity zone of Maharashtra state was lowest (45.61%) than that of the other agroclimatic zones. These differences might be attributed to variation of agroclimatic conditions and even likelihood of variation of characteristics of the locally adapted strains of the Murrah grades of she-buffaloes that were subjected to insemination across different zones. Anzar *et al.* (2003), Thirunavukkarasu (2006) and Shamsuddin *et al.* (2013) reported that conception rates in artificially inseminated bovines varied considerably across different geographical locations.

*Effect of body condition score:* There appeared to be influence of body condition score of buffaloes on conception rate. Buffaloes with BCS 3 (good) had more likelihood of getting pregnant than that of buffaloes with body condition scores BCS 1, BCS 2 and BCS 4. Animal with BCS 3 (Good) had 50.13% conception rate. Buffaloes with BCS 1 (Poor) and BCS 2 (Thin) had comparatively lower conception rate (47.18 and 45.22%). Body condition score could be considered as indicator of nutritional status and overall reproductive health status of buffaloes. Some authors reported that BCS had a significant effect on the quality of oocyte and showed linear relation with oocyte quality (Rhind *et al.* 1989, Dominguez 1995, Kumar *et al.* 1997, Fihri *et al.* 2005, Shamsuddin *et al.* 2013) which supported the effect of nutrition on reproduction process, particularly at the ovarian level. Female animals with lower score exhibited comparatively lower conception rate than that of animal in good condition. This system uses a numeric score to predict body energy reserves in the buffalo and research indicated that there could be a strong link between the body condition of a cow and her reproductive performance and clearly the important tool for monitoring and improving the reproductive efficiency.

*Order of lactation:* Lactation order had significant effect on conception rate of buffaloes. Highest conception rate was found in buffaloes with fourth parity (51.95%) than nulliparous (first parity) buffaloes (45.09% conception rate). There was small margin of differences in conception rates

of buffaloes ranging between 2nd to 5th parity. The average conception rate of 3rd to 5th parity was 49.43%. Our observations are in close agreement with those of Chebel *et al.* (2004), Grimard *et al.* (2006), SáFilho *et al.* (2009) and Tebug *et al.* (2011). Bhagat and Gokhale (1999) also reported that conception rate increased gradually from the 1st parity to the 4th parity and then decreased in the subsequent parities. While Guangsheng *et al.* (2013) reported higher conception rate in heifer buffaloes than multiparous buffaloes.

*Season of insemination:* Buffaloes are considered as seasonal polyestrous animal and short day breeder. They are usually active from July until the end of February. Inseminations carried out in our study showed similar trend with maximum and rising spread of insemination in July to December (Favourable season) and minimum and declining spread found in month of January to June (Lean season). Inseminations done during favourable season (July to June) and Lean season (January to June) were 61.34 and 38.64%, respectively. Conception rate during the favourable season was slightly higher (48.21%) than that of Lean season (47.25%), although the difference fail to reach statistical significance level at 5% level. It may be inferred that this aspect needs to be investigated further with additional data under controlled conditions. Overall findings in this respect are in agreement with Sarkar *et al.* (2005) and Shamsuddin *et al.* (2013).

This study indicates that agroclimatic zone, lactation order, body condition score significantly affect conception rate in buffaloes reared under field conditions. Season of insemination did not significantly affect conception rate but distribution of inseminations in both the season varied. Therefore, above factors should be taken into consideration while evaluating the conception rates of AI bred buffaloes.

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