

A study on conception rate in artificially inseminated buffaloes under field conditions of Telangana State

Syed Meraj Ahmed Ismail¹ and R L Bhagat^{*2}

1= BISLD, Southern region, Hyderabad HQ, India, 2= BAIF, Central Research Station, Uruli Kanchan, Pune, M.S. 412 202, India

1. Thematic Programme Executive E-mail: meraj.syed@baif.org.in
2. Senior Thematic Programme Executive E-mail: ramchandra.bhagat@baif.org.in

*Corresponding author:

Abstract:

The objective of this study was to investigate the potential factors affecting conception rate in Artificially Inseminated buffaloes under field conditions of Telangana state. The data used in the present investigation were collected from 755 villages in the jurisdiction of 49 Cattle Development Centres (CDC) being operated in 70 tehsils of Jagtial, Karimnagar, Peddapalli, Siddipet, and Sircilla districts. Total 43,954 artificial inseminations were performed on 36,645 buffaloes owned by 24,341 farmers during the years April 2019 to March 2021. The effect of factors such as district, CDC in-charge education, artificial insemination work experience, animal breed, age of buffalo at the time of insemination, order of lactation, heat stage, animal category, and animal's previous reproduction status was assessed. Logistic regression analysis was used to compute the odds ratio and probability of conception rate. The results revealed that the overall mean conception rate was 45.84 ± 0.24 percent and it was recorded significantly higher in animals from Karimnagar district (48.18%), inseminations performed by having 12th pass inseminators (47.72%), inseminators having 10 years and more A.I. work experience (49.74%), N.D buffaloes (49.22%), having 8 years age at the time of inseminations (52.97%), having 4th lactation (50.92%), early heat animals (46.33%), and farm-born animals (48.35%). Statistical analysis of data showed that district, CDC in-charge education, artificial insemination work experience, animal breed, age of buffalo at the time of insemination, order of lactation, heat stage, and animal category had a significant effect on conception rate and animal's previous reproduction status did not affect conception rate.

Keywords: Telangana State, Buffalo, Field Conditions, Artificial Insemination, Conception Rate, Logistic Regression.

Date of Submission: 12-01-2022

Date of Acceptance: 27-01-2022

I. Introduction:

The fertility of farm animals is mainly governed by the genetic potential and environmental combinations including nutrition, health, and overall management adopted by farmers, and assessing the same, the percent conception rate is the accepted indicator. The overall lifetime productivity of animals is depressed due to low conception rate either due to non-expression of heat, reproductive problems, increased number of services, increased age at first calving, service period, calving interval, etc. There is scope for improvement in the conception rate by adopting better management of animals as lower heritability of the trait is indicative of greater environmental and management influence. The available literature on the relation of the district, Cattle development center in-charge education, artificial insemination (A.I.) work experience, animal breed, age of the animal at the time of A.I., order of lactation, heat stage of the buffalo at the time A.I., animal category and animal previous reproduction status, with the conception rate of animals bred with A.I. is inadequate to explain the role of these factors for deciding fertility strategy at village level. Therefore, an attempt in the present investigation was made to study these factors affecting conception rate as an indicator of fertility in buffaloes under field conditions of some districts of Telangana state.

II. Materials And Methods:

The A.I. program in Telangana state is being operated by the Karimnagar cattle breeder welfare association for breeding field animals and BAIF is performing the role of the service provider. During the period of April 2019 to March 2021, a total of 43,954 buffalo A.I. were performed on 36,645 animals owned by 24,341 farmers spread over 755 villages in the jurisdiction of 49 Cattle Development Centres in 70 tehsils. All animals were maintained and reared by the farmers individually. The housing ranged from open to permanently constructed sheds. Animals were semi stall-fed with dry and green fodder along with some concentrate feed. The calls for A.I. received through mobile phones and animals were inseminated with frozen semen at the

doorstep of farmers. Buffaloes not repeated within 90 to 120 days post insemination were examined for conception confirmation by rectal palpation. The conception rate calculated by formula as suggested by Qureshi et. al. (2008)

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

The information on districts (Jagtial, Karimnagar, Peddapalli, Siddipet, Sircilla), CDC in-charges education (10th, 12th, Graduate), A.I. work experience (1, 2, 3, 4, 6, 8, 10 yrs. & more), animal breed (Jaffarabadi, Mehsana, Murrah, N.D. buffalo), age of the buffalo at the time of A.I. (2, 4, 6, 8, 10 yrs. & above), order of lactation (heifer, 1, 2, 3, 4, 5, 6 & above), heat stage (early, mid, late, No observation), animal category (non-respondent, farm-born, purchased) and animal previous reproduction status (not calved, calved) was compiled for studying the effect on conception rate.

Statistical analysis: Conception is a binary trait having only one of the two possibilities namely, success or failure. The most commonly used multiple analysis techniques pose 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, the logistic regression model is found to be a better choice (Bhave et. al. 2016) and have used a binary logistic regression model for predicting the probability of conception rate in artificially inseminated buffaloes 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 interests. The data were analyzed using the R project for statistical computing software (version 4.0.3).

III. Results And Discussion:

The mean conception rate in artificially inseminated buffaloes was recorded as 45.84±0.24 percent which was lesser than the finding of Guangsheng et. al. (2013), Bhave et. al. (2016), and Gokhale and Bhagat (2000) who reported an overall conception rate of 52.08, 48.01 and 51.84 percent in buffaloes under the field conditions, respectively. The Central Institute of Research on Buffalo reported 45.75 and 40% conception rates on Murrah and Nilli-Ravi buffalo herds, respectively. The other scientists Zicarelli et. al. (1997) reported the conception rate as 42.5–51.1 percent, Guangsheng et. al. (2013) noticed a 45.31 percent conception rate in the Italian Mediterranean buffaloes. Thirunavukkarasu and Kathiravan (2009) much less conception in buffaloes (25.52%). The present conception rate was studied in relation to the following factors;

District: District had a highly significant effect on the conception rate of buffaloes however, Pandey et. al. (2016) reported a non-significant effect of districts on conception rate under Jharkhand state conditions. The highest percentage of animals covered under A.I. in Sircilla district, however animals from Karimnagar district recorded the highest conception rate (48.18±0.42%) compared to the other districts under study (Table-1). The estimated highest conception rate was recorded in the animals from the Peddapalli district (52.49%). The individual farmers' management and agro-climatic conditions of the respective district including feed and fodder availability to the animals might be attributed to significant differences in the conception rate of buffaloes.

Table-1. District affecting conception rate in A.I. bred buffalo.

District***	N	% Coverage	Means	Std. error	Odds ratio	Relative Probability	Esti. conception rate%
Jagtial	4269	9.71	47.90 ^a	0.76	1	0.50	47.90
Karimnagar	13860	31.53	48.18 ^a ^b	0.42	1.11	0.53	50.51
Peddapalli	2548	5.80	48.00 ^b	0.99	1.21	0.55	52.49
Siddipet	6571	14.95	44.56 ^{cd}	0.61	0.86	0.46	44.43
Sircilla	16706	38.01	43.54 ^d	0.38	0.92	0.48	45.89

Means having the same superscripts within columns did not differ significantly (P<0.001)

CDC in-charge education: Education of inseminator significantly affected the conception rate (Table-2). The results observed in the present investigation were in agreement with Anzar et. al. (2003), Gokhale and Bhagat (2015), Bhagat and Gokhale (2016), and Bhagat et. al. (2020) who also noticed the significant effect of inseminator's education level on the conception rate in the field animals. More than two-thirds (72.31%) inseminations were performed by inseminators having 12th pass and recorded the highest conception rate (47.22±0.28%) compared to other education groups of inseminators. Bhagat and Gokhale (2016) recorded the highest conception rate of 63.94±1.31% for high school level inseminators (8 to 10th) but A.I. coverage was 5.54%, their long working experience, and skill in this field could be the reason. The percentage coverage of inseminations performed by graduate inseminators was 10.22% and they recorded the lowest conception rate (39.24±0.73%). The results of Gokhale and Bhagat (2015) and Bhagat and Gokhale (2016) supported the present findings who observed that higher educated inseminators recorded a lesser conception rate, this might be due to those graduate inseminators

paying less attention towards insemination work owing to engage in other allied activities. 10th class pass inseminators recorded a more conception rate (41.91±0.56%) and A.I. coverage (17.46%) than graduate inseminators.

Table-2. CDC in-charge education affecting conception rate in A.I. bred buffalo

In-charge education***	N	% Coverage	Means	Std. error	Odds ratio	Relative Probability	Esti. conception rate%
10 th Pass	7676	17.46	41.91 ^a	0.56	1	0.5	41.91
12 th Pass	31785	72.31	47.72 ^b	0.28	1.09	0.52	43.77
Graduate	4493	10.22	39.24 ^c	0.73	0.77	0.44	36.49

Means having the same superscripts within columns did not differ significantly ($P<0.001$)

A.I. work experience: It is general practice to offer rigorous training of artificial insemination and pregnancy diagnosis to self-employed youths who want to be an inseminator. Such training period depends upon individual skill and how fast somebody acquires that knowledge. In the present study, A.I. work experience was ranged from one year to ten years and more. The results indicated that work experience had a significant effect on the conception rate. The probability of getting the highest conception rate (0.70) was recorded for the inseminators having 10 years and more A.I. work experience. The highest coverage of inseminations (33.99%) as well as the highest conception rate (49.74±0.41%) was recorded for these inseminators, which ultimately improved the skill of inseminators (Table-3). The lowest percentage of inseminations (2.87), as well as the lowest conception rate (28.53±1.27%), was recorded by the inseminators who had one year of A.I. work experience compared with another group of inseminators. It was further noticed that as the A.I. work experience gained by the inseminators improved the conception rate significantly but A.I. coverage and work experience did not show a specific trend. The estimated conception rate was recorded to be much less as compared with that of actuals.

Table-3. A.I. work experience affecting conception rate in A.I. bred buffalo

Work experience***	N	% Coverage	Means	Std. error	Odds ratio	Relative Probability	Esti. conception rate%
1 Yr	1262	2.87	28.53 ^a	1.27	1	0.5	28.53
2 Yrs	4776	10.87	42.13 ^{bc}	0.71	1.96	0.66	37.75
4 Yrs	12699	28.89	43.59 ^c	0.44	1.60	0.62	35.15
6 Yrs	3675	8.36	47.95 ^d	0.82	2.05	0.67	38.33
8 Yrs	6604	15.02	46.15 ^{de}	0.61	1.82	0.65	36.80
10 Yrs & more	14938	33.99	49.74 ^{df}	0.41	2.38	0.70	40.19

Means having the same superscripts within columns did not differ significantly ($P<0.001$)

Animal breed: The Murrah breed of buffaloes was the highest (69.06%) coverage under inseminations, however, the probability of conceiving was highest in Non-Descript (N.D.) buffaloes (0.58) and the actual conception rate recorded was 49.22±0.43 percent (Table-4). Although conception rates within breeds recorded quite different statistically Murrah breed conceptions (44.35±0.29%) differ from N.D. buffaloes, this might be due to the number of observations being relatively less in Jaffarabadi and Mehsana buffalo. Gokhale and Bhagat (2000) reported comparatively less conception rate (41.36±4.20%) in Murrah buffalo but the conception rate in N.D. buffalo they reported was higher (50.88±0.85%) than that of the present investigation. Anzar et. al. (2003) and Sarkar et. al. (2005) reported much lower conception rates (31.30 and 33.19%) in Murrah buffaloes. While for Mehsana buffalo conception rate (40.37±3.05%) reported by Gokhale and Bhagat (2000) was almost similar to that of present findings (39.39±8.64%). The results of Gokhale and Bhagat (2000) in buffaloes, Miah et. al. (2004) in Bangladeshi crossbred cows, Bhagat and Gokhale (2016) in field crossbreed and indigenous cows, Bansal et. al. (2019) in Bihar state field animals, and Bhagat et. al. (2020) in Karnataka state field animals noticed the significant effect of animal breed on conception rate. In Murrah buffaloes much lower conception rates as 31.30 and 33.19 percent reported by Anzar et. al. (2003) and Sarkar et. al. (2005), respectively.

Table-4. Breed affecting conception rate in A.I. bred buffalo

Breed***	N	% Coverage	Means	Std. error	Odds ratio	Relative Probability	Esti. conception rate%
Jaffarabadi	44	0.10	38.64 ^a	7.43	1	0.5	38.64
Mehsana	33	0.08	39.39 ^a	8.64	0.94	0.48	37.35
Murrah	30353	69.06	44.35 ^{ab}	0.29	1.27	0.56	43.23
N.D.	13524	30.77	49.22 ^a	0.43	1.38	0.58	44.82

Means having the same superscripts within columns did not differ significantly ($P<0.001$)

Age of buffalo at the time of A.I.: The age of buffalo at the time of A.I. had a significant effect on the conception rate (Table-5). The results of Thirunavukkarasu and Kathiravan (2009) supported the present findings. It was noticed that the conception rate was significantly increased with the advancement of buffalo age from 4 years (43.29±0.37%) up to 8 years (52.97±0.85%) and as animals get older it was reduced considerably (41.21±2.08%) for buffaloes having 10 and above years age, but A.I. coverage percentages was very less

(1.28%). The present findings corroborated with the results of Thirunavukkarasu and Kathiravan (2009), who noticed older age buffaloes conceived in fewer numbers. The buffaloes of older age not conceived might be due to hormonal changes that naturally occurred in the animal body. Further, it was observed that buffaloes of age 2 years recorded less conception rate (23.58±0.87%) indicating breeding the animals at an early age was not beneficial and should permit them to gain proper body weight and develop reproductive organs. The probability of getting more conceptions was also highest in buffaloes having 6 years (0.82) and 8 years of age (0.85). The A.I. coverage was more than 85 percent in buffaloes having 4- and 6-years age group.

Table-5. Age at the time of A.I. affecting conception rate in A.I. bred buffalo

Age of buffalo***	N	% Coverage	Means	Std. error	Odds ratio	Relative Probability	Esti. conception rate%
2 Yrs	2362	5.37	23.58 ^a	0.87	1	0.5	23.58
4 Yrs	18247	41.51	43.29 ^b	0.37	2.75	0.73	34.58
6 Yrs	19314	43.94	49.82 ^c	0.36	4.42	0.82	38.47
8 Yrs	3468	7.89	52.97 ^d	0.85	5.48	0.85	39.88
10 Yrs & above	563	1.28	41.21 ^{bc}	2.08	3.89	0.80	37.52

Means having the same superscripts within columns did not differ significantly ($P<0.001$)

Order of lactation: Animal order of lactation significantly affected the conception rate (Table-6). The observations of Gokhale and Bhagat (2000), and Bhave et. al. (2016) supported the present findings. The other scientists Shindey et. al. (2014), Bhagat and Gokhale (2016), Potdar et. al. (2016), Bansal et. al. (2019), and Bhagat et. al. (2020) also recorded similar results in cows, however, Bhagat and Gokhale (2013) and Pandey et. al. (2016) recorded the non-significant effect of the order of lactation on conception rate in cattle. Compared with multiparous animals, the lowest conception rate was observed in buffaloes having six and more lactations (38.69±1.95%). The findings of Gokhale and Bhagat (2000) supported the present results as they noticed fewer conceptions in old-age buffaloes. In heifers, the overall conception rate was recorded as 41.46±0.48 percent which was noticed to be less in comparison with that of buffaloes having first to fifth lactations. The lower conception rate in heifers noticed in the present investigation agreed with findings of Gokhale and Bhagat (2000), Gunasekaran et. al. (2008), Razi et. al. (2010), Bhagat and Gokhale (2016), Pandey et. al. (2016), Bansal et. al. (2019), and Bhagat et. al. (2020), however, disagreed with the results of Potdar et. al. (2016) who noticed higher conception rate in cattle heifers. The lower conception in heifers might be due to more attention of farmers to animals under production. In multiparous buffaloes, the likelihood of getting more pregnancies was noticed in first lactation animals (0.54), followed by second (0.50), fourth (0.48), while third and fifth lactation was at par (0.46). The percentage coverage of A.I. was highest in buffaloes having second lactation (27.72%), followed by heifers (24.27%), third lactation (21.25%), first lactation (13.93%), the remaining buffaloes having fourth, fifth and six and more lactation recorded less than 10% coverage under A.I.

Table-6. Lactation order affecting conception rate in A.I. bred buffalo

Lactation order***	N	% Coverage	Means	Std. error	Odds ratio	Relative Probability	Esti. conception rate%
Heifer	10666	24.27	41.46 ^a	0.48	1	0.5	41.46
First	6122	13.93	46.15 ^b	0.64	1.16	0.54	44.57
Second	12183	27.72	46.55 ^{bc}	0.45	1.00	0.50	41.46
Third	9342	21.25	47.47 ^{bd}	0.52	0.87	0.46	38.52
Fourth	3551	8.08	50.92 ^c	0.84	0.92	0.48	39.71
Fifth	1462	3.33	50.89 ^{cd}	1.31	0.85	0.46	38.09
Six & more	628	1.43	38.69 ^e	1.95	0.52	0.34	28.32

Means having the same superscripts within columns did not differ significantly ($P<0.001$)

Heat stage: The deficiencies of various trace minerals, inadequate vitamin intakes, energy/protein imbalances, and excessive protein intake could lead to infertility and poor reproductive performance reflected through the poor expression of estrus symptoms (Balakrishnan, 2003). The nature and variation in expression of estrus behavior had a significant effect on the conception rate (Table-7). The probability of getting more animals pregnant and highest coverage of animals under A.I. was noticed in early heat animals (0.50 & 40.74%), followed by no observation (0.47 & 31.29%), then late heat animals (0.44 & 25.46%) and mid-heat animals (0.25 & 2.51%), respectively. These results agreed with those findings of Gunasekaran et. al. (2008) and Pandey et. al. (2016) in Karan Fries, Karan Swiss crossbreed, and Jharkhand state animals, respectively, who noticed higher conceptions in animals exhibiting early heat but differed with the results of Bhagat et. al. (2009) and Bansal et.al. (2019) who noticed the higher conceptions in mid-heat cattle.

Table-7. Heat stage affecting conception rate in A.I. bred buffalo

Heat stage***	N	% Coverage	Means	Std. error	Odds ratio	Relative Probability	Esti. conception rate%
Early	17909	40.74	46.33 ^a	0.37	1	0.5	46.33
Mid	1104	2.51	28.99 ^a	1.37	0.34	0.25	23.56
Late	11189	25.46	45.72 ^b	0.47	0.80	0.44	41.09
No observation	13752	31.29	46.64 ^a	0.43	0.89	0.47	43.53

Means having the same superscripts within columns did not differ significantly ($P<0.001$)

Animal Category: Animal category like farm-born or purchased from outside from market has very much relevance with overall reproduction and production performance as it is mainly governed by individual farmer's management and resources like feed and fodder availability with the farmers. In the present study, 11.89 percent of farmers were unable to respond whether inseminated buffaloes were either farm-born or purchased? Those who had responded, out that 58.30 percent of animals were purchased and the remaining 29.81 percent animals were farm born and the animal category had a significant effect on conception rate (Table-8). The farm-born buffaloes recorded the highest conception rate ($48.35\pm 0.44\%$), followed by purchased animals ($45.21\pm 0.31\%$) and non-respondent animals ($42.62\pm 0.68\%$). The significantly higher conception rate in farm-born buffaloes revealed the adoption of local animals to available feed and fodder resources, environmental conditions, and individual farmers' management.

Table-8. Animal category affecting conception rate in A.I. bred buffalo

Animal category***	N	% Coverage	Means	Std. error	Odds ratio	Relative Probability	Esti. conception rate%
Non-respondent	5225	11.89	42.62	0.68	1	0.5	42.62
Farm born	13102	29.81	48.35	0.44	1.11	0.52	44.75
Purchased	25627	58.30	45.21	0.31	0.95	0.49	41.57

Means having the same superscripts within columns did not differ significantly ($P<0.001$)

Animal's previous reproduction status: Animals previous reproduction status like whether the animal calved or not had an ardent relation with next conception as calved animals need utmost care post-calving which includes timely and complete removal of the placenta if animals develop dystocia or aborted then needs extra care till the placental material complete removed and so that animal normal heat cycle restores. In the present study, the probability of getting more animals pregnant when they are first time pregnant but actual conception rate was noticed in calved animals but the differences were non-significant.

Table-9. Animal's previous reproduction status affecting conception rate in A.I. bred buffalo

Animal's previous reproduction status NS	N	% Coverage	Means	Std. error	Odds ratio	Relative probability	Esti. Conception rate%
Not calved	10885	24.76%	41.69	0.47	1	0.5	41.69
Calved	33069	75.24%	47.20	0.27	0.78	0.44	36.65

Non-Significant ($P<0.05$)

IV. Conclusion:

The study indicated that the conception rate was significantly affected within districts, due to in-charge education, A.I. work experience of in-charges, animal breed, age of buffalo at the time of A.I., order of lactation, heat stage, and animal category, these factors need to be emphasized for having better conception rate in A.I. bred buffaloes under Telangana state field conditions.

Acknowledgment:

The financial assistance provided by the Karimnagar cattle breeder welfare association is gratefully acknowledged. Special thanks to Narra Muthymreddy, Joint District Programme Officer, and CDC in-charges for providing the data to undertake the present research work.

References:

- [1]. Anzar M, Farooq U, Mirza M A, Shahab M and Ahmad N (2003) Factors affecting the efficiency of artificial insemination in buffalo and buffalo in Punjab Pakistan. Pakistan Veterinary Journal 23 (3):106-13.
- [2]. Balakrishnan V. (2003). Role of nutrition in reproduction. National seminar on strategies for genetic and reproductive improvement in bovine, Madras Vet College Nov.13&14:144-46.
- [3]. Bansal S K, Bhagat R L, Sinha A K, Yadav A L and Phadke N L (2019). Factors affecting conception rate in A.I. bred buffalo under field conditions of Bihar state. Indian Journal of Animal Sciences. 89 (1):110-112.
- [4]. Bhagat R L, Gokhale S B, Gokhale R B, Pande A B and Karbade V G (2009). Reproduction attributes affecting conception rate in crossbred buffalo. International Journal of Tropical Agriculture 27 (1-2):169-72.
- [5]. Bhagat R L and Gokhale S B (2013). Factors affecting conception rate in crossbred buffalo under field conditions. International Journal of Tropical Agriculture 1 (3-4):249-52.
- [6]. Bhagat R L and Gokhale S B (2016). Studies on factors influencing conception rate in rural buffalo. Indian Journal of Animal Sciences 86

- (5):550-52.
- [7]. Bhagat R L, Basavaraj Madagunki, H A Ravishankar, N L Phadke (2020). Factors affecting pregnancy rate in A.I. bred cattle under field conditions of Karnataka state. *International Journal of Livestock Research* on 10 (4):73-78 online journal issue
- [8]. Bhave K G, Khadse J R, Gaundare Y S and Mangurkar B R (2016). Factors affecting conception rates in AI bred buffaloes in field conditions. *Indian Journal of Animal Sciences* 86 (12): 1401-1404.
- [9]. Central Institute of Research on Buffalo. Cited in www.cirb.res.in
- [10]. Gokhale S B and Bhagat R L (2015). Inseminator Attributes Affecting Conception Rate in Crossbred Buffalo. *International Journal of Tropical Agriculture*. 33 (3):2373-76.
- [11]. Gokhale S B and Bhagat R L (2000). Status of reproductive performance in rural buffaloes artificially inseminated using deep-frozen semen. *Indian Journal of Animal Sciences* 70 (4): 366-368.
- [12]. Guangsheng Q, Bingzhuang Y, Zhengzhun T, Hui L, Jian H and Xianwei L (2013). Effect of frozen semen from Italian Mediterranean buffalo on some reproductive parameters and conception rate performed to different species water buffalo in Southern China. *Buffalo Bulletin* 32 (2): 577-81.
- [13]. Gunasekaran M, Singh Chanran and Gupta A K (2008). Effect of estrus behavior on fertility in crossbred buffalo. *Indian Vet. Journal* 85:159-63.
- [14]. Miah Abdul Gaffar, Salma Ummay and Hossain M M (2004). Factors influencing the conception rate of local and crossbred cows in Bangladesh. *International Journal of Agriculture and Biology* 6 (5):797-01.
- [15]. Pandey A K, Singh M P, Bansal S K, Gokhale S B (2016). Response of rural buffalo to artificial insemination in Jharkhand. *Indian Journal Dairy Science*. 69 (5): 600-04.
- [16]. Potdar Vinod V, Bhave Kaustubh, Gaundare Yuvraj, Awasthi Hitesh R and Khadse Jayant R (2016). Factors influencing the conception rate of local and crossbred cows. *IOSR Journal of Agriculture and Veterinary Science*. 9 (10):51-54.
- [17]. Qureshi Akhtar M, Kahlid Javed, Jarral Z A and Khan S A (2008). Environmental factors affecting performance traits of crossbred and local dairy cows at Mirpur Azad Jammu and Kashmir. *Pakistan Journal Agri Science*. 45 (2):362-71.
- [18]. Razi K M A, Asgar M A, Kabir M H, Bag M A S and Parvez M M (2010). A study on estimation of conception rate and services per conception in buffalo after artificial insemination. *Int. J. Bio. Res.* 2 (7):25-29.
- [19]. Sarkar U, Gupta A K, Yadav P, Mohanty T K and Raina V S (2005). Factors affecting conception rate in Murrah buffaloes. *Journal of Dairying, Foods and Home Sciences* 24 (2): 113-15.
- [20]. Shindey D N, Dhanvijay R W, Bhagat R L and Gokhale S B (2014). A note on conception rate in animals of Wardha district in Vidharbha region of Maharashtra State. *International Journal of Tropical Agriculture*. 32 (3-4):595-99.
- [21]. Thirunavukkarasu M and Kathiravan G (2009). Factors affecting conception rates in artificially inseminated bovines. *Indian Journal of Animal Sciences* 79 (9): 871-875.
- [22]. Zicarelli L, De Filippo C, Francillo M, Pacelli C and Villa E (1997). Influence of insemination technique and ovulation time on fertility percentage in synchronized buffaloes. *Proceedings of Fifth World Buffalo Congress, Italy*.

R L Bhagat, et. al. "A study on conception rate in artificially inseminated buffaloes under field conditions of Telangana State." *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*, 15(01), 2022, pp. 37-42.