

Prediction of lifetime milk production on the basis of lactation traits in Phule Triveni crossbred cattle

N V SHINDE¹, M G MOTE², B B KHUTAL³ and D Z JAGTAP⁴

Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra 413 722 India

Received: 12 November 2009; Accepted: 6 July 2010

ABSTRACT

The data on early lactation traits, production efficiency traits of Phule Triveni Cows maintained at the MPKV, Rahuri, Maharashtra from 1978 to 2007 were used to predict lifetime milk production up to third lactation. Set-I consisting of 2 out of 7 for first lactation traits the best equation under multiple regression model explained 50.91% accuracy of prediction in LTP-3. The best equation under Set-II containing 3 out of 11 for first and second lactation traits showed 74.28% accuracy. When only production efficiency traits were incorporated in the prediction equation then the best equation having 3 out of 6 production efficiency traits explained 48.70% accuracy of prediction. The optimum equations under Set-IV including 4 out of 17 traits for LTP-3 lactation explained 88.03% accuracy of prediction. It was observed that the inclusion of production efficiency traits along with first and second lactation traits in an equation showed significant increase in R^2 value.

Key words : Cattle, Early lactation traits, Lactation traits, Lifetime milk production, Prediction, Productivity

Milk yield is the basic and important trait on which the economy of dairying is based. Economic variability of dairy animals in any farm depends on its life time productivity. The production, reproduction and production efficiency traits of first and second lactation are related to the life time milk production. Therefore, this study was planned to find the association between first and second lactation traits and lifetime milk production up to third lactation, and to predict lifetime milk production up to third lactation from first and second lactation traits of Phule Triveni (triple crossbred) cattle.

MATERIALS AND METHODS

Data of 132 Phule Triveni cows on first and second lactation traits, production efficiency traits and lifetime production traits up to third lactation maintained at Research cum Development Project on Cattle, Mahatma Phule Krishi Vidyapeeth, Rahuri from 1978 to 2007. The data regarding different traits such as age at first calving (AFC) lactation milk yield (LMY), lactation length (LL), peak yield (PY), service period (SP), dry period (DP) and calving interval (CI) for first and second lactation were classified. The different production efficiency traits included in the study

were FLMY/FLL, SLMY/SLL, FLMY + SLMY/FLL + SLL, and FLMY + SLMY/FCI + SCI. Records of abnormal cases

Table 1. Phenotypic correlation of early lactation traits with LTP-3

Early lactation traits	LTP-3
Age at first calving (AFC)	0.05
First Peak yield (FPY)	0.56**
First lactation milk yield (FLMY)	0.70**
First lactation length (FLL)	0.43**
First service period (FSP)	0.30**
First dry period (FDP)	-0.08
First calving interval (FCI)	0.26*
Second peak yield (SPY)	0.58**
Second lactation milk yield (SLMY)	0.78**
Second lactation length (SLL)	0.27**
Second service period (SSP)	0.10
Second dry period (SDP)	-0.02
Second calving interval (SCI)	0.15
FLMY/FLL	0.52**
SLMY/SLL	0.49**
FLMY/FCI	0.49**
SLMY/SCI	0.59**
FLMY + SLMY/FLL + SLL	0.60**
FLMY+SLMY/FCI+SCI	-0.07

*, $P < 0.05$; **, $P < 0.01$; LTP-3, lifetime production up to third lactation.

Present address : ¹M. Sc. student, ²Assistant Professor, Regional Extension Centre, College of Agriculture, Pune 411 005.

³Associate Professor, ⁴Head, Division of Animal Science and Dairy Science, MPKV, Rahuri.

Table 2. Prediction of LTP-3 on the basis of ealy lactation traits using backward elimination procedure of multiple regression analysis.

Step	Variable	Partial 'b' value	SE of 'b'	Partial 't' value	Intercept	R ² (%)
<i>Set one</i>						
First	AFC	0.54	1.04	0.52	738.84	51.52
	FPY	93.78	105.51	0.89		
	FLMY	1.64	0.39	4.26		
	FLL	29.10	134.70	0.22		
	FSP	-1.68	3.45	-0.49		
	FDP	29.30	134.18	0.22		
	FCI	-23.68	134.45	-0.18		
Final	FLMY	1.86	0.17	10.84	2646.50	50.91
	FCI	3.46	1.51	2.30		
<i>Set two</i>						
First	AFC	1.25	0.75	1.66	-654.54	75.96
	FPY	37.77	77.50	0.49		
	FLMY	0.86	0.30	2.88		
	FLL	4.52	2.47	1.83		
	FSP	-0.16	2.49	-0.07		
	FCI	-1.34	2.64	-0.51		
	SPY	-58.20	75.92	-0.77		
	SLMY	1.64	0.28	5.79		
	SLL	-0.19	2.67	-0.07		
	SSP	-1.07	1.91	-0.56		
	SCI	2.28	1.40	1.64		
Final	FLMY	1.19	0.15	8.07	607.30	74.28
	SLMY	1.35	0.14	9.40		
	SLL	3.58	1.58	2.27		
<i>Set third</i>						
First	FLMY/FLL	-67.22	447.38	-0.15	269.89	49.37
	SLMY/SLL	-202.16	250.39	-0.81		
	SLMY/SCI	441.30	102.79	4.29		
	FLMY/FCI	207.00	169.10	1.22		
	FLMY + SLMY/ FLL+SLL	537.33	637.84	0.84		
	FLMY+ SLMY/ FCI+SCI	6405.90	2099.7	3.05		
	Final	FLMY/FLL	417.10	75.91		
SLMY/SCI		478.16	67.67	7.07		
FLMY+ SLMY/ FCI+SCI		6899.30	2030.9	3.40		
<i>Set fourth</i>						
First	AFC	0.63	0.52	1.20	-12592	89.77
	FPY	-57.35	55.73	-1.03		
	FLMY	-0.08	0.44	-0.17		
	FLL	15.67	3.59	4.37		
	FCI	0.37	2.56	0.15		
	FSP	0.51	1.72	0.30		
	SPY	-49.02	57.64	-0.85		
	SLMY	0.77	0.45	1.71		
	SLL	9.50	3.98	2.39		
	SCI	0.28	1.68	0.17		
	SSP	-0.99	1.42	-0.70		
	FLMY/FLL	-453.54	275.87	-1.64		
	SLMY/SLL	-381.55	140.02	-2.72		
	SLMY/SCI	-80.533	129.62	-0.62		
	FLMY/FCI	197.58	178.72	1.11		
	FLMY+ SLMY/ FLL+SLL	1634.8	480.48	3.40		
	FLMY+ SLMY/ FCI+SCI	11798	1091.0	10.81		
	Final	FLL	14.15	1.10		
SLMY		1.63	0.09	17.43		
FLMY/FLL		459.04	38.94	11.79		
FLMY+ SLMY/ FCI+SCI		12398	1028.8	12.05		

like abortion, dystokia, still births and lactations less than 180 days were not included. The simple correlations of first and second lactation traits with lifetime production up to 3rd lactation were estimated as per Becker (1986) and their significance was tested as per table values Snedecor and Cochran (1989.) The lifetime milk production up to third lactation was predicted using Backward Elimination method of multiple Regression Analysis (Draper and Smith 1987). The 4 sets of explanatory variables studied were Set-I including all first lactation traits; Set-II, including second lactation traits; Set-III, including production efficiency traits and Set – IV, including all the traits of Set-II and III. The purpose of preparing different sets with possible combinations in first and final set was to get maximum accuracy of prediction.

RESULTS AND DISCUSSION

Prediction of LTP-3

The correlation of LTP-3 with AFC, FPY, FLMY, FLL, FSP, FDP and FCI was 0.05, 0.56, 0.70, 0.43, 0.30, 0.10 and 0.26, respectively (Table 1). The correlation of LTP-3 with FCI, FPY, FLMY, FLL, FSP was positive and significant, whereas negative and nonsignificant correlation of LTP-3 with FDP was observed. However, the correlation of LTP-3 with AFC was positive and nonsignificant. Similar results were reported by Gandhi and Singh (2000) in Murrah buffaloes and Dalal and Malik (2004) in Haryana cattle. This shows that AFC will not adversely affect the production in later lactation or lifetime production. From the study it was observed that the FLMY was important to predict LTP-3. Findings are in agreement with the Bhattachariya and Gandhi (1998). The correlation of LTP-3 with SPY, SLMY and SLL was positive and significant. Similar result were reported by Pundir and Raheja (1995) in Sahiwal and Haryana cattle. Whereas the correlation with SSP and SCI was positive and nonsignificant. However correlation of LTP-3 with SDP was negative and nonsignificant. Similar result was observed by Sharma and Singh (1996) in Murrah buffaloes.

The correlation of LTP-3 with FLMY/FLL, FLMY/FCI, SLMY/SLL and FLMY + SLMY/FLL + SLL was positive and highly significant. However the correlation of LTP-3 with FLMY + SLMY/FCI+SCI was negative and non-significant in Phule Triveni crossbred cattle. From the results it was observed that correlation among the different first, second lactation traits and production efficiency traits in LTP-3 ranged from 0.02 to 0.78. Association of FLMY, SLMY, SLMY/SCI and FLMY+SLMY/FLL +SLL was more than 59 %.

To predict LTP-3, when all traits of Set –I were

incorporated in the model, the accuracy of prediction was 51.52% (Table 2). The traits AFC, FPY, FDP FSP and FLL were dropped for final model by the technique of backward elimination procedure to get maximum accuracy. The best prediction equation including FLMY and FCI traits of first lactation explained 50.91% of total accuracy in prediction of LTP-3.

The second regression model incorporated 11 traits of first and second lactations, viz. AFC, FPY, FLMY, FLL, FSP, FCI, SPY, SLMY, SLL, SSP and SCI. There was 24.44% increase in the accuracy of prediction of LTP-3 from seven traits in Ist Set to eleven traits in IInd set. The traits AFC, FPY, FLL, FSP, FCI, SPY, SSP, SCI were dropped from the final model. The best combination explained 74.28% accuracy of prediction in LTP-3.

The third model of 6 production efficiency traits of first and second lactations gave the accuracy of prediction of 49.37%. The FLMY/FCI, SLMY/SLL, FLMY+SLMY/FLL+SLL traits were dropped from final model. The final model out of 6 traits involving 3 production efficiency traits explained 88.23% of total accuracy in prediction of LTP-3 in Haryana cattle. Dalal and Malik (2004), observed 67.61% R² value of total production in LTP-3.

The fourth model including the first and second lactation traits with production efficiency traits gave the accuracy 0 prediction of 89.77%. The final model having 4 traits was the best model which explained R² value of 88.03% accuracy of prediction of LTP-3.

REFERENCES

- Becker W A. 1986. *Manual of procedures in quantitative Genetics*. Publication of Washington State University, Pullman, USA.
- Bhattachariya T K and Gandhi R S. 1998. Prediction of lifetime milk production from early lactation traits in Karan Fries Cattle. *Indian Journal of Dairy Science* 51: 90-95.
- Draper N R and Smith H. 1987. *Applied Regression Analysis*. John Wiley and Sons Inc., New York.
- Dalal D S, Malik Z S, Chhikara B S and Chander Ramesh. 2004. Prediction of lifetime milk production from early lactation traits in Haryana Cattle. *Indian Journal of Animal Sciences* 74: 1145-49.
- Gandhi R S and Singh A. 2000. Prediction of lifetime production in Murrah buffaloes. *Indian Journal of Animal Sciences* 70: 304-6.
- Pundir R K and Raheja K L. 1995. Prediction of lifetime milk yield by early traits in Sahiwal and Haryana cows. *Indian Journal of Dairy Science* 48: 146-49.
- Sharma I H, Singh H and Prasad R B. 1996. Prediction of lifetime milk production from production traits in Murrah buffaloes. *Journal of Dairying Foods and Home Science* 15: 226-28.
- Snedecor G W and Cochran W G. 1989. *Statistical Methods*. 8th edn. Affiliated East-West press Pvt. Ltd, New Delhi.