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Impact of Non-genetic Parameters Altering Milk Yield Performance in Zebu Cows

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ABSTRACT

Background: Animal phenotype performance depends on both genetic and non-genetic factors, but mostly the genetic part analysed leaving non genetic parameters unnoticed. The aim of the study is to understand impact of non-genetic factors governing milk yield performance in Deoni cows.

Methods: A total of 821 lactation records from 340 lactating cows (2002-2017) along with their age at first calving, parity, season of calving were collected. These data were standardized and analysed to find significant differences using Duncan's multiple range Test.

Result: Deoni cows showed significant increase (P<0.05) in both lactation milk yield and lactation length with increase in parity. Season of calving had significant affects (P<0.05) on lactation milk yield but not in lactation length. Increase in age at first calving revealed there was a significant difference (P<0.05) in both lactation milk yield and lactation length.

Key words: Age, Deoni, Milk yield, Lactation length, Season.

INTRODUCTION

Deoni is an important indigenous dual-purpose cattle breed of Southern and western India. These animals received its name form place of their origin *i.e* "Deoni" taluk of lathur district in Maharashtra. It is also known as Surti, Dongarpati. By earlier studies Deoni is found to be a cross of Gir, Dangi and some local cattle (Joshi and Philips., 1953). Based on its coat colour a) Wannera: white coat with black colourization in face, b) Balankya: completely white coat with black spots in lower parts and c) Shevera: white coat with irregular black spots (Singh *et al*., 2002).

Variation in milk yield were depends on animals genotypic value and environment deviation. Majority of change in animal's performance was governed by non-genetic factors. Thus, to estimate genetic merit of an animal it is crucial to understand the non-genetic factors affecting production traits and the effective ways to minimize environmental deviation (Nagpal and Acharya,1971; Dhumal *et al*., 1993; Gandhi *et al*., 1995; Kumar *et al*., 2003 and Dhaware *et al*., 2008). Hence in this study to know about the effect of non-genetic factors *viz.*, parity, age at first calving and season of calving affecting lactation milk yield and its corresponding lactation length in Deoni cows were taken into account.

MATERIALS AND METHODS

Data source

A total of 821 lactation records on 340 Deoni cattle maintained at Livestock Research Centre, ICAR-National Dairy Research Institute, Southern Regional station, Bengaluru pertaining to the period between 2002 to 2017 (15 years) were used for the present study.

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Data normalization

The milk performance traits like total lactation milk yield and its corresponding lactation length were studied. Data for milk yield traits were classified on basis of parity into six group 1st to 5th parity as one distinct group and greater than 5th parity were pooled into a single group. Based on Season of calving data were classified into three groups of animals calved during rainy (July to October), summer (March to June) and winter season (November to February). Based on age at first calving, data were classified into three groups as animals calved within 40 months, between 40-50 months and exceeding 50 months. Animals having incomplete records due to abortion and still birth were excluded from the study. The data were standardized by taking the records of the performances within the range of two standard deviation from the mean value.

Least squares analysis technique (Harvey,1966) was used for non-orthogonal data to find the effect of parity, season of calving and age at first calving on lactation milk

yield (LMY) and lactation length (LL) of the cattle as per the following formula.

$$Y_{ij} = \mu + F_i + e_{ij}$$

Where,

Y_{ij} = Performance record (LMY and LL) of the j^{th} cow under i^{th} subclass of the non-genetic factor.

μ = Overall population mean.

F_i = i^{th} subclass of the non-genetic factor.

i = 1, 2, 3, 4,5 and >5 for Parity.

i = 1, 2 and 3 for season of calving.

i = 1, 2 and 3 for age at first calving).

e_{ij} = Random error which is normally independently distributed.

Pairwise comparison of the least squares means was analysed by Duncan's Multiple Range Test (DMRT), as modified by Kramer (1957) and its significance were estimated by one-way ANOVA using SPSS 16.0 software.

RESULTS AND DISCUSSION

Under present study analysis of 821 lactation records collected from 340 lactating cows revealed that least squares mean lactation milk yield of 870.70±42.46 kg in a lactation length of 192.5±8.54 days.

Further, it was observed that there was an increase in lactation milk yield which started from fourth lactation and reached highest in greater than fifth lactation with a yield of 1084.61±58.62 kg in a lactation length of 230±9.3 days (Table 1). It was also observed that animals in first lactation exhibited lowest milk yield of 662.05±25.6 kg in a period of 174±10.3 days.

Das *et al.,* (2011) and Basak and Das (2018) reported lower lactation milk yield and lactation length of 779.27±18.31 kg in 186.61±3.02 days and 819.98±16.50 kg in 189.6±5.76 days respectively in Deoni cows than the present study. Bhutkar *et al.* (2014) reported lower least squares mean lactation milk yield of 358.31±27.18 kg in Deoni cattle than the present study. Similarly, Chakravarthy *et al.* (2002) also reported lower lactation milk yield 238.86±76 kg in 149.43±33.52 days of lactation. Records of higher lactation milk yield and lactation length in Deoni cattle were reported by Deshpande and Singh (1977) as 942.7±16.6 kg and 293.3±2.9 days respectively. Based on ANOVA, it was revealed that with an increase in lactation number, there was a significant (P value<0.01) increase in lactation milk yield and lactation length (Table 3). In Ongole breed, similar kind of results was reported by Kumar *et al.* (2003) in which significant enhancement in lactation milk yield was observed after third parity. In the same study, increase in parity showed non-significant effect on lactation length. Reports of Dhumal *et al.* (1993) exhibited that parity has no significant effect on lactation milk yield and lactation length of Deoni cattle. Although the exact mechanism underlying the increased lactation milk yield and lactation length in response to lactation number has yet to be discovered, some researchers believe it is due to an increase in mammary epithelial cells (MEC) and decrease of MEC apoptosis which causes increased cell activity in mammary glands (Ahmed *et al*., 2007 and McNamara *et al.*, 2008).

Season of calving showed significant effect on lactation milk yield but not on lactation length (Table 3). Animals calved during winter showed higher level of milk production in comparison with animals calved during summer and rainy seasons (Table 1). Similar kind of results was reported in Ongole cattle (Kumar *et al*., 2003) and Khillar cattle (Dhaware *et al*., 2008) for lactation milk yield. Dhumal *et al*. (1993) found that season of calving had non-significant effect on lactation milk yield and lactation length in Deoni cattle. Effect of season of calving on lactation milk yield could be due to availability of sufficient good quality fodder resources.

Animals were grouped based on age at first calving with its corresponding lactation milk yield and lactation length

Table 1: Least squares Mean±S.E of lactation milk yield and lactation length based on non-genetic factors.

Subclass	N	Lactation milk yield (Kg)	Lactation length (Days)
Overall	821	870.70±42.40	192.5±8.54
		Parity	
I	258	662.05±25.61^{a}	174±10.3^{a}
II	212	787.1±29.85^{b}	185±8.5^{b}
III	152	818.17±35.19^{b}	191±5.8^{c}
IV	97	933.52±45.01^{c}	201.8±7.3^{cd}
V	57	938.79±60.14^{c}	201±10^{cd}
VI	45	1084.61±58.62^{d}	230±9.3^{d}
		Season of calving	
Winter	297	881.61±27.42^{b}	198.42±4.27^{ab}
Summer	283	783.47±25.68^{a}	190.34±4.63^{a}
Monsoon	241	843.53±26.33^{b}	192.83±4.38^{a}

^{a,b,c}Represents groups classified by DMRT, LSM with different superscript differs significantly.

Table 2: Least squares Mean±S.E of lactation milk yield and lactation length based on effect of age at first calving and sire effect.

Subclass	N	Lactation milk yield (kg)	Lactation length (days)
		Age at first calving (months)	
≤40	47	745.29±45.81^{b}	187.45±7.21^{b}
41-50	182	630.83±34.94^{a}	164.79±5.47^{a}
>50	67	663.49±50.5^{a}	182.05±10.7^{b}

^{a,b,c}Represents groups classified by DMRT, LSM with different superscript differs significantly.

Table 3: Mean sum of squares of lactation milk yield and lactation length under various non-genetic effect.

Production trait	Parity	Season of calving	Age at first calving
LMY	2509873.5**	5617660.60*	195351.89*
LL	29746.82*	4392.76^{NS}	13583.77*

(NS=Non-Significant, *Significant at P-value-<0.05, **Significant at P-value<0.01).

were estimated. Results revealed that animals calved before 40 months showed higher lactation milk yield and lactation length than to animals calved between 41 and 50 months and higher than 51 months (Table 2). ANOVA revealed that highly significant change in lactation milk yield and lactation length between age groups (Table 3). Similar result was observed by Basak (2013) in which age at first calving significantly affected lactation milk yield.

CONCLUSION

Indigenous cattle's lactation yield is an important parameter influence decision for its longevity or disposal. Lactation milk yield and lactation length in Deoni cows were significantly affected by all factors considered in the study *viz.,* parity, season of calving and age at first calving whereas season of calving didn't affect lactation length significantly.

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