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Social factors affecting the conception rate of cattle in Telangana state

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Abstract

The present study was planned with the objective to investigate the social factors affecting the conception rate in Artificially Inseminated cattle under field conditions in Telangana state. For the present investigation data were collected from 733 villages in the jurisdiction of 49 Cattle Development Centres (CDC) being operated by BISLD Telangana with financial support by Karimnagar Dairy in 70 tehsils of Jagtial, Karimnagar, Peddapalli, Siddipet, and Sircilla districts. Total 40,693 artificial inseminations were considered as per the factors taken for study, performed on 32,121 cattle owned by 17,372 farmers from the years April 2019 to March 2021. The effect of social factors of the district, A.I. Technician education, distance covered for A.I., animal breed, lactation order, breed of bull used for A.I., A.I. season, estrous stage, and origin of animal was assessed. Logistic regression was used to compute the odds ratio and probability of conception rate. The results revealed that the overall mean conception rate was 46.23 ± 0.25 percent and it was recorded significantly higher in animals from Karimnagar district (47.70%), inseminations performed by 12th pass A. I. Technicians (47.58%), animals covered within the distance of 3 to 6 km (46.76%), non-descript cows (49.20%), heifers (49.13%), animals inseminated in summer season (47.77%), mid-heat animals (48.39%) and farm-born animals (48.59%) compared with the corresponding group of respective social factors. Statistical analysis of data showed that district, A.I. Technician education, distance covered for A.I., animal breed, Lactation order, A.I. season, estrous stage, and origin of animal had a significant effect on conception rate, however, the breed of bull used for A.I. and A.I. sequence did not affect conception rate.

Keywords: Telangana state, cattle, field conditions, artificial insemination, conception rate, logistic regression

Introduction

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. The percent conception rate is the accepted indicator for assessing the fertility of farm animals which is mainly governed by the genetic potential of an individual animal and environmental combinations such as nutrition, health, and overall management adopted by the individual farmers. There is scope for improvement in the conception rate by adopting better management practices for the animals as lower heritability of the trait is indicative of greater environmental and management influence. The available literature on the relation of the district, A. I. Technicians education status, actual distance covered for inseminating the animal, animal breed, lactation number of the animal, service sire breed, insemination sequence, heat stage of the animal at the time insemination, and animal origin with the conception rate of animals which were bred with Artificial Inseminations (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 cattle under field conditions of some selected districts of Telangana state.

Materials and Methods

The A.I. program in Telangana state is being operated by BISLD Telangana and financially supported by 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 40,693 cattle A.I. were considered as per our factors taken for study performed on 32,121 animals owned by 17,372 farmers spread over 733 villages in the jurisdiction of 49 Cattle Development Centres in 70 tehsils. The animals were maintained and reared by the farmers individually. The housing ranged from open to permanently constructed sheds.

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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. Cattle not repeated within 60 to 90 days post insemination were examined for conception confirmation by rectal palpation. The information on districts (Jagtial, Karimnagar, Peddapalli, Siddipet, Sircilla), A.I. Technician education (10th pass, 12th pass, Graduate), distance covered for A.I. from head-quarter (Less than 2, 3 to 6, 7 to 10, 11 to 14, 15 to 25 Km), animal breed (HF cross, Indigenous, Jersey cross, N.D. cow), lactation order (heifers, 1, 2, 3, 4, 5, 6 & above), breed of bull used for A.I. (Gir, HF100%, HF cross, Jersey 100%, Jersey cross, Ongole, Sahiwal), A.I. sequence (1, 2, 3, 4, 5), A.I. season (rainy, summer, winter), estrous stage (early, mid, late, No observation) and animal origin (non-responder, farm-born, purchased) was compiled for studying the effect on conception rate in cattle of Telangana state.

Statistical analysis: Conception is a binary trait having two possibilities either success or failure. The most commonly used multiple analysis techniques pose difficulty when the dependent variable has only two outcomes *viz.* event occurred or not occurred, 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. The logistic regression model was used for predicting the probability of conception rate. The data were analyzed using the R project for statistical computing software (version 4.0.3).

Results and Discussion

The overall mean conception rate was recorded as 46.23±0.25 percent which was remarkably higher than the findings of Bhagat *et al.* (2008 & 2009) [8, 7] in field crossbred cattle (45.16±0.46 & 43.58±0.40%) in Maharashtra state, however at par with that reported by Shindey *et al.* (2014) [18] in animals from Wardha district of Maharashtra state (46.40±0.19%) and much lower to reports of Gokhale and Bhagat (2015) [11] under field conditions of Maharashtra (55.96±0.31%) and Bansal *et al.* (2019) [2] in Bihar state animals (52.16%). The social factors affecting conception rate in cattle with a multivariate regression model is given in Table-1 and conception rate was studied in relation to the following factors;

District: District had a highly significant effect on the conception rate of cattle however, Pandey *et al.* (2016) [15] reported a non-significant effect of districts on conception rate under Jharkhand state conditions. The highest percentage of animals covered under A.I. (48.33) as well as the conception rate (47.70±0.36%) was recorded in the Karimnagar district compared to the other districts under study. The lowest coverage of animals (6.41%) and estimated conception rate (43.84%) were recorded in the animals from the Peddapalli district. 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 cattle.

A.I. Technician education: The A.I. Technician education significantly affected the conception rate. The results observed in the present investigation were in agreement with Gokhale and Bhagat (2015) [11], Bhagat and Gokhale (2016)

[5], and Bhagat *et al.* (2020) [6]. The percentage of inseminations performed by A. I. Technicians having 12th pass was more than two-third (72.57) and recorded the highest conception rate (47.58±0.29%) compared to other education groups of A. I. Technicians. Bhagat and Gokhale (2016) [5] recorded the highest conception rate of 63.94±1.31% for high school level A. I. Technicians (8 to 10th) but A.I. coverage was too less (5.54%) in comparison with present investigation. The long working experience and individual skill in this field could be the reason for achieving the highest conception rate. The percentage coverage of inseminations performed by 10th pass and graduate A. I. Technicians was 16.95 and 10.48%, respectively but graduate A.I. Technician recorded the higher conception rate (42.83±0.76%) compared with 10th pass A.I. Technician. The results of Gokhale and Bhagat (2015) [11] and Bhagat and Gokhale (2016) [5] disagreed with present findings who observed that higher educated A. I. Technicians recorded a lesser conception rate.

Distance covered for A.I.: The actual distance covered for performing the insemination has very much relevance as it decides the time span between onset of estrous and actual A.I. because the farmer herds having long distance from headquarter takes more time to A.I. Technician to reach actual animal and perform the A.I. In the present study, 46.60 percent inseminations were performed having 3 to 6 Km distance and significantly ($p < 0.05$) higher conception rate (46.76±0.36%) was recorded in cows bred between this distance and lowest (43.58±1.41%) in cows bred between 15 to 25 Km distance. Bedi *et al.* (2007) [3] and Gunasekaran *et al.* (2008) [12] had reported a negative relationship of conception rate with increased duration of oestrus and the present findings supported these results.

Animal breed: More than half inseminations were performed for the HF crossbred cattle (55.16%), however, the probability of conceiving the animals was highest in Jersey crossbred (48.17%) and Non-Descript (N.D.) cattle (48.11%). and the coverage of inseminations was 30.51 and 12.00 percent, respectively. The local indigenous breed like Ongole, Gir, Sahiwal, etc. coverage of A.I. was 2.33 percent and their conception rate was recorded as 41.82 percent. The results of Gokhale and Bhagat (2000) [10] in cattle, Miah *et al.* (2004) [14] in Bangladeshi crossbred cows, Bhagat and Gokhale (2016) [5] in field crossbred and indigenous cows, Potdar *et al.* (2016) [16] in Maharashtra state field animals, Bansal *et al.* (2019) [2] in Bihar state field animals, and Bhagat *et al.* (2020) [6] in Karnataka state field animals noticed the significant effect of animal breed on conception rate, however Souames and Berrama (2020) [19] recorded the non-significant effect of breed on conception rate in Algeria cattle.

Order of lactation: Animal order of lactation significantly affected the conception rate. The observations of Gokhale and Bhagat (2000) [10], and Bhave *et al.* (2016) [9], Shindey *et al.* (2014) [18], Bhagat and Gokhale (2016) [5], Potdar *et al.* (2016) [16], Bansal *et al.* (2019) [2], and Bhagat *et al.* (2020) [6] also recorded similar results in cows, however, Bhagat and Gokhale (2013) [4], Pandey *et al.* (2016) [15] and Souames and Berrama (2020) [19] 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 cattle having six and more lactations (38.96±1.47%). The findings of Gokhale and Bhagat (2000) [10] and Howlader *et*

al. (2019) [13] supported the present results as they noticed fewer conceptions in old-age animals. In heifers, the overall conception rate was recorded as 49.13 ± 0.56 percent which was noticed to be highest in comparison with that of cattle having first to fifth lactations. The highest conception rate in heifers noticed in the present investigation disagreed with the findings of Gokhale and Bhagat (2000) [10], Gunasekaran *et al.* (2008) [12], Razi *et al.* (2010) [17], Bhagat and Gokhale (2016) [5], Pandey *et al.* (2016) [15], Bansal *et al.* (2019) [2], and Bhagat *et al.* (2020) [6], however, agreed with the results of Potdar *et al.* (2016) [16] who noticed higher conception rate in cattle heifers. The higher conception in heifers might be due to more attention of farmers to heifers as future cows and reap maximum benefit from young animals. In multiparous cattle, the likelihood of getting more pregnancies was noticed in second lactation animals (0.48), followed by first, third, fourth which was at par (0.47), fifth (0.46), and lowest in sixth and more lactations (0.38). The percentage coverage of A.I. was highest in cattle having second lactation (26.81), followed by third lactation (25.70), heifers (19.50), first lactation (13.54), and the remaining animals having fourth, fifth, and six and more lactation recorded less than 10% coverage under A.I.

Breed of bull used for A.I.: The bull (used for inseminating the animals) breed had a non-significant influence on conception rate. The present findings supported by the observations of Miah *et al.* (2004) [14] from Bangladesh reported that the genotype of bulls used for A.I. did not affect the conception rate, while Potdar *et al.* (2016) [16] had reported contradictory observations. The results indicated that almost half of the inseminations (54.73%) were performed by using HF purebred and HF crossbred bulls while 27.64 percent by Jersey purebred and Jersey crossbred bulls; among these groups, the highest conception rate ($51.98 \pm 1.38\%$) was recorded in animals inseminated with Jersey purebred bulls' semen, followed by local breed Ongole ($49.45 \pm 1.35\%$), Gir ($47.93 \pm 0.74\%$), animals inseminated with the semen of HF purebred, Jersey cross and Sahiwal breed were at par ($>46\%$). The conception rate of animals was inseminated with HF crossbred bulls' semen was recorded lowest 44.95 ± 0.35 percent. The A.I. coverage of local indigenous breeds was for Gir 11.15 percent, Ongole 3.37 percent, and Sahiwal 3.10 percent.

A.I. sequence: Out of total inseminations 44.79 percent of inseminations were performed in the first attempt followed by the second (23.58%), third (15.44%), fourth (10.08%), and 6.11 percent in the fifth and above attempt. Although the conceptions recorded in the second attempt were highest ($46.70 \pm 0.51\%$) compared to inseminations performed in the remaining attempts, there was no statistical difference. The results were non-corroborated with the findings of Shindey *et al.* (2014) [18] who recorded a significantly highest conception rate in the first attempt.

A.I. season: The study results indicated that maximum

(40.03%) inseminations were performed in the rainy season (June to September), followed by 30.38 percent in the winter season (October to January), and 29.58 percent in the summer season (February to May). The season had a significant effect on the conception rate. The study results of Bhagat and Gokhale (2013) [4] and Shindey *et al.* (2014) [18] not supported the present findings as they noticed a non-significant effect of season on conception rate. The animals inseminated in the summer season recorded a significantly highest conception rate ($47.77 \pm 0.46\%$) compared with animals inseminated in the other two seasons. The findings of Shindey *et al.* (2014) [18] supported the present results who also noticed that animals inseminated during the summer season registered a significantly higher conception rate.

Estrous stage: The scientist Balakrishnan (2003) [1] reported that 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. In present study the nature and variation in expression of estrus behavior had a significant effect on the conception rate. The probability of getting more animals pregnant and highest coverage of animals under A.I. was noticed in early heat animals (0.50 & 47.54%), followed by mid-heat animals (0.50 & 47.18%), then animals in which no observations were recorded (0.45 & 43.07%) and late heat animals (0.31 & 29.37%), respectively, however actual conception rate was recorded highest in animals having mid-heat ($48.39 \pm 0.48\%$). The results of Bhagat *et al.* (2009) [7] and Bansal *et al.* (2019) [2] corroborated with the present findings, however, the findings of Gunasekaran *et al.* (2008) [12] in Karan Fries, Karan Swiss crossbreed, Pandey *et al.* (2016) [15] in Jharkhand state animals and Potdar *et al.* (2016) [16] in field animals disagreed as they noticed higher conceptions in animals exhibited early heat.

Origin of Animals: The animals' overall reproduction and production performance are mainly governed by individual farmers' management and resources like feed and fodder availability with the farmers and also on animal origin like farm-born or purchased from outside. In the present study, 17.36 percent of farmers were unable to respond whether the inseminated animal was either farm-born or purchased? Of those who had responded, out that 64.73 percent of animals were purchased and the remaining were farm-born (17.91%). The origin of animals had a significant effect on the conception rate. The farm-born cattle recorded the highest conception rate ($48.59 \pm 0.59\%$), followed by the animals owned by farmers who were unable to respond to the question ($47.08 \pm 0.59\%$) and purchased animals ($45.34 \pm 0.31\%$). The significantly higher conception rate in farm-born cattle revealed the adoption of local animals to available feed and fodder resources, environmental conditions, and individual farmers' management.

Table 1: Social factors affecting conception rate in cattle with a multivariate regression model

Particulars	Parameter	N	% A.I. Coverage	Means	Std. error	Odds ratio	Relative probability	Estimated conception rate%
District***	Jagtial	4094	10.06%	45.82	0.78	1	0.5	45.82
	Karimnagar	19665	48.33%	47.70	0.36	1.09	0.52	47.81
	Peddapally	2607	6.41%	43.92	0.97	0.92	0.48	43.84
	Siddipeta	5749	14.13%	46.84	0.66	1.07	0.52	47.44
	Sircilla	8578	21.08%	43.33	0.54	0.97	0.49	45.10
A.I. Technician Education***	10th pass	6899	16.95%	42.53	0.60	1	0.5	42.53
	12th pass	29531	72.57%	47.58	0.29	1.21	0.55	46.56
	Graduate	4263	10.48%	42.83	0.76	1.03	0.51	43.08
Distance covered for A.I.*	Less than 2	6328	15.55%	45.20	0.63	1	0.5	45.20
	3 to 6	18962	46.60%	46.76	0.36	1.04	0.51	46.18
	7 to 10	11304	27.78%	46.63	0.47	1.03	0.51	45.93
	11 to 14	2869	7.05%	44.51	0.93	0.97	0.49	44.46
	15 to 25	1230	3.02%	43.58	1.41	0.91	0.48	42.94
Animal breed***	HF cross	22447	55.16%	44.75	0.33	1	0.5	44.75
	Indigenous	947	2.33%	41.82	1.60	0.89	0.47	42.14
	JR cross	12415	30.51%	48.07	0.45	1.17	0.54	48.17
	N.D. Cow	4884	12.00%	49.20	0.72	1.16	0.54	48.11
Lactation order***	Heifers	7934	19.50%	49.13	0.56	1	0.5	49.13
	1	5511	13.54%	45.42	0.67	0.88	0.47	45.95
	2	10911	26.81%	46.21	0.48	0.92	0.48	47.02
	3	10457	25.70%	45.56	0.49	0.90	0.47	46.56
	4	3590	8.82%	45.82	0.83	0.90	0.47	46.54
	5	1189	2.92%	44.58	1.44	0.84	0.46	44.93
	6 & more	1101	2.71%	38.96	1.47	0.61	0.38	37.22
Breed of bull used for A.I. (NS)	Gir	4536	11.15%	47.93	0.74	1	0.5	47.93
	HF 100%	1940	4.77%	46.60	1.13	0.92	0.48	45.91
	HF cross	20332	49.96%	44.95	0.35	1.01	0.50	48.07
	JR 100%	1316	3.23%	51.98	1.38	1.06	0.51	49.31
	JR cross	9934	24.41%	46.78	0.50	0.93	0.48	46.26
	Ongole	1373	3.37%	49.45	1.35	1.03	0.51	48.53
	Sahiwal	1262	3.10%	46.28	1.40	0.91	0.48	45.65
A.I. Sequence (NS)	1	18226	44.79%	46.44	0.37	1	0.5	46.44
	2	9596	23.58%	46.70	0.51	1.03	0.51	47.04
	3	6282	15.44%	46.28	0.63	0.99	0.50	46.29
	4	4101	10.08%	45.01	0.78	0.95	0.49	45.18
	5	2488	6.11%	44.69	1.00	0.94	0.48	45.04
A.I. Season***	Rainy	16291	40.03%	46.22	0.39	1	0.5	46.22
	Summer	12039	29.58%	47.77	0.46	1.07	0.52	47.80
	Winter	12363	30.38%	44.74	0.45	0.99	0.50	46.07
Estrous stage***	Early heat	19513	47.95%	47.54	0.36	1	0.5	47.54
	Late heat	861	2.12%	30.31	1.57	0.45	0.31	29.37
	Mid heat	10807	26.56%	48.39	0.48	0.98	0.50	47.18
	No observation	9512	23.38%	42.50	0.51	0.83	0.45	43.07
Origin of animals***	Non-respondent	7064	17.36%	47.08	0.59	1	0.5	47.08
	Farm Born	7289	17.91%	48.59	0.59	1.02	0.51	47.65
	Purchased	26340	64.73%	45.34	0.31	0.92	0.48	45.10

Significance codes: 0 ‘***’, 0.05 ‘*’, NS Non-Significant ($p < 0.05$).

Conclusion

The study results indicated that the conception rate was significantly affected within districts, due to A.I. Technician education, distance covered for A.I., animal breed, lactation order, A.I. season, estrous stage and origin of animal, these factors need to be emphasized for having better conception rate in A.I. bred cattle under Telangana state field conditions.

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