

Relative Importance of First Lactation Production Traits on Herd Life Characters in Buffaloes

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Abstract

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For studying the relative importance of different first lactation production traits on herd life characters, information on 1753 buffaloes (Murrah, Nili Ravi and graded Murrah) maintained at six military dairy farms of northern India were collected and profit analysis was done based on milk production, body weight, calving interval and prices of feed, milk and calves as well as cost on depreciation & interest on buildings, expenditure on electricity, veterinary cost, labor cost etc.

The third degree polynomial analysis revealed that linear, quadratic and cubic regression coefficients of age at first calving and first lactation period were significant for herd life profit. R² value of first lactation profit were maximum for herd life milk yield, average milk yield per day of herd life, herd life profit and average profit per day of herd life indicating that selection of buffaloes could be emphasized more on first lactation profit rather than age and weight at first calving as well as first lactation milk yield.

Key words: profit, herd life, coefficient of determination, optimum, independent and dependent variable

Abbreviations: FMLY (first lactation milk yield), AFLMY (average milk yield per day of first calving interval), PHL (Herd life profit), APHL (Average profit per day of herd life), HLMY (herd life milk yield), AMHL (Average milk yield per day of herd life)

Introduction

Profitability from dairy enterprise represents the cumulative effect of various factors with expenditure on the buffaloes

and the income from them during a specified period. Improvement in milk production during early part of life may not always lead to profit due to different rate of increase in cost of inputs and milk price.

Other factors like age and weight at first calving were also important, as the maintenance cost of buffaloes will be directly influenced by these two traits. Gill and Allair (1976) attempted to find out the relationship of age at first calving, days open, days dry with herd life milk production and profit in Holstein cows. But the information was meager in buffaloes to draw any definite conclusion about the minimum milk production in first lactation to get more herd life milk production and profit. It has been suggested that average milk yield and profit per day of herd life was better understood by dairy farmers than total milk yield and profit in herd life (Pearson and Millar 1981).

Therefore, the present study was an attempt to find out relative importance of first lactation production traits in deciding the herd life milk yield and profit in buffaloes.

Materials and Methods

The information on economic traits of first lactation like age (months) and weight (kg) at first calving, first lactation period (days), first calving interval (days), first lactation milk production (kg) and average milk yield per day of first calving interval (kg) were collected from history sheet of 1753 buffaloes maintained at six military dairy farms and used for profit analysis traits like profit in first lactation (Rs.), average profit per day of first calving interval (Rs.), herd life profit (Rs.) and average profit per day of herd life (Rs.) as per Kumar (1998). Cost of rearing and maintenance of buffaloes during different lactations, milk production, labor, electricity, depreciation on building and equipment, interest on cost of rearing during respective calving intervals etc. were considered

as inputs. Income from sale of milk, prices of calves and salvage value of buffaloes were considered as out put from each individual.

The relationship and varying level of first lactation production traits were estimated for maximum and minimum herd life traits. Herd life was defined, as total days required completing first three lactation's from date of first calving. The fixed effect of farms, period and season of calving were corrected by least squares method (Harvey, 1990) and then used in predicting dependent variables (herd life milk yield, average milk yield per day of herd life, herd life profit and average profit per day of herd life) using polynomial analysis ($y = a + b_1 x + b_2 x^2 + b_3 x^3$). To determine the rational range with respect to the level of first lactation production traits, first and second order derivatives were marked out and equated to zero, respectively, and maximum & minimum levels of the traits were determined.

Results and Discussion

Least squares means and standard error of first lactation and herd life traits have been presented in Table 1 and results of third degree polynomial regression coefficients in Table 2. Age at first calving is the time at which return starts from buffaloes. The least squares mean of age at first calving was 1230 days (41.12 months), which was in agreement with the findings of Sethi and Nagarcenkar (1992). Age at first calving caused 0.02, 0.69, 1.14 and 12.40 percent variation in herd life milk yield ($5381.07 \pm 66.6\text{kg}$), average milk yield per day of herd life ($4.77 \pm 0.04\text{ kg}$), herd life profit (Rs. 8698.62 ± 946.49) and average profit per day of herd life (Rs. 6.98 ± 0.75) respectively (R^2 value in Table 2). The

Table 1
Least squares mean and standard error of the traits under study

S. no.	Traits	Mean	Standard error
1	Age at first calving (months)	41.12	0.35
2	Weight at first calving (kg)	483.588	2.962
3	First lactation period (days)	302.75	2.66
4	First lactation milk yield (kg)	1818.41	21.26
5	Average milk yield per day of first calving interval (kg)	3.95	0.07
6	Profit in first lactation (Rs.)	1992.02	370.79
7	Average profit per day of first calving interval (Rs.)	5.43	0.08
8	Average first dry period (days)	180.27	4.5
Herd life traits			
1	Herd life milk yield (kg)	5381.07	66.63
2	Average milk per day of herd life (kg)	4.77	0.04
3	Herd life profit (Rs.)	8698.62	946.49
4	Average profit per day of herd life (Rs.)	6.98	0.75

coefficient of determinations were non-significant for herd life milk yield and average milk yield per day of herd life indicating that age at first calving was not important trait to affect herd life traits. However, if we compare the real time importance of age at first calving for herd life production (HLMY and AMHL) and profit traits (PHL and APHL) then it was noticed that age at first calving was more important for profit traits than for production traits. None of the linear, quadratic or cubic regression coefficients were significant except herd life profit. However, negative value for linear regression coefficient of age at first calving indicated that there was scope of reducing age at first calving in buffaloes. Similar type of lower

degree of variation in herd life traits was reported by Prasad et. al. (1987) in cows.

Influence of weight at first calving on herd life traits

Weight at first calving was observed to be 483.58 ± 2.96 kg in the present study (Table 1) which was in agreement with the findings of Nautiyal and Bhat (1977), Sethi, and Nagarcenkar (1992). Weight at first calving caused 0.12, 0.29, 5.57 and 5.02 percent variation in the respective herd life milk yield, average milk yield per day of herd life, herd life profit and average profit per day of herd life. All the regression coefficients were non-significant indicating that weight was also not important for herd life traits. Comparing the importance of age at first calving and

Table 2
Third degree polynomial regression coefficients of herd life milk yield and profit on first lactation traits

Traits	Constant	Polynomial Regression Coefficients			R ² x 100
		Linear (b ₁)	Quadratic (b ₂)	Cubic (b ₃)	
Age at first calving					
Herd life milk yield	6887.165	-88.686	1.764	1.105 x 10 ⁻²	0.0238
Average milk yield per day of herd life	6.008	-0.117	2.499 x 10 ⁻³	1.709 x 10 ⁻⁵	0.699
Herd life profit	50941.73	-2293.99**	44.17**	-0.316**	1.14**
Average profit per day of herd life	35.632	-1.338	2.191 x 10 ⁻²	-1.426 x 10 ⁻⁴	12.48**
Weight at first calving					
Herd life milk yield	6236.817	-6.527	1.802 x 10 ⁻²	-20.95	0.127
Average milk yield per day of herd life	4.604	-3.490 x 10 ⁻³	1.106 x 10 ⁻⁵	-1.113 x 10 ⁻⁸	0.297
Herd life profit	26076.61	-14.440	-53.57	-8.106 x 10 ⁻⁵	5.57**
Average profit per day of herd life	20.111	-1.989 x 10 ⁻²	3.928 x 10 ⁻⁵	-1.011 x 10 ⁻⁷	5.02**
First lactation period					
Herd life milk yield	5495.943	-16.664	9.033 x 10 ⁻²	-1.157 x 10 ⁻⁴	41.90**
Average milk yield per day of herd life	2.117	1.930 x 10 ⁻²	-5.054 x 10 ⁻⁵	3.432 x 10 ⁻⁸	1.82**
Herd life profit	126859.7	-1052.91**	3.18**	-3.262 x 10 ^{-3**}	2.45**
Average profit per day of herd life	105.884	-0.854**	2.521 x 10 ⁻³	2.550 x 10 ^{-6**}	3.39**
First lactation milk yield					
Herd life milk yield	2079.745	1.523	3.833 x 10 ⁻⁴	-9.047 x 10 ⁻⁸	40.79**
Average milk yield per day of herd life	0.603	3.090 x 10 ^{-3**}	-7.424 x 10 ⁻⁷	9.155 x 10 ⁻¹¹	30.80**
Herd life profit	45965.32	-57.91**	2.62 x 10 ^{-2**}	-3.24 x 10 ⁻⁶	2.08**
Average profit per day of herd life	36.576	-4.407 x 10 ^{-2**}	1.963 x 10 ^{-5*}	-2.415 x 10 ⁻⁹	1.51**
Average milk yield per day of first calving interval					
Herd life milk yield	3057.035	709.574	-29.323	1.562	22.08**
Average milk yield per day of herd life	1.402	0.725**	6.710 x 10 ⁻³	-1.778 x 10 ⁻⁵	53.88**
Herd life profit	30905.15	18637.26**	-2683.32*	155.79	7.71**
Average profit per day of herd life	-14.645	7.916	-0.649	2.948 x 10 ⁻²	8.34**
Profit in first lactation					
Herd life milk yield	5262.664	9.312 x 10 ^{-2**}	-1.990 x 10 ⁻⁵	-2.609 x 10 ^{-8*}	25.39**
Average milk yield per day of herd life	3.999	9.520 x 10 ^{-5**}	2.771 x 10 ⁻¹⁰	-7.515 x 10 ^{-14**}	34.57**
Herd life profit	2287.6	2.087**	2.825 x 10 ^{-5**}	8.109 x 10 ⁻⁸	73.06**
Average profit per day of herd life	2.472	1.680 x 10 ^{-3**}	1.643 x 10 ^{-8**}	2.413 x 10 ^{-10*}	77.89**
Average profit per day of first calving interval					
Herd life milk yield	3056.179	507.577	-15.112	0.577	22.08**
Average milk yield per day of herd life	1.4	0.519*	3.320 x 10 ⁻³	-6.438 x 10 ⁻⁴	53.87**
Herd life profit	30943.83	13333.04**	-1372.345**	56.934	7.77**
Average profit per day of herd life	-14.683	5.674	-0.334	1.091 x 10 ⁻²	8.34**
First dry period					
Herd life milk yield	5938.566	-6.918	2.675 x 10 ⁻²	-2.871 x 10 ⁻⁵	0.4208
Average milk yield per day of herd life	5.302	-9.450 x 10 ^{-3**}	1.775 x 10 ⁻⁵	-1.423 x 10 ⁻⁸	13.46**
Herd life profit	22725.54	-114.41**	0.213	-1.963 x 10 ⁻⁴	6.02**
Average profit per day of herd life	20.299	-0.108*	1.966 x 10 ⁻⁴	-1.461 x 10 ⁻⁷	7.40**

weight at first calving for any of the herd life traits, weight at first calving was more important than age at first calving as indicated by R^2 values (Table 2). The comparative influence of weight at first calving on herd life profit was 5 times more ($R^2 = 5.57\%$) than that of herd life milk yield ($R^2 = 1.14\%$) indicating that more emphasis should be given on weight at first calving to earn more profit.

Influence of first lactation period on herd life traits

Average of first lactation period in the study was noticed to be 302 days, which was very close to standard lactation period in buffaloes. First lactation period could influence only 41.90, 1.82, 2.45 and 3.39 percent of variation in herd life milk yield, average milk yield per day of herd life, herd life profit and average profit per day of herd life respectively (Table 2). Linear, quadratic and cubic regression coefficient of both profit traits was significant (Table 2) indicating the importance of the first lactation period on determining the profit. As per expectation, increase in lactation period resulted in increase in milk and they're by herd life profit.

Influence of first lactation milk yield on herd life traits

First lactation 305-day milk yield was observed to be 1818.44 ± 21.26 kg (Table 1) and coefficient of variation was 23.04%, which was in close agreement with the findings of Kuralkar (1996). The result of polynomial regression equation (30) of herd life traits on milk yield have been presented in Table 2, which indicated that 40.7 and 30.8 percent of variation in herd life milk yield and average milk yield per day on herd life was explained only by first lactation milk yield. Regression curve

of all the herd life traits on first lactation milk yield has been presented in Figure 1, which indicated that if first lactation milk yield was increased up to 4000 kg, there was scope of increasing herd life milk yield and average milk yield per day of herd life and there after it may decline which was observed in the present data. Average milk yield per day of herd life expressed increasing trend due to increase in first lactation milk yield.

The variability in herd life profit and average profit per day of herd life was explained to the extent of 2.08 and 1.51 percent by first lactation milk yield. Though the coefficient of determinations were significant at $P < 0.01$ but were very low indicating that traits responsible for expenditure on buffaloes were important for profit rather than only first lactation milk yield. Therefore, more emphasis was to be given on the management so that there was reduction in cost of maintaining the buffaloes. Selecting the buffaloes for increased milk production up to 4000 kg in first lactation will help in increasing the income and therefore increase the profit.

Influence of average milk yield per day of first calving interval on herd life traits

The linear trend of relationship between milk yield per day of first calving interval (3.95 ± 0.07) and all the four dependent variables (herd life traits) presented in (Table 2) indicated that increase in milk yield per day of first calving interval will result in to an increase in herd life milk yield, herd life profit and average profit per day of herd life.

The optimum level of milk yield per day of first calving interval (Figure 2) was much beyond the existing level of the trait in the present data. The average milk yield per day of first calving interval can fur-

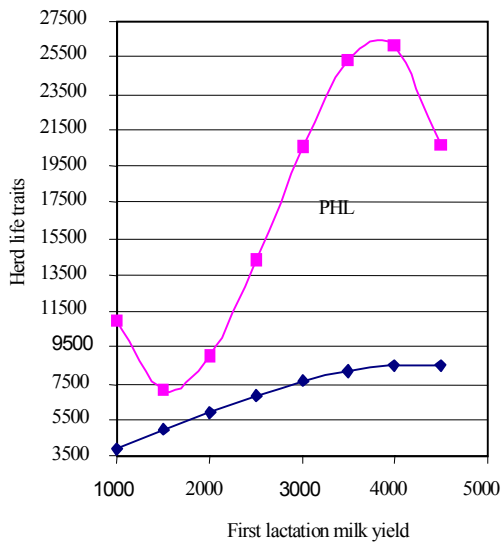


Fig. 1. Polynomial regression curve of HLMY & PHL on first lactation milk yield

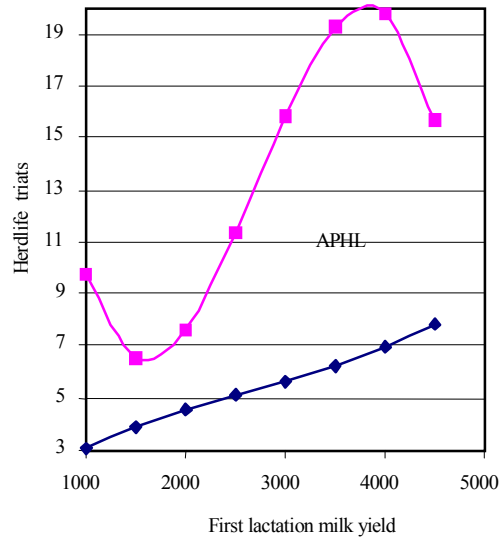


Fig. 2. Polynomial regression curve of AHLM & APHL on first lactation milk yield

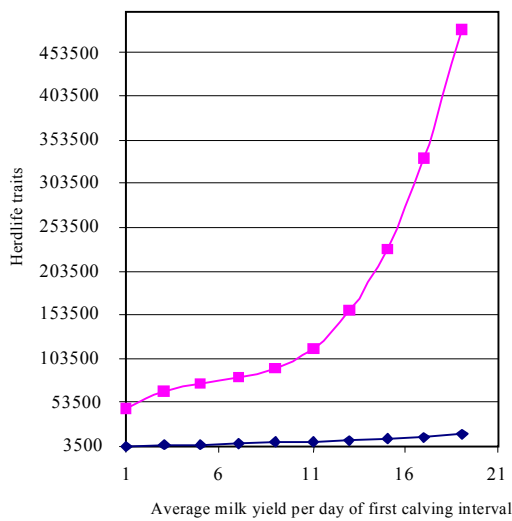


Fig. 3. Polynomial regression curve of HLMY & PHL on average milk yield per day of first calving interval

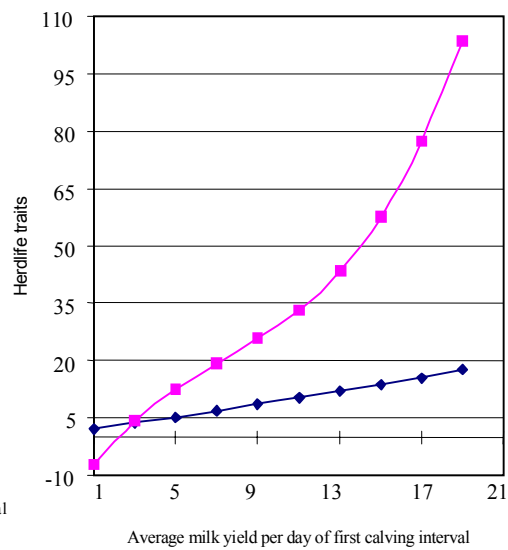


Fig. 4. Polynomial regression curve of AHLM Y & APHL on average milk yield per day of first calving interval

ther be increased without affecting the profit or production traits at herd life.

Influence of first lactation profit on herd life traits

Due to multi-colinearity between first lactation profit with herd life profit and herd life profit per day of herd life, coefficients of determination were 0.730 and 0.778 (Table 2) indicating that 73 and 77 percent of variation in herd life profit traits could be explained by variation in profit in first lactation only.

Profit in first lactation was able to explain only 25.3 and 34.5 % of variation in herd life milk yield and average milk yield per day of herd life. It indicated that more emphasis on milk production in first lactation along with body weight at first calving should be given for selecting animals for herd life milk production traits.

Influence of average profit per day of first calving interval on herd life traits

Least squares mean of average profit per day of first calving interval was Rs. 5.43 ± 0.08 with coefficient of 228.77 percent. Similar trait was studied by Sharma (1982) and was reported to be loss than profit. Average profit per day of first calving interval could explained 53.87 percent of variation in average milk yield per day of herd life while it could explain very less (7.77 to 8.34 percent) amount of variation in herd life profit and average profit per day of herd life.

Influence of first dry period on herd life traits

The average first dry period noticed in the present study was 180.27 ± 4.50 days which was in agreement with the findings of Dutt and Tanejs (1995). Comparing the R2 values of age at first calving, weight at first calving and first dry period, it could

be concluded that first dry period was more important for any of the herd life traits.

Conclusion

It was concluded that emphasis should be given on increasing first lactation profit for increasing herd life traits than only increasing first lactation milk yield or age and weight at first calving.

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