Indian J. Anim. Res., 51 (1) 2017 : 170-174
Print ISSN:0367-6722 / Online ISSN:0976-0555

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
www.arccjournals.com/www.ijaronline.in

Pregnancy diagnosis-positive rate and conception rate as indicator of farm reproductive performance

Muzamil Abdullah*, T.K. Mohanty, T.K. Patbandha, M. Bhakat, A.R. Madkar, A. Kumaresan and A.K. Mohanty[1]

Livestock Production Management,
ICAR-National Dairy Research Institute, Karnal–132 001, India.
Received: 14-05-2015 Accepted: 21-05-2015 DOI:10.18805/ijar.5708

ABSTRACT

The present study was designed to evaluate the Pregnancy Diagnosis-Positive Rate (PD-PR) along with conception rate (CR) in an organised farm (Livestock Research Centre, National Dairy Research Institute, Karnal) to take effective management decision. One year record of Artificial Insemination (A.I.) and PD of dairy animals (N=1327; comprised 1003 cows and 324 buffaloes) was analysed. On an average, cows and buffaloes were presented for per rectal pregnancy diagnosis after 75.63 (38-119) and 76.3 (46-128) days, respectively of A.I. Overall PD-PR value of cattle was observed to be significantly higher compared to buffaloes (70.77 and 59.45%, respectively, $p<0.001$). However, buffaloes showed a higher trend of overall CR compared to cattle (41.28 and 46.6%, respectively, $p=0.092$). PD-PR value were 14.23% and 25.55% less in cattle and buffaloes, respectively compared to the farm standard i.e, 85%. The PD-PR and CR value were observed to be higher during winter season both in cattle (77.42 and 47.86%, respectively) and buffaloes (69.23 and 60.00%, respectively). However, lower value of PD-PR and CR were observed during rainy in cattle (66.14 and 36.68%, respectively) and summer in buffaloes (50.98 and 36.11%, respectively). It was evident that heat stress along with humidity has negative effect on display of oestrus symptoms as well as on CR.

Key words: Buffaloes, Cattle, Conception rate, Oestrus, Pregnancy Diagnosis-Positive Rate.

INTRODUCTION

In order to have economical and scientific dairy farming, dairy cattle and buffaloes must calve every 12-14 months interval, and to maintain this sequence, identifying non-pregnant animals at an early date is of utmost importance. Identification of non-pregnant dairy animals at early date post breeding can improve reproductive efficiency when rapidly submit non-pregnant cows for a subsequent AI service (Fricke, 2002). Each day of an extended calving interval results in huge economic loss (Rupees 281 and 368 in Zebu and crossbred cattle, respectively) for the farmers because of decrease in milk production and increasing maintenance costs of non-pregnant cow (Abdullah *et al*., 2014). If an animal does not conceive after A.I. then it reduces overall CR and again if same animal is not identified by farm personnels then presented for PD after 60 days which again reduces PD-PR value. Various causes lead to decrease in conception rate like environmental stress, nutritional stress, health causes and poor monitoring of oestrus. Further, oestrus expression appears to be reduced in intensity and duration in the recent times of dairy cows leading to lower oestrus detection efficiency (Lucy, 2002) and again buffaloes show less physiological adaptation to extremes of heat (Dash *et al*., 2014). Thermal stress on lactating buffaloes has negative impact on gonadal functions, oestrus symptoms, duration and conception (Upadhyay *et al*., 2012). Further, poor monitoring of inseminated cows whether they conceived or not conceived in an important managemental factor which decreases pregnancy diagnosis positive rate (PD-PR) and thereby increases days open. The PD-PR is defined as number of cows diagnosed positive for pregnancy divided by the total number of cows presented for pregnancy diagnosis and it should be >85% if pregnancy diagnosis done after 42 days (Gordon, 2011). The PD-PR value is a good indicator of farm reproductive performance as it reflects the efficiency of oestrus detection and conception rate in inseminated animals and regarded as indicative of farm reproductive performance. Thus, the present study was designed to evaluate the Pregnancy diagnosis-Positive Rate (PD-PR) and conception rate (CR) in an organised farm.

*Corresponding author's e-mail: mabhatndri@gmail.com
[1]Animal Biotechnology Centre, National Dairy Research Institute, Karnal–132 001, India.

MATERIALS AND METHODS

The study was carried out at Livestock Research Centre (LRC), ICAR- National Dairy Research Institute, Karnal, Haryana. One year record (January-December, 2012) of artificial insemination (AI) and pregnancy diagnosis (PD) of dairy animals (N=1327; included 1003 cows and 324 buffaloes) was analysed. Karnal is located at 29° 42' N latitude and 72° 02' E longitudes in the bed of Indo-Gangetic alluvial plain and has a subtropical climate having four major seasons in a year, winter (December-March), summer (April-June), rainy (July-September) and autumn (October and November). Data related to daily dry bulb temperature (T_{db}) and relative humidity (RH) were obtained from Meteorological department of Central Soil and Salinity Research Institute, Karnal. Daily weather information were used to calculate monthly average T_{db} (°C) and RH (%) and subsequently used to calculate the monthly average dew point temperature (T_{dp}) and temperature humidity index (THI) values by the method given by Dash *et al*. (2015). The THI values for different months during 2012 are presented in Fig. 1.

The PD-PR and CR data was generated by using the following formula:

$$\textbf{Pregnancy Diagnosis-Positive Rate} = \frac{\text{Number of cows diagnosed as positive pregnant}}{\text{Total number of cows presented for pregnancy diagnosis at a particular day after AI.}} \times 100$$

(Gordon, 2011).

$$\textbf{Conception Rate} = \frac{\text{Number of animals conceived}}{\text{Total number of insemination done}} \times 100$$

Statistical analysis: Data of AI and PD were compiled, tabulated as month and season wise for frequency and then converted into percentage to draw inferences. Chi-square test was used to see the overall difference of PD-PR and CR between two species, among different months and seasons within a particular species. The analysis was considered as statistically significant if 'P' value ≤0.05, while a trend was reported if 'P' value >0.05 and ≤0.1. Statistical analysis was done using free SPSS 16 version.

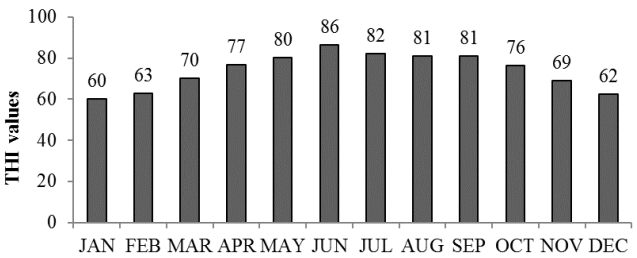

Fig 1: Temperature humidity index (THI) at Karnal during January to December, 2012

RESULTS AND DISCUSSION

Days of pregnancy diagnosis after AI: The present study reports the days at which dairy cattle and buffaloes were presented for per rectal pregnancy diagnosis, and further PD-PR and CR values based on number of animals confirmed pregnant at the time of examination. In the present study, the average days after A.I at which animals were presented for per recta PD was 75.63 (38-119) and 76.3 (46-128) days, respectively for dairy cattle and buffaloes (Fig. 2). Pregnancy diagnosis at early days after insemination identifies open animals and could reduce the maintenance cost for non-pregnant animals. Per rectal examination for PD is considered as gold standard under field condition and generally preferred ≥2 months after insemination to obtain greater accuracy and less embryonic losses (Gomes, 1978).

The average days for PD was significantly higher from the normal 60 days recommended for per rectal examination, which means it is 15 days more than recommended. This may be due to delay in reporting for pregnancy diagnosis of animals. Pregnancy diagnosis at early days after insemination has much economic importance and helps in shortening service period by identifying non-pregnant animals at early days. Increase in days open in dairy cattle leads huge economic losses to the farmers (Abdullah *et al*., 2014). Hence, there is need of managemental intervention such as decision support system for proper reporting, so that number of days lost for PD would be reduced in dairy animals.

Pregnancy diagnosis-positive rate and conception rate: Monthly pregnancy diagnosis-positive rate (PD-PR) and conception rate (CR) of cattle and buffaloes are presented in Table 1 and Table 2, respectively. Although, there was no significant monthly variation of PD-PR and CR values in cattle and buffaloes, we observed higher value of both PD-PR and CR during January and lower during June. The overall PD-PR of cattle and buffaloes was 70.77 and 59.45%,

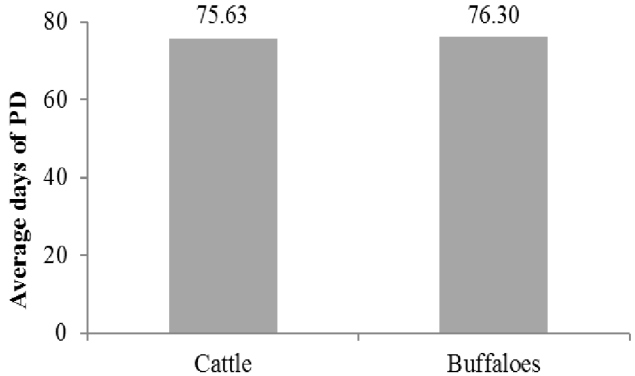

Fig 2: Average number of days of pregnancy diagnosis in cattle and buffaloes after A.I.

Table 1: Pregnancy Diagnosis-Positive Rate in Cattle

Months	No. of A.I (N=1003)	No. of cows presented for PD after 45 d (N=585)	Pregnant (N=414)	PD-PR (%)	CR (%)
Jan	89	51	44	86.27	49.44
Feb	76	48	37	77.08	48.68
Mar	87	52	40	76.92	45.98
Apr	88	53	36	67.92	40.91
May	92	51	35	68.63	38.04
Jun	91	50	32	64.00	35.16
Jul	77	42	28	66.67	36.36
Aug	87	49	32	65.31	36.78
Sep	65	36	24	66.67	36.92
Oct	58	33	22	66.67	37.93
Nov	94	54	37	68.52	39.36
Dec	99	66	47	71.21	47.47
Overall	1003	585	414	70.77	41.28

PD: pregnancy diagnosis, CR: conception rate, PD-PR: Pregnancy diagnosis-positive rate

Table 2: Pregnancy Diagnosis-Positive Rate and CR in Buffaloes

Months	No. of A.I (N=324)	No. of buffaloes presented for PD after 45 d (N=254)	Pregnant (N=151)	PD-PR (%)	CR (%)
Jan	16	14	11	78.57	68.75
Feb	29	25	17	68.00	58.62
Mar	11	10	6	60.00	54.55
Apr	29	19	11	57.89	37.93
May	27	20	10	50.00	37.04
Jun	16	12	5	41.67	31.25
Jul	55	41	21	51.22	38.18
Aug	32	29	15	51.72	46.88
Sep	24	20	11	55.00	45.83
Oct	29	17	12	70.59	41.38
Nov	22	18	12	66.67	54.55
Dec	34	29	20	68.97	58.82
over all	324	254	151	59.45	46.60

PD: pregnancy diagnosis, CR: conception rate, PD-PR: Pregnancy diagnosis-positive rate

respectively, which differed significantly ($\chi 2=10.32$, df=1, $p<0.001$). However, overall CR for cattle and buffaloes (41.28 and 46.6%, respectively) did not differ significantly but reflected a trend of higher CR in buffaloes compared to cattle ($\chi 2=2.84$, df=1, p=0.092). On contrary, Thirunavukkarasu and Kathiravan (2009) reported higher CR in cattle than buffaloes (34.53 and 25.52%, respectively) under field condition. Higher CR value of buffaloes compared to cattle might be attributed to insemination of buffaloes at proper time, as teaser bull is used for heat detection.

For good reproductive performance pregnancy diagnosis done after 42 days should have PD-PR value >85% (Gordon, 2011). Compared to this PD-PR standard, there is difference of PD-PR value 14.23% and 25.55% in cattle and buffaloes, respectively. This gap can be reduced by improving oestrus detection rate and conception rate as both parameters influence the PD-PR value (Gordon, 2011). Further, significantly higher overall PD-PR value in cattle compared to buffaloes might be explained by higher submission rate (animals detected in heat after insemination and presented for insemination) after A.I. in cattle. In cattle, oestrus detection is easy as the oestrus signs are more prominent than buffaloes (silent oestrus); hence more number of open cows could be identified by the farm personals before they are being presented for PD. Thus, more number of cattle presumed to be pregnant were presented for PD and subsequently improved PD-PR value in this species compared to buffaloes.

The seasonal variations of PD-PR and CR in cattle and buffaloes are presented in Table 3. Although, PD-PR values did not differ statistically among different seasons, the result showed a higher trend of PD-PR during winter season (77.42%) and lower during rainy season (66.14%) in cattle ($\chi 2=7.44$, df=3, P=0.059). However, CR was significantly higher during winter (47.86%) and lower during rainy (36.68%) in cattle ($\chi 2=9.85$, df=3, P=0.02). On the other hand, there was higher trend of PD-PR during winter

Table 3: Seasonal variations in PD-PR and conception rates in cattle and Buffalo

Season	No. of AI	No. of animals presented for PD after 45 d	Pregnant	PD-PR (%)	CR %
Cattle					
Winter	351	217	168	77.42	47.86
Summer	271	154	103	66.88	38.01
Rainy	229	127	84	66.14	36.68
Autumn	152	87	59	67.82	38.82
$\chi 2$ value	-	-	-	7.44	9.85*
Buffaloes					
Winter	90	78	54	69.23	60.00
Summer	72	51	26	50.98	36.11
Rainy	111	90	47	52.22	42.34
Autumn	51	35	24	68.57	47.06
$\chi 2$ value	-	-	-	7.77#	10.49*

PD: pregnancy diagnosis, CR: conception rate, PD-PR: Pregnancy diagnosis-positive rate# $p>0.05$ and <0.1; * $p<0.05$

season (69.23%) and lower during summer season (50.98%) in buffaloes ($\chi 2=7.77$, df=3, P=0.051) (Table 3). Similar to cattle, CR was significantly higher during winter (60.00%) but lower during summer (36.11%) in buffaloes ($\chi 2=10.49$, df=3, P=0.015).

The seasonal variations of PD-PR and CR value might be due to differences in stress levels during different seasons as indicated by THI or nutritional factors. Moran (2005) considered THI <72 as comfortable zone for animals; thus our animals were free from thermal stress during winter season as indicated by the THI value. Although thermal stress was less in autumn but animals faced nutritional stress as autumn is lean period in the agroclimatic zone where farm was situated. The two species showed peculiarity in response towards heat stress; the stress was more during rainy season (hot-humid) in cattle but more for buffaloes during summer (hot-dry) which was reflected by PD-PR and CR value. The cows have well developed physiological evaporative cooling mechanism during dry hot period so suffer less during summer heat but due to high atmospheric humidity during rainy season evaporation gets depressed so cows feel more stress. Whereas buffaloes have black body coat and less efficient evaporative cooling owing to poor sweating ability as they possess less number of sweat glands (Marai and Haeeb, 2010), which might contributed more heat load during summer season. On the other hand buffaloes have natural inherent instinct of wallowing (Azawi, 2008); hence, rainy season may be less stressful to buffaloes. Our findings are similar line with Dash *et al*. (2014; 2015) who found depression in conception rate in Murrah buffaloes during the period of heat stress. Thirunavukkarasu and Kathiravan (2009) observed effect of climate on CR under field condition, and found higher CR in cattle and buffaloes inseminated during winter compared to other seasons. More recently, Khan *et al*. (2013) reported significantly lower CR in crossbred cows inseminated during heat stress period (>72 THI) compared to those inseminated during stress free condition. Similarly, lower CR has been observed in temperate breed Taurus cattle by several authors (Zi *et al*., 2003; Garcio-Ispierto *et al*., 2007; Morton *et al*., 2007; Schuller *et al*., 2014). The decrease PD-PR and CR during heat stress period may either be affected directly or indirectly. Heat stress directly affects fertility by reducing oocyte quality (Ferreira *et al*., 2011) and indirectly by reducing feed intake thereby causing negative energy balance in animals and negatively affects reproductive performance by reducing quality of oocyte and embryo.

CONCLUSION

The overall PD-PR value of cattle was significantly higher compared to buffaloes, but CR in buffaloes showed a higher trend compared to cattle. The PD-PR and CR was highest during winter season in dairy cows and buffaloes due to favourable climatic condition. On the other hand lesser conception rate was found during rainy and summer season for cattle and buffaloes respectively. In general the PD-PR and CR value can be improved by proper oestrous detection, pregnancy diagnosis and mitigating environmental stress through managemental interventions.

ACKNOWLEDGEMENT

The authors are thankful to the Director and Vice-Chancellor of National Dairy Research Institute, Karnal for providing the facilities and Indian Council of Agricultural Research, New Delhi, for an award of a Junior Research fellowship for MVSc. program to the first author. The work was funded by NFBSFARA/BS-3014 Project.

REFERENCES

Abdullah, M., Mohanty, T.K., Kumaresan, A., Mohanty, A.K., Madkar, A.R., Baithalu, R.K. and Bhakat, M. (2014). Early pregnancy diagnosis in dairy cattle: economic importance and accuracy of ultrasonography. *Adv. Anim. Vet. Sci*., **2** : 464-467

Azawi, O.I. (2008). Postpartum uterine infection in cattle. *Anim. Reprod. Sci*., **105**:187–208.

Dash, S., Chakravarty, A.K., Singh, A., Behera, R., Upadhyay, A. and Shivahre, P.R. (2014). Determination of critical heat stress zone for fertility traits using temperature humidity index in Murrah buffaloes. *Indian J. Anim. Sci*., **84**: 1181–1184

Dash, S., Chakravarty, A.K., Singh, A., Shivahre, P.R., Upadhyay, A., Sah, V. and Singh, K.M. (2015). Assessment of expected breeding values for fertility traits of Murrah buffaloes under subtropical climate, *Vet. World*, **8**:320-325.

Ferreira, R.M., Ayres, H., Chiaratti, M.R., Ferraz, M.L., Araujo, A.B., Rodrigues, C.A. (2011). The low fertility of repeat-breeder cows during summer heat stress is related to a low oocyte competence to develop into blastocysts. *J. Dairy Sci*., **94**:2383–2392.

Fricke, P. M. (2002). Scanning the future ultrasonography as a reproductive management tool for dairy cattle. *J. Dairy Sci*., **85**:1918-1926.

Garcia-Ispierto, I., Lopez-Gatius, F., Bech-Sabat, G., Santolaria, P., Yaniz, J.L., Nogareda, C., De Rensis, F. and Lopez-Bejar, M. (2007). Climate factors affecting conception rate of high producing dairy cows in north-eastern Spain. *Theriogenology*, **67**:1379–85.

Gomes, W.R. (1978). Gestation. *In:* Physiology of Reproduction and Artificial Insemination of Cattle (Salisbury, G.W., VanDemark, N.L. and Lodge, J.R., 2nd Eds.). Freeman WH and Company, San Francisco, USA. Page 130-167.

Gordon, P. (2011). Oestrus detection in dairy cattle. *In Pract*., **33**:542-546.

Khan, F.A., Prasad, S. and Gupta, H.P. (2013). Effect of heat stress on pregnancy rates of crossbred dairy cattle in Terai region of Uttarakhand, *India. Asian Pacific J. Reprod*., **2**: 277-279.

Lucy, M.C. (2002). Reproductive loss in farm animals during heat stress. In Proceeding of 15th Conference on Biometeorology and Aerobiology and the 16th International Congress of Biometeorology, American Meteorological Society, Boston, MA, USA. pp. 50–53.

Marai, I.F.M. and Haeeb, A.A.M. (2010). Buffalo's biological functions as affected by heat stress: a review. *Livest. Sci*., **127**:89–109.

Moran, J. (2005). Tropical Dairy Farming: Feeding Management for Small Holder Dairy Farms in the Humid Tropics. Colling wood, Landlinks Press. p. 312.

Morton, J.M., Tranter, W.P., Mayer, D.G and Jonsson, N.N. (2007). Effects of environmental heat on conception rates in lactating dairy cows: critical periods of exposure. *J. Dairy Sci*., **90**:2271–8.

Schuller, L.K., Burfeind, O. and Heuwieser, W. (2014). Impact of heat stress on conception rate of dairy cows in the moderate climate considering different temperature– humidity index thresholds, periods relative to breeding, and heat load indices. *Theriogenology*, **81**: 1050-1057

Thirunavukkarasu, M. and Kathiravan, G. (2009). Factors affecting conception rates in artificially inseminated bovines. *Indian J. Anim. Sci*., **79**: 871–875

Upadhyay, R.C., Ashutosh, Rani, R., Singh, S.V., Mohanty, T.K. and Gohain, M. (2012). Impact of climate change on reproductive functions of Murrah buffaloes. *J. Anim. Plant Sci*., **22:** 234-236.

Zi, X.D., Ma, L., Zhou, G.Q., Chen, C.L. and Wei, G.M. (2003). Fertility of Holstein cows in Chengdu, China. *Asian-Aust. J. Anim. Sci*., **16**: 185–88.