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Effect of Non-Genetic Factors on Production Performance of *Pandharpuri Buffalo* Maintained at Organized Dairy Farm

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Abstract

The data pertaining to the production traits of *Pandharpuri* buffalo was collected from *Pandharpuri* Buffalo Improvement Project, Zonal Agriculture Research Station (ZARS), Shenda park, Kolhapur. A total of 355 records of 100 *Pandharpuri* buffaloes spread over a period from 1992 to 2020 were utilized to study the effect of period of calving, season of calving and lactation order on different production traits viz. TLMY, 305 DMY, LL, PMY and MY/LL. The Least squares mean for the LMY, 305 DMY, LL, PMY and MY/LL were analysed by least square method as described by Harvey (1990) The overall least square mean recorded for lactation milk yield (LMY), 305 days milk yield (305 DMY), lactation length (LL), peak milk yield (PMY) and milk yield per lactation length (MY/LL) were 1421.56 ± 27.56 kg, 1590.79 ± 39.28 kg, 282.41 ± 3.03 days, 6.942 ± 0.11 kg and 4.944 ± 0.07 kg respectively. The period of calving shows the significant effect on 305 DMY, LL. The season of calving had the significant effect on LMY, LL, PMY and MY/LL whereas shows non-significant effect on 305 DMY. The lactation order had non-significant effect on all the production traits except PMY and MY/LL.

Key words : *Pandharpuri buffalo, production traits, non genetic factor, reproduction traits.*

Introduction

As per the report unveiled by Department of Animal Husbandry and Dairying in 2019, there was an increase of 4.6% with total number of livestock population of 535.78 million in India over 2012 livestock census. The total buffaloes in the country are 109.85 million showing an increase of about 1.0% over previous census. The total milch animals (in milk and dry) in cows and buffaloes is 125.34 million, an increase of 6.0% over the previous census (20th livestock census). *Pandharpuri* buffalo is a water buffalo breed originated in Pandharpur tahasil of Solapur distict of Maharashtra also called as “Black Gold” of Maharashtra. It is native to town Pandharpur in Solapur, Kolhapur, Sangli and Satara districts of Maharashtra (M.H.). These breeds are hardy in nature and can produce 6-7 litres of milk even in adverse conditions. The drying off of an animal is important because udder needed rest prior to parturition. For the resuscitation of tissue secreting milk and preparation of udder for next lactation for optimal milk production performance dry period is important. The profit and success of Indian dairy sector is highly dependent on the production and reproduction efficiency of dairy animals. So, as to enhance the production performance of dairy animals, it is necessary to develop an understanding of the factors affecting production traits. Various non-genetic factors such as period of calving, season of calving and lactation order had effect on production and reproduction performances. Therefore, it is necessity to investigate and understand the effect of non-genetic factors on production performances to make improvement in management practices.

Materials and Methods

Source of data : The data comprising of 355 calving records of *Pandharpuri* buffalo spread over a period from January 1992 to May, 2020 were collected from the *Pandharpuri* Buffalo Improvement Project, Zonal Agricultural Research Station, Shenda Park, Kolhapur for the present investigation.

Location and climate : Zonal Agricultural Research Station (ZARS), Shenda Park, Kolhapur is located in South-West of Maharashtra state. It comes under the sub-montane zone of Maharashtra state and is situated at an elevation of 561 meters above the mean sea level on the 16^0 721’ North latitude and 74^0 2413’ East longitude. The maximum and minimum temperatures recorded were 30.4^{0}C and 17^{0}C, respectively.

History of herd and breeding programme : The Indian Council of Agricultural Research, New Delhi has sanctioned Network Project on *Pandharpuri* Buffalo Improvement in the IX five-year plan and started on 29/03/2001. An elite herd of 50 *Pandharpuri* buffaloes are being reared at Zonal Agricultural Research Station, Shenda Park, Kolhapur, Mashrashtra (India). Breeding bulls are produced from elite buffaloes and are reared on the farm. Breeding bulls reared are trained for semen donation and quality semen is freezed in the semen freezing laboratory established at Zonal Agricultural Research Station, Shenda Park, Kolhapur (Maharashtra State) under Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar.

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Classification of the data : The buffaloes calved during the entire period were divided into four periods as P_1 (1992-1999), P2 (2000-2008), P3 (2008-2015) and P_4 (?2015). Similarly, on the basis of season of calving data were grouped for rainy (June-September), winter (October-January), summer season (February-May) and coded as S_1, S_2 and S_3 respectively. Also, data were grouped on the basis of lactation order from 1 to 4 and coded as L_1 to L_4. The buffalo having four and above lactation were considered under group 4 and coded as L_4.

Least square analysis : The influence of various non-genetic factors on different traits except age at first calving were studied by least square analysis of variance by using the technique described by (1). The two different models were constructed and used to study the effect of period of calving, season of calving and lactation order on different traits under study.

Model-I : The following model was used to study the effect of period of calving, season of calving and lactation order on all the production and reproduction traits except age at first calving.

$$Y_{ijkl} = \mu + P_i + S_j + L_k + e_{ijkl}$$

Where,

Y_{ijkl} = Observation on l^{th} parameter belonging to i^{th} period of calving, j^{th} season of calving, and k^{th} lactation order

μ = Overall mean

P_i = Effect of i^{th} period of calving (i = 1, 2, 3 and 4)

S_j = Effect of j^{th} season of calving (j = 1, 2 and 3)

L_k = Effect of k^{th} lactation order (k = 1, 2, 3 and 4)

e_{ijk} = Random error, NID with mean and variance (0, ^{2})

Model-II : The effect of season of calving and period of calving on age at first calving was studied by using following model.

$$Y_{ijk} = \mu + P_i + S_j + e_{ijk}$$

Where,

Y_{ijk} = Observation on k^{th} parameter belonging to i^{th} period of calving of j^{th} and season of calving.

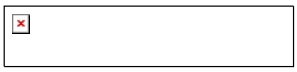
μ = Overall mean

P_i = Effect of i^{th} period of calving (i = 1, 2, 3 and 4)

S_j = Effect of j^{th} season of calving (j = 1, 2 and 3)

e_{ijk} = Random error, NID with mean and variance (0, ^{2})

Duncan's Multiple Range Test (DMRT) : Duncan's multiple range test as modified by (2) was used to make pair wise comparison among the least squares means within the different groups with the use of inverse elements and root mean squares for error. Whenever, the effects found significant. If the values are greater than ó^{2}e, Z (P,ne) then the difference are considered to be significant.



If the value was greater than  then difference was considered to be significant.

Where,

 = Mean difference between two subclasses

Cii = Corresponding diagonal element of i^{th} subclass

Cjj = Corresponding diagonal element of j^{th} subclass

Cij = Corresponding off-diagonal element of ij^{th} subclass

Z (p,ne) = Significant (P < 0.05 and P > 0.01) Studentized Range Value in Duncan's Table at number of higher mean in range chosen (p) and error degree of freedom (ne)

Results and Discussion

Least squares mean of various production traits is showed in table-2. The overall least squares mean for LMY, 305 DMY, LL, PMY and MY/LLwere 1421.56 ± 27.56 Kg, 1590.71 ± 39.29 kg, 282.41 3.02 days, 6.94 0.10 kg and 4.944 ± 0.07 kg respectively. The period of calving had significant effect on all the production traits. The buffaloes calved during P_2 had significantly highest LMY followed by buffaloes calved in P_1, P_4 and lowest in P_3. There was highly significant difference in LMY of buffaloes calved during different periods. These results were in complaince with (2, 4) in Murrah buffalo, (5) in Jaffarabadi buffalo. Non-significant effect of period of calving on LMY was mentioned by (6,7) in Murrah buffalo. The significantly highest 305 days milk yield was obtained from the buffaloes calved during period P_2, The difference in 305 DMY during P_4, P_3 and P_1 were at par with each other. The significant effect of period of calving on 305 days milk yield was also commented by (4,8,9) in Murrah buffaloes and (10) in Nagpuri buffaloes. However, non-significant effect of period of calving on 305 DMY was remarked by (3) in Murrah buffalo. Lactation length (days) was highest in buffaloes calved during period P_1 followed by P_2, P_3 and lowest in P_4. The significant effect of period of calving on lactation length was also detected by (12) in Bhadawari buffalo, (13) in Murrah buffalo and (14) in Jaffarabadi buffalo. However non-significant effect was spotted by (3) in Murrah buffaloes and (15) in Surti buffalo. The PMY of buffaloes calved during period P_2 was higher than those calved in P_3, P_1 and P_4. Similar results were stated by (8) in Murrah buffalo and (14) in Jaffarabadi buffalo. However, non-significant effect of period of calving on PMY were remarked by (16) in Murrah and (17) Swamp buffaloes.

Table-1 : Least square analysis of variance (Mean sum of square) for non-genetic factors affecting various production traits.

Source of Variation	LMY	305 DMY	LL	PMY	MY/LL
Period of Calving	1285255.96***	594815.71*	8223.33*	23.03***	9.49***
Season of Calving	1260026.36***	96591.69^{NS}	7579.65*	5.23*	7.23***
Lactation Order	267581.68^{NS}	279753.70^{NS}	521.35^{NS}	7.50*	2.43^{NS}
Error	193302.216	150826.17	2325.65	2.79	1.37

* P < 0.05; ** p < 0.01 NS = Non-Significant

Table-2 : Least squares mean for different production traits of *Pandharpuri* buffalo.

Effect	Traits				
	TLMY	305 DMY	LL	PMY	MY/LL
Overall Mean (μ)	1421.56 ± 27.56 (355)	1590.71 ± 39.29 (151)	282.41 ± 3.02 (355)	6.94 ± 0.10 (355)	4.95 ± 0.07 (355)
Period of Calving (Years)					
P_1 (1992-1999)	1424.24^{b} ± 47.80 (94)	1502.356^{b} ± 58.15 (51)	293.73^{a} ± 5.24 (94)	6.67^{b} ± 0.18 (355)	4.82^{bc} ± 0.13 (355)
P_2 (2000-2007)	1572.62^{a} ± 47.59 (91)	1746.16^{a} ± 53.26 (55)	288.17^{a} ± 5.22 (91)	7.70^{a} ± 0.18 (91)	5.33^{a} ± 0.13 (91)
P_3 (2008-2015)	1300.59^{b} ± 42.26 (119)	1528.88^{ab} ± 69.94 (32)	277.92^{ab} ± 4.64 (119)	6.75^{b} ± 0.16 (119)	4.61^{c} ± 0.11 (119)
P_4 (2015)	1388.80^{b} ± 63.04 (51)	1585.80^{b} ± 111.37 (13)	269.83^{b} ± 6.92 (51)	6.64^{b} ± 0.24 (51)	5.02^{ab} ± 0.17 (51)
Season of Calving					
S_1 (Rainy)	1378.02^{b} ± 51.71 (76)	1568.38± 66.81 (37)	278.24^{ab} ± 5.67 (76)	7.18 ± 0.11 (76)	4.89^{b} ± 0.14 (76)
S_2 (Winter)	1333.62^{b} ± 32.31 (207)	1558.11 ± 49.23 (78)	276.05^{b} ± 3.54 (207)	6.74 ± 0.12 (207)	4.71^{b} ± 0.09 (207)
S_3 (Summer)	1553.04^{a} ± 52.34 (72)	1645.10 ± 68.90 (36)	292.95^{a} ± 5.74 (72)	6.90 ± 0.11 (72)	5.23^{a} ± 0.14 (72)
Lactation Order					
L_1	1370.41 ± 47.03 (96)	1508.71 ± 70.94 (39)	279.59 ± 5.16 (96)	6.56^{b} ± 0.18 (96)	4.84 ± 0.13 (96)
L_2	1497.83 ± 49.93 (82)	1706.40 ± 67.55 (38)	282.88 ± 5.48 (82)	7.26^{a} ± 0.19 (82)	5.20 ± 0.13 (82)
L_3	1424.13 ± 57.46 (62)	1601.11 ± 73.41 (30)	285.83 ± 6.30 (62)	6.95^{ab} ± 0.22 (62)	4.89 ± 0.15 (62)
L_4	1393.87 ± 44.34 (115)	1546.97 ± 62.67 (44)	281.37 ± 4.86 (115)	7.00^{ab} ± 0.17 (115)	4.86 ± 0.12 (115)

Similar superscripts within the column does not differ significantly, Figure in parenthesis indicate number of observations.

The MY/LL in buffaloes calved during P_2 was higher than buffaloes calved in P_4, P_1 and P_3. The findings of this research fortified the findings of (18) in Murrah buffaloes.

The season of calving had significant effect on all the production traits except 305 DMY. The significantly highest LMY were observed in buffaloes calved during season summer season followed rainy and lowest in winter season. These results were in conformity with (12) in Bhadawari buffaloes and (19) in Murrah buffaloes. However, present results were incongruence with (3,15) reported in Murrah buffaloes and (5) in Jaffarabadi buffaloes. The highest lactation length was perceived in buffaloes calved during summer season followed by rainy and lowest in winter season. These results were in consistent with (4) in Murrah buffaloes. In *Pandharpuri* buffalo, the highest PMY was observed in buffaloes calved during rainy season followed by summer season and lowest in winter season. These results were in obedience with (3) in Murrah. Whereas, non-significant effect of season of calving was noted by (4) in Murrah buffalo and (14). MY/LL (kg) was higher in buffaloes calved during season summer season followed by rainy season and winter season. These results were similar to (18).

The lactation order had non-significant effect on all the production traits except peak milk yield and MY/LL. The significantly highest PMY was observed during L_2 followed by L_4, L_3 and lowest in L_1 lactation. Similar results were perceived by (3, 4) in Murrah buffalo, (17) in Swamp buffalo and (14) in Jaffarabadi buffalo. The LSM of MY/LL

(kg) was higher in buffaloes calved during lactation order L_2 followed by L_3, L_4 and lowest L_1. These results incongruence with the findings of (20) in Murrah buffaloes, (21) in Egyptian buffaloes and (10) in Nagpuri buffaloes.

Conclusions

The overall least square mean for lactation milk yield (LMY), 305 days milk yield (305 DMY), lactation length (LL), peak milk yield (PMY) and milk yield per lactation length (MY/LL) were 1421.56 ± 27.56 kg, 1590.79 ± 39.28 kg, 282.41 ± 3.03 days, 6.942 ± 0.11 kg and 4.944 ± 0.07 kg respectively. The period of calving shows the significant effect on 305 DMY and LL. The season of calving had the significant effect on LMY, LL, PMY and MY/LL. Whereas, season of calving shows non-significant effect on 305 DMY. The lactation order had non-significant effect on all the production traits except PMY and MY/LL. It might be indicate that *Pandharpuri* buffalo breed is well adopted to Kolhapur district and their production performance can not be affected by most of the non-genetic (Climatic) factor. Further, it is recommended that this study must be correlated with larger data size for valid conclusion.

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