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Persistency of Lactation in Nili-Ravi Buffaloes

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ABSTRACT

Persistency of lactation index was calculated using 2390 lactation records of Nili-Ravi buffaloes. Five definitions of persistency were evaluated. Buffaloes were 87% persistent. Environmental effects such as season of calving, parity and lactation length had a significant effect on the trait. Persistency was 9% heritable with a repeatability of 13%. Correlation with lactation length was positive and suggested that buffaloes with greater lactation length were more persistent. Response to selection for persistency of lactation is expected to be much lower as compared to traits like milk yield due to poorer genetic control of the trait.

Key Words: Persistency; Milk yield; Nili-Ravi Buffaloes

INTRODUCTION

An increase in milk yield towards peak after calving and decline thereafter is typical in buffaloes as in other dairy species. The animals that remain on or around peak production for a longer time are preferred because of higher lactation yields. This quality of remaining consistent in milk production is called persistency and is considered as an important economic trait.

The value of persistency varies with the number of lactation stages defined. In Pakistan, persistency of lactation milk yield in dairy animals (Ghaffar, 1983; Shah, 1990; Ahmad, 1993, Zakariyya, 1995) has been reported using the formula given by Ludwick and Peterson (1943). This formula requires that lactations are complete. The lactations are divided into different stages/phases and a weighted ratio of milk yield is calculated. In Mahadevan (1951)'s formula milk yield of first 26 weeks (180 days) is used to measure the persistency index; milk yield from 11^{th} week to 26^{th} week as numerator and milk yield in first 10 weeks as the denominator. Gajbhiye and Tripathi (1992) has discussed 11 such measures of calculating persistency index and reported that environmental factors such as lactation length affect persistency differently as the definition of persistency would vary.

The objective of the present study was to evaluate different persistency definitions used in the literature for calculating persistency index in Nili-Ravi buffaloes and to see the effect of environmental factors on persistency in this breed.

MATERIALS AND METHODS

Weekly milk yield records of 993 Nili-Ravi buffaloes, maintained at Livestock Experiment Station, Bahadurnagar, Okara from 1970 to 1998 were used for the study. History sheets were used to match the cumulative yields of these animals. A total of 2704 lactations had length of at least 60 days. If milk yield was missing for any week, it was estimated by averaging previous and next available weekly record. However, if milk yield information was missing for more than eight weeks (56 days) consecutively, such records were excluded. Errors in data entry were minimized by deleting outliers and allowing a maximum of 100% increase / decrease between two consecutive weeks. Season of calving was defined as Summer (for buffaloes calving from April to September) and Winter (for buffaloes calving from October to March). As lactations were required to be complete (308-days of length) for calculating different measures of persistency, only 1102 lactations were finally used.

The five measures of persistency calculated were those of Ludwick and Peterson (1943) using 11 stages of 4 weeks each; or using 4 stages of 11 weeks each or using 3 stages of 11 weeks each and ignoring 4^{th} stage; modification proposed by Gajbhiye and Tripathi (1992); persistency index of Mahadevan (1951) and index of Johnson and Hanson (1940). In the formula of Johnson and Hanson (1940), for example, persistency is defined as the ratio of milk yield in second 100 days of lactation to the milk yield in the first 100 days.

$$\text{Persistency (\%)} = \frac{\text{Milk yield in 101 to 200 days of lactation}}{\text{Milk yield in 1 to 100 days of lactation}} \times 100$$

As data available were weekly milk yield records, slight modification for this study was as follows:

$$\text{Persistency (\%)} = \frac{\text{(Milk yield in 28 weeks-Milk yield in first 14 weeks)}}{\text{Milk yield in first 14 weeks}} \times 100$$

A sixth measure of persistency, using coefficients from Wood's formula (Wood, 1967) as calculated by Mansour (1992) for Egyptian buffaloes was used but excluded because of unrealistic values for curves with negative rate of increase towards peak yield or positive rate of decrease following peak. To evaluate effect of

environmental factors such as year of calving, season of calving, parity and age at calving, a mixed effect model was used. The effects included in the model were sire (random) and year, season, parity as fixed effects along with linear and quadratic effect of age at calving as covariables. The 28 years of calving from 1970-1998 were pooled into 14 periods/groups of two years each (1970-71, 1972-73, …1996-97). Milk yield was used as a covariable and lactations were required to be 28 weeks of duration.

RESULTS AND DISCUSSION

Basic statistics on different measures of persistency are given in following Table I.

It may be observed that using LP1, coefficient of variation of the measure of persistency is just 4.21%. Using the other two variants of Ludwick and Peterson (1943) (LP2 and LP3) coefficient of variation increase to 11%. Shah (1990) also used the LP1 and reported measure of persistency to vary by 4.19%. Using the formula of Johansson and Hanson (1940), JOH, per cent variation is 16.45%. Variation in persistency index by MAH is also in the same range but the mean value of persistency index is quite high i.e. 146.24% and so is the maximum value (247.89%). Examining these statistics, formula of Johansson and Hanson (1940) seems better for defining this trait as higher variation exists among buffaloes leading to better selection opportunities for selection if other factors are assumed similar. Another property of the index is that it can be calculated at 28th week of lactation and thus improves the opportunity of earlier selection. The MAH was chosen for examining the relationship between persistency and other variables such as lactation length.

Table I. Persistency of milk yield calculated by different formulae*

Statistics	LP1	LP2	LP3	JOH	MAH
Mean	98.17	89.07	91.43	87.37	146.24
SD	4.14	8.18	10.01	14.37	23.75
CV(%)	4.21	9.19	10.95	16.45	16.24
Minimum	85.91	63.19	63.78	42.39	77.89
Maximum	134.04	121.39	132.95	156.10	247.89

*LP1, Persistency as calculated by Ludwick and Peterson (1943) using 11 stages of 4 weeks each; LP2, Persistency as calculated by Ludwick and Peterson (1943) using 4 stages of 11 weeks each; LP3, Persistency as calculated by Ludwick and Peterson (1943) using 3 stages of 11 weeks each, (modification proposed by Gajbhiye and Tripathi (1992); JOH, Persistency calculated by Johansson and Hanson (1940)'s formula; MAH, Persistency calculated by Mahadevan (1951)'s formula

Out of 2704 observations, 2390 had information on milk yield for first 28 weeks. Cow effects and other environmental variables had a significant effect on the trait (Table II). Repeatability value was 0.132±0.025. When sire identification required (n=1965) heritability of the trait by paternal half sib-correlation method was 0.091±. 0.043. Overall least squares means was 79.4±0.57. The value is lower than simple average (91.3±0.55) reported for buffaloes (Shah, 1990). Milk yield as covariable was highly influential (F-value = 25.30). Persistency had a positive correlation of 0.33 with actual lactation length. Even if lactation length was assumed to be truncated at 308-days, correlation coefficient was 0.36. With increase in lactation length, persistency index increased. Lowest mean was observed at 28 weeks (65.7±2.72 %) while value at 44 weeks was 84.2±0.89

Table II. Degrees of freedom and calculated F-values from analysis of variance of factors affecting persistency of lactation

Source of variation	d.f	F-value
Cow (random)	929	
Year group	13	4.57**
Season	1	7.94**
Year group * Season	13	5.83**
Age within parity	34	2.45**
Weeks in milk	16	4.99**
Milk yield	1	25.30**
Error	1382	

** Significant (P < .01)

Shah (1990) reported a correlation coefficient of 0.439 between lactation length and persistency in Nili-Ravi buffaloes. Zakariyya (1995) also reported increasing trend in persistency with increase in lactation length for Nili-Ravi buffaloes. Earlier studies of Khan *et al.* (1980) in Murrah buffaloes have suggested a similar trend. Shah (1990) reported a correlation of 0.191 and 0.273 between persistency and 305-day milk yield and total milk yield, respectively. Dhaka *et al.* (1998) has reported correlation range from 0.07 to 0.53 between persistency and lactation milk yield (depending on the, method of calculating persistency) in Murrah buffaloes. Least squares means of persistency (%) for season of calving and parity are given in Table III.

First parity buffaloes were most persistent (85.1±2.83). Differences among the later parities were less prominent. The relationship with age was generally negative (simple correlation coefficient was -0.17). Phenotypic trend in the trait was negative (Fig. I). Season had a significant effect (P<0.01) and buffaloes calving in Summer (80.5±0.67%) had a slightly better persistency as compared to those calving in Winter season (78.3±0.74%). Gajbhiye and Tripathi (1992) also reported significant effect of season of calving on various expressions of persistency in Murrah buffaloes.

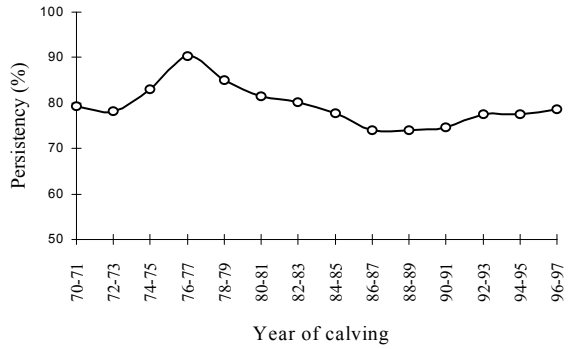
Lactation length had a significant effect on some (and not other) measures of persistency in first parity Murrah buffaloes. First parity buffaloes were more persistent than buffaloes with greater parities. Age also affected the trait although both the quadratic effects could not reach statistical significance.

Table III. Least squares means of persistency (%) for season of calving and parity

Factor		N	Mean
Season			
	Winter	753	78.3±0.74
	Summer	1212	80.5±0.67
Parity			
	1	518	87.61±1.513
	2	424	81.79±1.015
	3	331	80.85±1.026
	4	249	82.28±1.310
	≥5	443	80.84±1.586

The basic statistics of persistency were similar to the earlier reports on Nili-Ravi buffaloes. Shah (1990) reported for 664 lactations of Nili-Ravi buffaloes that persistency averaged 89.0% with a coefficient of variation of 4.2%. Zakariyya (1995) also reported that for 437 lactations of Nili-Ravi buffaloes from Livestock Experiment Station, University of Agriculture, Faisalabad, persistency averaged 92.6% with a standard error of 4.4% and a coefficient of variation of 3.4%. Values for Sahiwal cows (Ahmad, 1993) was 92.8±0.19%. Metry *et al.* (1994) reported that persistency index (%) averaged 57±13 for lactations with >28 days in length and 85±11 and 102±10 for >149 days and ≥ 308-days, respectively. Seasonal effects were significant for records of >28 days duration while for lactations of >149 days duration, season of calving did not affect persistency index. Winter calvers had the lowest persistency. Persistency index in 173 Murrah buffaloes (Dhakka *et al.*, 1998) was negatively correlated with peak yield (r = - 0.13) while correlation with lactation milk yield was 0.14.

Fig. 1. Least squares means of persistency index by year of calving



Although, correlation between lactation length and persistency was positive and suggests that buffaloes with higher the lactation length have tendency to be more persistent. Yet, results do not suggest that selection for a very long lactation length would result in more persistent buffaloes. The correlation between the two traits is not very high and lactation length used for calculating the statistic was 33 weeks only. The 9% heritability of the trait further indicates that response in the trait would be much lower as compared to traits like milk yield which is usually reported to have a genetic control in the range of 20-25%.

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