



Studies on Production Performance of Phule Triveni

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Abstract

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 from 1977-2016, were used for research work. The overall least squares mean for 300 DMY, LMY, PMY, DAPMY and LL in Phule Triveni were 2638.76±31.61 kg, 2692.48±37.02 kg, 13.91±0.10 kg, 32.71±0.65 days and 331.89±2.96 day, respectively. Most of the traits under study were significantly affected by period of calving, lactation order and peak milk yield, while season of calving and age at first calving had non-significant effect.

Keywords: Lactation Milk Yield, Milk Production, Peak Milk Yield, Period of Calving, Phule Triveni



Introduction

Milk production is the major trait around which the economy of dairy animal revolves. In village it is the main trait on the basis of which cows are selected. The milk production criteria include various trait *viz.* peak yield, days to attain peak yield, total milk yield and lactation length. The lactating animals are primarily evaluated on the basis of peak yield and market values of cows are fixed on quantity of milk given by a cow at peak yield. Milk yield is the result of interaction between genetic constitution of animal and environment in which they thrive. To achieve maximum productivity the deliberate manipulation of phenotype of animal as well as environment is necessary and this manipulation should result in attainment of a suitable balance between the genetic capability and the environment. 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.

Materials and Methods

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 from 1977-2016, were used for present research work. The traits considered for production performance of Phule Triveni cows were 300 days milk yield (300 DMY), Lactational milk yield (LMY), Peak milk yield (PMY), Days to attain peak milk yield (DAPMY) and Lactation length (LL). To examine milk production performance of Phule Triveni the research data was classified into 7 periods of calving *viz.* P1 (1977-1982), P2 (1983-1988), P3 (1989-1994), P4 (1995-2000), P5 (2001-2006), P6 (2007-2013), and P7 (2013- 2016); 3 seasons of birth, *viz.* S1 (Rainy) June- September, S2 (Winter) October-January and S3 (Summer) February-May; 5 order of lactation *viz.* L1 first lactation, L2 second lactation, L3 third lactation, L4 fourth lactation, L5 fifth lactation; 3 different age at first calving groups as A1 (<860 days), A2(861-1000 days) and A3(\geq 1001 days); and 3 peak milk yield groups *viz.* Y1 (12 kg), Y2 (12-14 kg) and Y3(>14 kg). In order to overcome non-orthogonality of data resulting from unequal and disproportionate subclass frequencies, the least-squares method as suggested by Harvey (1990) was used for analysis of data of production traits *viz.*, 300 days milk yield, lactational milk yield, peak milk yield, days to attain peak milk yield and lactation length of Phule Triveni.

Model

$$Y_{ijklmn} = \mu + P_i + S_j + L_k + A_l + B_m + e_{ijkmn}$$

Where,

Y_{ijklmn} = n th individual having i th period of calving, j th season of calving, k th lactation order, l th AFC group and m th PMY group.

μ = Overall mean,

P_i = Effect of i th period of calving, ($i = 1, 2, \dots, 7$)

S_j = Effect of j th season of calving ($j = 1, 2$ and 3)

L_k = Effect of k th order of lactation ($k = 1, 2, \dots, 5$)

A_l = l th AFC group ($l = 1, 2$, and 3)

B_m = m th PMY group ($m = 1, 2$, and 3)

e_{ijkmn} = The Random error associated with $NID \sim (0, \delta^2 e)$.

Whenever the effects were significant the differences between means were tested for significance by Duncan's Multiple Range Test (DMRT) as modified by Kramer (1957) to make pair wise comparison between the least-squares means with the use of inverse elements root mean squares for error.

Result and Discussion

300 Days Milk Yield

The overall least squares mean for 300 days milk yield in Phule Triveni was 2638.76 ± 31.61 kg. The least squares analysis of variance showed that influence of period of calving, lactation order, peak milk yield on 300 days milk

yield was found significant in Phule Triveni (Table 1). The highest 300 days milk yield (2966.00 ± 88.46 kg) was observed in cows calved in P6 and lowest (2315.64 ± 133.02 kg) in P7 period of calving in Phule Triveni. These variations might be due to different herd strength and variations in feeding and management during respective periods. The 300 DMY of cows calved during L5 (2822.90 ± 73.98 kg) was significantly higher than cows calved in rest of the lactations. The DMRT revealed that 300 DMY of cows of Y1 (2123.27 ± 53.20 kg), Y2 (2601.17 ± 42.75 kg) and Y3 (3191.83 ± 34.41 kg) PMY groups was significantly differed from each other. These results indicated that as peak milk yield increased the 300 days milk yield also simultaneously increased.

Table 1: Analysis of variance for 300DMY, LMY, PMY, DAPMY, LL in Phule Triveni

Source/ Traits	Period of calving		Season of calving		Order of lactation		Age at first calving		Peak milk yield		Total	Error
	d.f	MSS	d.f	MSS	d.f	MSS	d.f	MSS	d.f	MSS	d.f	M.S.S.
300 DMY	6	3961536.488**	2	548280.44	4	2408396.439**	2	43629.907	2	56865800.059**	852	275631.31
LMY	6	10093326.157**	2	430668.77	4	2094620.133*	2	168665.92	2	86432784.495**	1032	502249.51
PMY	6	25.136**	2	19.143	4	81.873**	2	3.643	2	3122.721**	1032	4.05
DAPMY	6	780.601**	2	1591.39**	4	166.387	2	504.558*	2	296.886	1032	155.88
LL	6	5903.603	2	1162.856	4	10409.338*	2	1586.393	2	3966.55	1032	3209.95

(* = $P < 0.05$), (** = $P < 0.01$)

Lactation Milk Yield

The overall least squares mean for lactation milk yield observed in the present investigation was 2692.48 ± 37.02 kg. The least squares analysis of variance showed that influence of period of calving, lactation order and peak milk yield had significant effect while season of calving and age at first calving had non-significant effect on lactation milk yield in Phule Triveni (Table 1). The DMRT revealed that cows calved during period P2 had significantly higher LMY than cows calved in rest of the periods. The LMY of cows calved during L5 (2826.97 ± 88.31 kg) was significantly higher than cows calved in rest of the lactations (Table 2). The present results indicated that in Phule Triveni the LMY gradually increased from 1st lactation to 5th lactation. This might be attributed to their physiological development of body, milk secretory tissues and mammary gland with advancing age. The DMRT revealed that LMY of cows of Y1, Y2 and Y3PMY groups was significantly differed from each other. These results indicated that as peak milk yield increased the lactational milk yield also simultaneously increased.

Peak Milk Yield

The overall least squares mean for peak milk yield in Phule Triveni was 13.91 ± 0.10 kg. The variation due to period of calving and lactation order in peak milk yield was significant ($P < 0.01$) in Phule Triveni. The DMRT revealed that cows calved during period P6 had significantly higher PMY than cows calved in rest of the periods. The PMY of cows calved during L5 (14.69 ± 0.25 kg) was significantly higher than cows calved in rest of the lactations. The PMY of cows calved during lactation L3, L4 and L5 were at par from each other.

Days to Attain Peak Milk Yield

The overall average number of days required to attain peak milk yield was 32.71 ± 0.65 days in Phule Triveni. The least squares analysis of variance showed that influence of period of calving, season of calving, age at first calving on days to attain peak milk yield was found significant. In present study the cows calved during period P4 (35.79 ± 1.44 days) required significantly higher days to attain peak milk yield than those calved during rest of the periods. The winter calved cows required significantly more days (35.13 ± 0.83 days) to reach peak milk yield than summer calvers (31.61 ± 0.88 days) and rainy calvers (31.39 ± 0.84 days). The DAPMY of cows of A₁ age at first calving group (34.19 ± 0.90 days) was significantly higher than A₃ (32.03 ± 0.88 days) and A₂ (31.91 ± 0.86 days) groups which did not differed significantly from each other.

Table 2: Least squares means of 300DMY, LMY, PMY, DAPMY, LL in Phule Triveni

μ	N	300 DMY (Kg)	N	LMY (Kg)	PMY (Kg)	DAPMY(Days)	LL (Days)
		Mean \pm SE		Mean \pm SE	Mean \pm SE	Mean \pm SE	Mean \pm SE
	869	2638.76 \pm 31.61	1049	2692.48 \pm 37.02	13.91 \pm 0.10	32.71 \pm 0.65	331.89 \pm 2.96
Period of Calving							
P ₁	169	2674.28 ^b \pm 52.55	199	2665.41 ^b \pm 63.92	13.93 ^b \pm 0.18	30.36 ^{ab} \pm 1.12	326.53 \pm 5.11
P ₂	297	2913.67 ^c \pm 39.42	362	3120.34 ^c \pm 47.52	14.41 ^c \pm 0.13	29.66 ^a \pm 0.83	337.87 \pm 3.79
P ₃	203	2554.07 ^b \pm 39.64	257	2634.05 ^b \pm 47.11	13.48 ^{ab} \pm 0.13	34.25 ^b \pm 0.83	328.13 \pm 3.76
P ₄	71	2501.91 ^b \pm 64.73	79	2593.75 ^b \pm 82.15	13.90 ^{ab} \pm 0.23	35.79 ^b \pm 1.44	336.23 \pm 6.56
P ₅	75	2545.74 ^b \pm 65.65	80	2620.90 ^b \pm 84.84	13.57 ^{ab} \pm 0.24	32.52 ^{ab} \pm 1.49	330.17 \pm 6.78
P ₆	38	2966.00 ^c \pm 88.46	48	3091.61 ^c \pm 105.96	14.60 ^c \pm 0.30	35.17 ^{ab} \pm 1.86	346.87 \pm 8.47
P ₇	16	2315.64 ^a \pm 133.02	24	2121.29 ^a \pm 146.62	13.45 ^a \pm 0.41	31.20 ^{ab} \pm 2.58	317.42 \pm 11.72
Season of Calving							
S ₁	282	2660.90 \pm 39.94	333	2722.04 \pm 48.09	13.64 \pm 0.13	31.39 ^a \pm 0.84	332.31 \pm 3.84
S ₂	328	2668.49 \pm 39.04	394	2703.56 \pm 47.24	14.09 \pm 0.13	35.13 ^b \pm 0.83	329.91 \pm 3.77
S ₃	259	2586.88 \pm 42.97	322	2651.82 \pm 50.07	13.99 \pm 0.14	31.61 ^a \pm 0.88	333.45 \pm 4.00
Order of Lactation							
L ₁	336	2449.92 ^a \pm 36.85	384	2579.71 ^a \pm 45.25	12.93 ^a \pm 0.12	33.95 \pm 0.79	340.06 ^{bc} \pm 3.61
L ₂	217	2569.30 ^b \pm 43.05	276	2567.63 ^b \pm 50.74	13.54 ^b \pm 0.14	33.36 \pm 0.89	327.46 ^{ab} \pm 4.05
L ₃	154	2630.08 ^b \pm 49.27	189	2666.18 ^b \pm 58.42	14.33 ^c \pm 0.16	31.94 \pm 1.02	330.07 ^{abc} \pm 4.67
L ₄	105	2721.59 ^c \pm 57.88	127	2781.89 ^c \pm 69.54	14.04 ^c \pm 0.19	32.87 \pm 1.22	340.10 ^c \pm 5.55
L ₅	57	2822.90 ^c \pm 73.98	73	2826.97 ^c \pm 88.31	14.69 ^c \pm 0.25	31.43 \pm 1.55	321.75 ^a \pm 7.06
Age at First Calving							
A ₁	336	2642.56 \pm 43.78	412	2674.77 \pm 51.47	13.78 \pm 0.14	34.19 ^a \pm 0.90	329.39 \pm 4.11
A ₂	281	2650.45 \pm 41.48	341	2718.02 \pm 49.30	13.98 \pm 0.14	31.91 ^a \pm 0.86	333.69 \pm 3.94
A ₃	252	2623.26 \pm 41.32	296	2684.64 \pm 50.28	13.96 \pm 0.14	32.03 ^a \pm 0.88	332.59 \pm 4.02
Peak Milk Yield							
Y ₁	132	2123.27 ^a \pm 53.20	167	2112.47 ^a \pm 62.72	10.72 ^a \pm 0.17	33.64 \pm 1.10	328.18 \pm 5.01
Y ₂	229	2601.17 ^b \pm 42.75	275	2670.23 ^b \pm 51.51	13.40 ^b \pm 0.14	32.92 \pm 0.90	331.45 \pm 4.11
Y ₃	508	3191.83 ^c \pm 34.41	607	3294.73 ^c \pm 40.96	17.60 ^c \pm 0.11	31.56 \pm 0.72	336.03 \pm 3.27

Lactation Length

The overall least squares mean for lactation length observed in the present investigation was 331.89 \pm 2.96 days. The lactation length was non-significantly affected by period of calving, season of calving, age at first calving and peak milk yield. The least squares analysis of variance revealed that order of lactation had significant ($P < 0.05$) effect on lactation length in Phule Triveni (Table 1). The DMRT indicated that the L₄ had significantly higher lactation length than rest of lactation and L₅ had lowest lactation length among rest of lactation orders.

Conclusion

Least squares means for 300 DMY, LMY, PMY, DAPMY and LL in Phule Triveni were observed as 2638.76 \pm 31.61 kg, 2692.48 \pm 37.02 kg, 13.91 \pm 0.10 kg, 32.71 \pm 0.65 days and 331.89 \pm 2.96 days, respectively. Most of the traits under study were significantly affected by period of calving, lactation order and peak milk yield, while season of calving and age at first calving had non-significant effect.

Conflict of Interests

There is no conflict of interest.

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