PHENOTYPIC TRENDS FOR MILK YIELD IN NILI RAVI BUFFALOES REGISTERED UNDER BULL MOTHER SCHEME AND AT LIVESTOCK EXPERIMENT STATION BAHADURNAGAR- OKARA

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ABSTRACT: Efficient breeding plans depend upon the availability of reliable and accurate data. To evaluate the productive and reproductive performance of the Nili-Ravi buffalo, registered under the bull mother scheme, was evaluated from 1980-2020. General Linear Model is used to study the effect of phenotypic characters on milk yield i.e., year of calving, age at first calving, and dam's parity on productive traits under consideration. The lactation records of all parity are used for the analysis. The data on pedigrees, breeding, and performance records through analysis of variance procedure shows statistically significant ($P < 0.05$) differences for the effect of 305 days milk yield and lactation length. The Least Squares Mean for lactation milk yield, age at first calving and lactation length are 2108.62 ± 12.80 liters, 1574.49 ± 8.1 and 295.50 ± 1.47 days, respectively. The inclusive results depict that buffaloes calve in the winter season have the highest and most significant total milk yield. The data set could be used as a phenotype for genome-wide association studies as a reference population.

Key words: Nili Ravi buffaloes, milk yield, age at first calving, lactation length.

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INTRODUCTION

Buffalo is the black gold of Pakistan and has an important role in dairy production. There are 43.7 million head and have share approximately 62% of the total volume of milk. Buffalo is an essential element of a sustainable rural economy after cash crops, especially in plan lands of Punjab (Anonymous 2021). There are three recognized buffalo breeds in Pakistan and Nili- Ravi buffalo stands first among these breeds due to its production potential. It is considered as prime dairy breed in Pakistan due to its milk quality and quantity traits. Its milk is preferred by consumers of certain regions of the world owing to its color, flavor, and high fat percentage (El Salam and El Shibiny, 2011). The production potential of this Nili Ravi shows wide variation among the individuals thus providing the chance to pool high producers through selective breeding. In subtropical regions due to extreme variations in environmental temperature and feedstuffs, buffalo performance considerably become affected by the season of calving and parity (Aziz *et al.*, 2001). A nucleus herd is an essential step toward the genetic improvement of a breed. The Livestock Experiment Station (LES), Bahadurgarh (Latitude and longitude: 30.808500, 73.459396) is an important nucleus herd of Nili Ravi buffalo with the objective of superior animals' selection for the future generations. The animal recording has important role in a breeding programme. Genetic evaluation of this herd showed that in years 1988-89 sire selection was good. Further improvement may possible to improve the worth of this breed through advanced breeding and management practices (Ahmad et al., 2008). Assessment of the true phenotypic value of an animal is hardly conceivable. Though, phenotypic parameters are supportive in determining the method of selection to predict direct and correlated responses to selection and breeding system to be adopted for future improvement and also the estimation of genetic response (Sarubbi *et al., 2012).* Therefore, the aim of present study was to estimate phenotypic parameters associated with the productive and reproductive traits in Nili Ravi buffalo herds of Bull Mother Scheme, Punjab and LES/Bahadurnagar, Okara. The information so generated will be used in ranking the elite class of buffaloes/bulls for the further breeding programs under the progeny testing program (PTP) and could be used as phenotypes in genome-wide association studies as reference population.

MATERIALS AND METHODS

The data on production, breeding, and reproductive performance of 4,036 lactation records of Nili Ravi buffaloes maintained under Bull Mother

Scheme and at the LES/Bahadurnagar, Okara from 1980 to 2020 was utilized for the present study. The parameters used in this study were the identity of animals (ID), Sire, Dam, date of birth (DOB), date of calving (DOC), drying, lactation number (parity), lactation length in days (LL) and lactation milk yield (MY). Phenotypic parameters of production and reproductive traits were estimated. All valuable information was included in the analysis to minimize the biases due to selection and non-random mattings. Incomplete lactations for any recorded reason or lactations showing any abnormality were not utilized in the analysis. The records have less than 60 days of lactation length were also not used. Data were checked for other unrealistic entries as well (Ahmad, 2007). General Linear Mixed Model (IBM-SPSS, 20.0) was used to analyze the productive and reproductive parameters affecting lactation milk yield; and the estimation of phenotypic values including permanent environmental factors.

RESULTS AND DISCUSSION

Table 1 presents the least square analysis of variance (LES) $P < 0.05$, $P < 0.01$) variation for the effects of year of calving and season of calving and significant ($P<0.05$) for lactation number (parity) on 305 days lactation milk yield. The results of the present study are in line with the results reported by Ahmad *et al*. (2007) and Hussain, *et al*. (2006) which showed highly significant results for lactation yield and lactation length (Garcha and Dev, 1994, Ahmad, 2001). These variations might be due to the difference in the breed type (crossbreds), herd size, data sets, methods of estimation, the level of productivity and even the periods/time of collecting the data for particular traits.

Table-1: LES (F. Ratio) of 305 days milk yield.

Source of Variation (SOV)	D.F. (*n-1*)	Mean Squares (MS)	F. Ratio
Year of calving (YC)	1	30307245	101.33**
Season of calving (SC)	2	5480349	18.29**
Lactation number (Parity)	10	2660123.802	4.629
Error	3530	573672.184[b]	

SPSS.20.0

The overall mean for 305 days milk yield in present study was 2108.62±21.7 liters and winter calver milk yield was 267.36 liters more than summer calvers (Table-2). Similar averages of 2145±12.6 and 2119.86±35.55 were found by Bashir, *et al*. (2015) and Hussain, *et al*. (2006) in Nili Ravi buffaloes, respectively. These estimates are also in accordance with some earlier works where the least squares mean for lactation milk yield was 2462.92 ± 195.93 and 2030.12 ± 14.58 liters for average lactation length of 340.57 ± 61.70 and 305 days (Ahmad *et al.,* 2007; Ahmad *et al*., 2008), respectively. The work is not in agreement with Hyder *et al*. (2007) who indicated first parity average lactation milk yield 1813±23.2 litres and averages of later parity 1926±19.0 litres in Nili-Ravi buffaloes. These differences are might due to differences in number of parities, lactation records, and herd size or management practices at farms.

The calving trend was observed 52.67, and 47.10 percent during summer and winter season, respectively. Month of calving is important source of variation in lactation milk yield of Nili-Ravi buffaloes and this fact is also reported by Hyder *et al*. (2007) who found significant ($P<0.01$) interactions in month of calving with parity as well as with herd in Nili Ravi buffaloes. The findings of the present study are partially in agreement with Faiz, *et al*. (2010) who found higher calving frequency in Autumn (August – September) for Nili Ravi buffaloes and winter (January to February) for Sahiwal cattle.

Table-2: LSM± SE (305 days) milk yield in Nili Ravi buffalo.

Particulars	No of Obser.	MY-305 D	S.E
Overall Mean	3541	2108.62	12.80
Season of Calving			
Winter (52.67 %)	1876	2242.26	36.48
Summer (47.101%)	1665	1974.90	31.07

Table-3 Descriptive Statistics.

Lactation no	N	Mean	Std. Deviation	Std. Error
1	987	2080.90	760.727	24.21
2	781	2177.59	775.828	27.76
3	611	2181.43	769.461	31.12
4	457	2144.36	762.627	35.67
5	304	2080.53	732.106	41.98
6	189	1963.96	708.607	51.54
7	113	1938.57	634.561	59.69
8	56	1747.41	825.156	110.26
9	25	1803.36	840.413	168.08
10	14	1916.43	533.566	142.60
11	4	1693.50	842.135	421.06
Total	3541	2108.62	761.947	12.80

The phenotypic trend for 305 day lactation milk yield although depicted a positive trend. Present study revealed that the highest milk yield was obtained on the third parity (Table-3) and then the amount gradually declined upto 8th parity (Figure-1). This finding is also in

agreement with Bashir *et al*. (2015) who found increase in average milk yield with increase in parity number through maximum in 3rd lactation. A sudden increase in total milk yield in the declining curve (Figure-1) in 9th and 10th parity is due to the culling of low producers after their 7th and 8th parity resulted in increase in average milk yield by remaining elite animals in herd in coming years (Figure-2 and Table-4). Same fact is true in fluctuation average milk productions in various years (Table-4) that in year 1987-88 due to use of elite bull semen buffalo born in succeeding years were rich in milk producing genes pushing milk production curve upward.

In present study maximum milk yield was observed for buffaloes calved in winter (2242.26 ±36.38) and lower in summer (1974.90±31.07) Table-2. This trend is similar with the work of Khan *et al* (1991) reporting 2298 litres in winter and 1712 litres in summer. The age at 1st calving estimated in this study 1574 days which was higher than the previously reported by Ramadan *et al*. (2018) and Naqvi and Shami (1999) i.e., 1380 and 1302days, respectively. The difference indicate late maturity in present studies herd of buffaloes. Another study revealed 1056 days age of puberty at public sector dairy farms (Okara). Age at puberty was calculated by subtracting date of birth from date of first fruitful service. Winter born calves gain puberty earlier than summer autumn or spring born (Naveed, 2021).

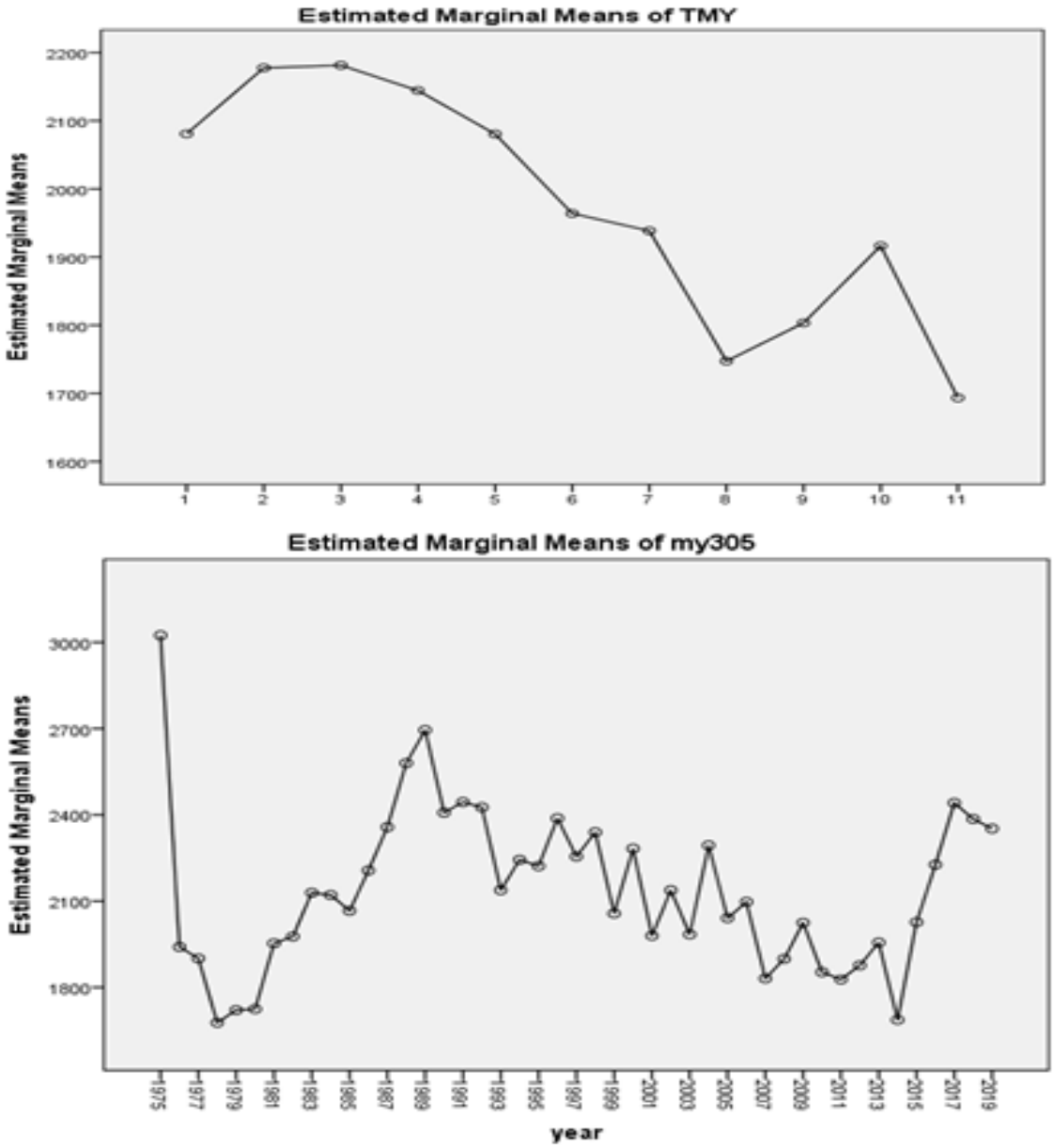

Figure 1: Total Milk Yield and milk yield 305 days.

Table-4: Descriptive Statistics Year wise.

Year	Mean	Std. Deviation	Std. Error	N
1975	3024.43	1149.599	239.707	23
1976	1940.43	926.204	156.56	35
1977	1900.50	779.783	102.39	58
1978	1677.06	770.511	111.21	48
1979	1720.90	592.333	63.50	87
1980	1724.47	544.977	62.105	77
1981	1953.02	677.015	92.995	53
1982	1976.83	732.720	92.31	63
1983	2129.04	815.030	117.63	48
1984	2120.98	844.750	112.88	56
1985	2066.34	792.088	119.41	44
1986	2206.72	788.950	95.67	68
1987	2357.29	883.170	103.36	73
1988	2580.04	839.951	92.75	82
1989	2694.86	918.649	110.59	69
1990	2407.78	891.454	88.70	101
1991	2444.26	852.120	95.26	80
1992	2426.24	714.954	72.96	96
1993	2138.24	746.757	74.30	101
1994	2243.72	881.116	102.42	74
1995	2221.87	734.319	80.120	84
1996	2388.12	734.587	72.73	102
1997	2254.99	788.195	80.44	96
1998	2339.38	906.093	109.87	68
1999	2057.04	784.417	78.05	101
2000	2282.71	717.112	74.36	93
2001	1979.55	639.389	79.92	64
2002	2137.59	776.654	87.93	78
2003	1984.08	744.266	86.51	74
2004	2293.72	703.177	84.65	69
2005	2041.06	731.883	71.42	105
2006	2097.20	537.782	53.51	101
2007	1830.78	526.048	48.42	118
2008	1899.22	593.140	57.88	105
2009	2024.57	533.336	50.85	110
2010	1852.94	453.151	41.19	121
2011	1827.55	512.319	45.28	128
2012	1876.51	621.159	54.27	131
2013	1955.68	510.621	57.44	79
2014	1686.95	598.388	55.79	115
2015	2026.70	841.947	105.24	64
2016	2226.80	620.000	72.56	73
2017	2441.48	604.601	91.14	44
2018	2385.72	890.936	123.55	52
2019	2352.12	762.031	132.65	33
Total	2106.77	758.758	12.74	3544

Table-5: The Age at Calving of Different Lactation in Buffaloes of LES Bahawalnagar, Okara.

LN	Mean	Std. Deviation	N	Std. Erro
1	1574.49	266.326	1056	8.19
2	2095.99	370.595	873	12.54
3	2612.93	494.818	697	18.74
4	3085.10	629.790	529	27.38
5	3530.99	741.971	356	39.32
6	3927.59	858.168	227	56.95
7	4378.10	883.568	143	73.88
8	4583.20	1114.224	75	128.65
9	4868.56	1317.779	36	219.62
10	5349.47	1397.933	15	360.96

Table-6: Overall Lactation Length at LES/Bahadurgarh, Okara

Mean	N	Std. Deviation	Std. Error
295.5045	3663	89.22159	1.47

The profitability of a dairy operation is depended on the accurate determination of calving season and parity. Productive and reproductive traits are key elements to help in the determination of accurate estimation. The present study showed that the animals born in the winter season have high milk yield and the best performance. However, it is also estimated that the potential of this herd might be improved further with the selection of the best animals among this herd. Furthermore, this data set could be used for the genome-wide association as a reference herd.

Conclusion: This study is drawing a picture of the performance and reproductive traits of Nili Ravi buffalo in its home tract. The data set of this study could be used for genome-wide association studies as a reference population. Further enhancement of these economically important traits needs advanced intervention to explore the potential of this important dairy breed of Pakistan.

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