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Studies on Persistency of Milk Yield in Phule Triveni

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A B S T R A C T

The records pertaining to 1049 lactations of 382, Phule Triveni cows maintained at Research Cum Development Project on Cattle, MPKV, Rahuri over a period of 40 years from1977-2016, were used for research work. The least squares means of milk production traits and persistency of milk yield were estimated by considering the effect of period of calving, season of calving, order of lactation, age at first calving and peak milk yield. The data were first adjusted for the significant effect of non-genetic factors considered in this study and then stepwise regression analysis was carried out. Persistency of milk yield was significantly affected by period of calving, season of calving, order of lactation and peak milk yield. The lactation milk yield can be (R^2-96.8 %) predicted by using persistency index P_6 including lactation length and peak milk yield by using Y= -2967.97+14.74 PI+ 0.18 LL+ 195.76 PMY equation in Phule Triveni cattle.

Introduction

The persistency of milk production is of economical interest to dairy farmers as it is closely associated with the total milk production in cows. Persistency is generally expressed as the rate of decline in milk yield from maximum production after parturition until milk secretion ceases. Milk yield is the result of interaction between genetic constitution of animal and its environment in which they thrive. Milk yield is complex character observed at later age and thus direct selection for it, may not be very efficient at an early age hence selection for milk yield may be based on highly heritable but easily associated with milk yield. Milk production is the major trait around which the economy of dairy animal revolves. The milk production criteria includes various trait viz. peak yield, days to attain peak yield, total milk yield and lactation length.

Persistency of milk yield is important factor which determines the shape of lactation curve. There is also consideration that highly persistent animal have more milk yield and thus provide regular source of income to the farmer throughout the year. Persistent animals are more beneficial to farmers to maintain it's economic development. Therefore, present investigation was carried out to study persistency of milk yield in Phule Triveni.

Materials and Methods

The records pertaining to 1049 lactations of 382, Phule Triveni cows maintained at Research Cum Development Project on Cattle, MPKV, Rahuri Dist. Ahmednagar (Maharashtra) over a period of 40 years from1977-2016, were used for research work. All complete lactations with lactation length not less than 200 days and lactation yield not less than 1000 kg were analyzed.

To examine the persistency of milk yield, the research data was classified into 7 periods of calving viz. P_1 (1977-1982), P_2 (1983-1988), P_3 (1989-1994), P_4 (1995-2000), P_5 (2001-2006), P_6 (2007-2013), and P_7 (2013- 2016); 3 seasons of birth, viz. S_1 (Rainy) June-September, S_2 (Winter) October-January and S_3 (Summer) February-May; 5 order of lactation viz. L_1 first lactation, L_2 second lactation, L_3 third lactation, L_4 fourth lactation, L_5 fifth lactation; 3 different age at first calving groups as A_1 (<860 days), A_2(861-1000 days), A_3(≥1001 days); and 3 peak milk yield groups viz. Y_1 (12 kg), Y_2 (12-14 kg), Y_3(>14 kg). Persistency index was calculated by following methods:

Method I (Johanson and Hanson, 1940)

$$PI_1 = \frac{2^{nd}\ 14 \text{ week yield}}{1^{st}\ 14 \text{ week yield}} \times 100$$

$$PI_2 = \frac{3^{rd}\ 14 \text{ week yield}}{1^{st}\ 14 \text{ week yield}} \times 100$$

Method -2 (Ludwick and Peterson, 1943)

$$PI_3 = \frac{\left(4\frac{x_2}{x_1} + 3\frac{x_3}{x_2} + 2\frac{x_4}{x_3}\right)}{9}$$

$$PI_4 = \frac{4\frac{x_2}{x_1} + 3\frac{x_3}{x_2}}{7}$$

Where, x_1, x_2, x_3 and x_4 are 1st, 2nd, 3rd and 4th ten weak yield.

Method -3 (Mahadevan, 1951)

$PI_5 = (A-B) / B$

where,

A =Total lactation milk yield in first 26 week of lactation; and,
B = Lactation yield in first 10 week of lactation.

Method -4 (Rao and Sundaresan, 1982)

$$PI_6 = \frac{\text{Lactation milk yield}}{\text{Peak yield}}$$

Method-5 (Weller *et al.*, 1987)

$$PI_7 = \frac{5^{th} \text{ month postpartum production}}{\text{Peak postpartum production}}$$

The following model was used for step-wise regression of milk yield on lactation length, peak yield and a measure of persistency taken one by one:

$$\gamma = a + b_1(X_1 - X_1) + b_2(X_2 - X_2) + b_3(X_3 - X_3) + e$$

Where, b' s are the partial regression coefficients and X_1, X_2,X_3 and Y are the persistency index, peak yield, lactation length and lactation yield respectively. The residual error (e) is NID $(0,\delta^2 e)$.

Results and Discussion

The persistency of milk yield was calculated by five different methods viz., Method I (Johanson and Hanson, 1940), Method II (Ludwick and Peterson, 1943), Method III (Mahadevan, 1951), Method IV (Rao and Sundarsean, 1982) and Method V (Weller *et al.*, 1987) in Phule Triveni and presented.

Table.1 Least squares means of persistency of milk yield in Phule Triveni

	N	Method-I		Method-II		Method-III	Method-IV	Method-V
		PI_1	PI_2	PI_3	PI_4	PI_5	PI_6	PI_7
µ	1049	81.80 ± 0.86	53.16 ± 1.50	0.84 ± 0.006	0.88 ± 0.006	1.38 ± 0.15	195.53 ± 2.21	18.89 ± 0.20
Period of Calving								
P_1	199	82.32^{b} ± 1.49	56.08^{bc} ± 2.60	0.85^{b} ± 0.011	0.88^{b} ± 0.011	1.38 ± 0.026	194.03^{b} ± 3.82	19.05^{abc} ± 0.35
P_2	362	85.84^{b} ± 1.11	58.53^{b} ± 1.93	0.87^{b} ± 0.008	0.90^{b} ± 0.008	1.40 ± 0.019	216.55^{c} ± 2.84	19.91^{bc} ± 0.26
P_3	257	84.39^{b} ± 1.10	53.32^{b} ± 1.91	0.86^{b} ± 0.008	0.89^{b} ± 0.008	1.40 ± 0.019	198.81^{bc} ± 2.82	18.96^{abc} ± 0.25
P_4	79	80.41^{b} ± 1.92	51.88^{b} ± 3.34	0.84^{b} ± 0.014	0.87^{b} ± 0.014	1.38 ± 0.033	189.51^{b} ± 4.92	18.47^{abc} ± 0.45
P_5	80	82.58^{b} ± 1.98	64.67^{c} ± 3.45	0.87^{b} ± 0.014	0.89^{b} ± 0.014	1.39 ± 0.034	192.41^{b} ± 5.08	18.15^{ab} ± 0.46
P_6	48	83.44^{b} ± 2.48	50.07^{b} ± 4.31	0.85^{b} ± 0.018	0.90^{b} ± 0.018	1.43 ± 0.042	213.70^{c} ± 6.34	20.32^{c} ± 0.58
P_7	24	73.65^{a} ± 3.43	37.57^{a} ± 5.97	0.74^{a} ± 0.024	0.82^{a} ± 0.025	1.28 ± 0.059	163.71^{a} ± 8.78	17.38^{a} ± 0.80
Season of Calving								
S_1	333	86.25^{c} ± 1.12	58.89^{b} ± 1.95	0.86^{c} ± 0.008	0.90^{c} ± 0.008	1.41^{b} ± 0.019	200.46^{b} ± 2.88	19.33^{b} ± 0.26
S_2	394	81.51^{b} ± 1.10	50.83^{a} ± 1.92	0.84^{b} ± 0.008	0.88^{b} ± 0.008	1.41^{b} ± 0.019	193.55^{a} ± 2.83	19.30^{b} ± 0.26
S_3	322	77.65^{a} ± 1.17	49.76^{a} ± 2.03	0.82^{a} ± 0.008	0.85^{a} ± 0.008	1.31^{a} ± 0.020	192.58^{a} ± 3.00	18.05^{a} ± 0.27
Order of Lactation								
L_1	384	83.03 ± 1.06	58.52^{b} ± 1.84	0.86^{b} ± 0.008	0.88 ± 0.008	1.40 ± 0.018	200.82^{b} ± 2.71	18.88 ± 0.24
L_2	276	82.00 ± 1.18	50.79^{a} ± 2.06	0.83^{a} ± 0.008	0.87 ± 0.009	1.38 ± 0.020	192.61^{ab} ± 3.04	18.76 ± 0.27
L_3	189	79.72 ± 1.36	52.31^{a} ± 2.37	0.83^{a} ± 0.010	0.86 ± 0.010	1.34 ± 0.023	188.23^{a} ± 3.50	18.35 ± 0.32
L_4	127	82.40 ± 1.62	52.20^{a} ± 2.83	0.84^{a} ± 0.012	0.88 ± 0.012	1.38 ± 0.028	198.35^{b} ± 4.16	19.15 ± 0.38
L_5	73	81.87 ± 2.06	51.99^{a} ± 3.59	0.84^{a} ± 0.015	0.89 ± 0.015	1.40 ± 0.035	197.65^{b} ± 5.29	19.33 ± 0.48
Age at First Calving								
A_1	412	82.21 ± 1.20	52.13 ± 2.09	0.84 ± 0.009	0.88 ± 0.009	1.39 ± 0.021	195.12 ± 3.08	18.86 ± 0.28
A_2	341	80.86 ± 1.15	52.07 ± 2.00	0.84 ± 0.008	0.87 ± 0.008	1.37 ± 0.020	195.84 ± 2.95	18.82 ± 0.27
A_3	296	82.35 ± 1.17	55.28 ± 2.04	0.85 ± 0.008	0.88 ± 0.008	1.39 ± 0.020	195.63 ± 3.01	18.99 ± 0.27
Peak Milk Yield								
Y_1	167	87.95^{c} ± 1.47	56.90^{b} ± 2.55	0.88^{c} ± 0.010	0.92^{c} ± 0.011	1.49^{c} ± 0.025	200.14^{b} ± 3.75	19.93^{c} ± 0.34
Y_2	275	81.52^{b} ± 1.20	53.43^{a} ± 2.09	0.84^{b} ± 0.009	0.88^{b} ± 0.009	1.38^{b} ± 0.021	199.85^{b} ± 3.08	19.19^{b} ± 0.28
Y_3	607	75.95^{a} ± 0.96	49.15^{a} ± 1.66	0.80^{a} ± 0.007	0.83^{a} ± 0.007	1.28^{a} ± 0.016	186.60^{a} ± 2.45	17.55^{a} ± 0.22

Means with different superscripts differ significantly from each other

Table.2 Step-wise regression of lactation yield on lactation length (LL), peak milk yield (PMY), persistency index (PI)

Step	Variable	Partial 'b'	SE of 'b'	Partial 't'	Intercept	R^2(%)
I	PI_1	14.95	0.83	17.81	-3435.63	76.2
	LL	7.11	0.24	28.76		
	PMY	186.97	3.99	46.79		
II	PI_2	6.57	0.605	10.86	-1971.91	72.1
	LL	5.83	0.312	18.69		
	PMY	175.32	4.22	41.54		
III	PI_3	2209.10	127.28	17.35	-3676.53	75.9
	LL	5.89	0.266	22.13		
	PMY	186.73	4.02	46.42		
IV	PI_4	2070.36	118.10	17.53	-4015.53	76
	LL	7.03	0.24	28.25		
	PMY	188.35	4.03	46.63		
V	PI_5	757.92	51.47	14.72	-3306.411	74.3
	LL	7.39	0.25	28.89		
	PMY	184.81	4.16	44.33		
VI	PI_6	14.74	0.154	95.89	-2967.97	**96.8**
	LL	0.18	0.118	1.55		
	PMY	195.76	1.427	137.20		
VII	PI_7	85.43	3.08	27.70	-3799.94	82.1
	LL	7.07	0.21	33.07		
	PMY	187.13	3.39	55.08		

Note- All requested variable entered

The least squares means for persistency index PI_1, PI_2, PI_3, PI_4, PI_5, PI_6 and PI_7 in Phule Triveni indicated that the overall least squares means for corresponding persistency were 81.80 ± 0.86, 53.16 ± 1.50, 0.84 ± 0.006, 0.88 ± 0.006, 1.38±0.15, 195.53 ± 2.21 and 18.89 ± 0.20, respectively shown in Table 1. The period of calving had significant ($P<0.01$) effect on persistency of milk yield estimated by PI_1, PI_2, PI_3, PI_4, PI_6, PI_7 in Phule Triveni. The effect of season of calving on persistency of milk yield was significant in PI_1, PI_2, PI_3, PI_4, PI_5, PI_6 and PI_7. The Lactation order had significant effect on persistency of milk yield in PI_2, PI_3, PI_6. The effect of age at first calving had non significant effect on persistency of milk yield estimated by all five methods.. The peak milk yield had significant effect on persistency of milk yield in PI_1, PI_2, PI_3, PI_4, PI_5, PI_6, and PI_7 (Table 1).

For prediction of LMY step down regression analysis was carried out. For step down regression analysis LL, PMY and various persistency indexes were considered. Out of them LL and PMY was kept constant and only persistency index was changed for regression analysis. From results depicted in Table 2 indicated that prediction of LMY by using LL, PMY and various persistency indexes all were having R^2. However, prediction of LMY by using LL, PMY and persistency index PI_6 had maximum R^2 (96.8%). From these results it can be

recommended that for prediction of LMY in Phule Triveni following equation can be used.
Y= -2967.97 + 14.74 PI + 0.18 LL + 195.76 PMY.

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