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Prediction of lactation yield from test day milk yield and peak yield in Kankrej cows*

R K SAH[1], R R SHAH[2] and D P PANDEY[3]

Gujarat Agricultural University, Sardarkrushinagar, Gujarat 385506 India

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ABSTRACT

Complete record keeping is very difficult due to time and labour consumed, transfer, sale and death of animals. Test day and peak milk yield have high relationship with lactation yield. Therefore, the present study was carried out to predict the lactation yield based on test day and peak yield. Test day milk record was taken at 30 days interval from records of 7 lactations belonging to 300 Kankrej cows maintained at Livestock Research Station, Gujarat Agricultural University, Sardarkrushinagar. The simple regression analysis using TDYs and PY revealed that peak yield alone could predict the lactation yield to the 49% of accuracy. Prediction of LY based on 125th, 155th, 185th and 215th day would be quite useful and reliable with more than 66% accuracy. The multiple regression equation indicated that R^2 values showed increasing trend when more number of test day milk yields were included in prediction. The best suggested equation with 78% accuracy is:

$$Lv = -118.62 + 81.12\ PY + 85.20\ TDY_{155} + TDY_{185}$$

Key words: Cattle, Kankrej, Peak yield, Test day

Milk recording is one of the essential criteria for better herd management, selection of animals with higher genetic potential and for culling of low producing animals. Since last two centuries, animal breeders have realized the importance of record keeping. It is used extensively for the estimation of the breeding value and in other selection programmes. Complete record keeping is a difficult and phenomenal task because of several reasons, viz. time and labour consumed, transfer and sale and death or culling of animals etc. Therefore, various workers have tried to estimate the lactation yield of dairy animals through different methodologies. The best alternatives available are: (i) daily recording for a part of lactation, and (ii) interval recording on test days spread over complete lactation. Some of the research workers have also tried to predict the milk yield based on various input variables of test day yields and several types of cumulative milk yields.

The selection based on test day milk recording in early part of lactation results in reduction of generation interval, cost of recording and minimizes the cost of maintaining cows and bulls of low breeding values (Danell, 1990). Mc. Daniel (1969) suggested that at least 90% of the milk yield estimates calculated from a single day's yield once a month are within ± 5% of true production error, while those computed from bimonthly samples have about 30% greater error than those based on monthly test. Thus both test day milk yield and peak yield records have shown high genetic and phenotypic relationship with lactation yield. One can predict the lactation yield more precisely and accurately using these traits. Therefore, efforts have been made to find out the day which can be considered as most precise so as to estimate the lactation yield.

MATERIALS AND METHODS

The data for the present study on test day milk yields at 30 days intervals starting from fifth day of lactation were collected from the records of 7 lactations belonging to 300 Kankrej cows sired by 42 sires, born during 1981 to 1997 and maintained at Livestock Research Station, Gujarat Agricultural University, Sardarkrushinagar.

Simple and multiple regression equation aimed at predicting the lactation yield on the basis of one or more test day yields as independent variables was as follows:

$$\hat{Y} = a + \sum b_i x_j$$

where $\hat{Y}$, predicted lactation yield, a, intercept value, b_i, regression coefficient of lactation yield (Y) on test day/peak

*From M.V.Sc. thesis submitted by the first author to Gujarat Agricultural University, Sardarkrushinagar 385506 (Gujarat).

Present address: [1] Assistant Professor (drrkvet@yahoo.com), Department of Animal Breeding and Genetics, Bihar Veterinary College, Patna.

yield (X), and x_j, independent variables (test day yield or peak yield).

The coefficient of determination (R^2) was calculated on the basis of following formula:

$$R^2 = \frac{\text{Regression sum of square}}{\text{Total sum of square}} \times 100$$

The data were subjected to simple regression equation taking one dependent and another independent variable. The multiple regression equation also were obtained by using 2 and 3 independent variables and the finding incorporated accordingly.

RESULTS AND DISCUSSION

The milk yields recorded on different test days (TDY) and peak milk yield (PY) were considered as independent variables for prediction of lactation yield. The constants, regression coefficients and coefficients of determination are presented in Table 1. It was found that peak yield alone could predict the lactation yield with 49.9%. When different test days were taken for prediction of lactation yield independently then it was observed that one can predict lactation yield on the basis of milk yields from TD_5 to TD_8 up to the accuracy of 67.1%. The co-efficient of determination (R^2) for test day milk yield was found to increase (21.9 to 67.1) from TD_1 to TD_8 while it decreased (63.2 to 38.0) from TD_9 to TD_{11}. Prediction equations developed for predicting LY on the basis of single test day yields revealed that the prediction based on 125th, 155^{th,} 185th and 215th day would be quite useful and reliable with more than 66% accuracy. Mandal and Mehla (1997) also showed similar trend of increase and decrease in accuracy of prediction of LY on the basis of monthly milk yields. They predicted LY on the basis of TD yield of third, fourth, fifth, sixth and seventh month of lactation with more than 64% of accuracy in Murrah buffaloes. Dass and Sadana (1999) also used monthly test day milk yields for prediction of LY by simple regression method. They observed an increasing trend in the accuracy of prediction of LY from monthly milk yields up to fourth month, the increase in the accuracy being negligible thereafter up to seventh month of TDY. The findings indicated that for the early prediction of lactation yield, fifth month test day yield would be ideal.

The multiple regression equations combining peak yield and different test day yields showed similar trend of increasing in the accuracy of prediction of LY. On the basis of all possible combinations, it was observed that the magnitude of R^2 values increased when more number of test day milk yields were included in prediction. The best suggested prediction equation with 78% accuracy is:

$$Lv = -118.62 + 81.12\ PY + 85.20\ TDY_{155} + 102.71\ TDY_{185}$$

The present finding is very similar to that of Pander and Hill (1993) who estimated LY with 71% accuracy. Appannavar *et al*.(1995) found that R^2 value of prediction

Table 1. Regression equations for prediction of lactation yield

Simple Regression Analysis

	X	a	b	R^2 (%)
$\hat{LY}$=	PY	–214.21	205.63	49.9
	TD_5	1015.99	150.82	21.9
	TD_{35}	429.85	177.16	42.5
	TD_{65}	178.47	204.17	51.3
	TD_{95}	173.23	220.45	60.5
	TD_{125}	238.58	223.15	66.7
	TD_{155}	399.34	218.03	66.8
	TD_{185}	568.88	212.78	67.0
	TD_{215}	740.93	206.29	67.1
	TD_{245}	979.72	191.42	63.2
	TD_{275}	1263.85	175.67	50.6
	TD_{305}	1458.20	176.16	38.0

Multiple Regression Analysis

	X	a	b1	b2	R2
	PY + TD_{05}	–207.49	200.05	9.70	49.0
	PY + TD_{35}	–156.31	152.81	60.11	51.3
	PY + TD_{65}	–164.62	104.70	119.00	55.3
	PY + TD_{95}	–162.19	79.23	161.80	63.6
	PY + TD_{125}	–126.20	73.23	174.05	69.8
	PY + TD_{155}	–162.44	93.93	164.41	73.1
	PY + TD_{185}	–107.00	101.74	164.15	75.1
	TD_{05} + TD_{35}	407.06	29.13	161.55	43.0
	TD_{05} + TD_{65}	148.15	31.02	188.76	51.9
	TD_{05} + TD_{95}	97.37	41.67	203.13	61.8
	TD_{05} + TD_{125}	148.07	40.94	207.56	68.0
	TD05 + TD_{155}	237.67	57.67	199.57	69.5
	TD_{05} + TD_{185}	337.79	70.38	193.76	71.2
	TD_{35} + TD_{65}	92.57	68.35	149.40	53.9
	TD_{35} + TD_{95}	38.53	59.50	177.60	63.0
	TD_{35} + TD_{125}	58.08	59.29	184.94	69.5
	TD_{35} + TD_{155}	60.94	81.65	175.10	73.2
	TD_{35} + TD_{185}	163.64	86.27	170.78	74.5
	TD_{65} + TD_{95}	–4.08	81.34	157.96	63.8
$\hat{LY}$=	TD_{65} + TD_{125}	–13.37	80.74	168.94	70.8
	TD_{65} + TD_{155}	22.07	94.55	161.97	73.3
	TD_{65} + TD_{185}	69.90	104.87	157.98	76.1
	TD_{95} + TD_{125}	60.87	96.15	148.08	70.6
	TD_{95} + TD_{155}	79.16	110.64	142.36	74.0
	TD_{95} + TD_{185}	133.48	177.64	140.18	76.4
	TD_{125} + TD_{155}	175.46	122.53	120.46	73.5

Multiple Regression Analysis

	X	a	b_1	b_2	b_3	R^2
$\hat{LY}$=	PY + TD_5 + TD_{35}	- 157.99	154.12	- 4.07	61.29	51.5
	PY + TD_{35} + TD_{65}	–136.04	83.04	33.75	109.58	55.8
	PY + TD_{65} + TD_{95}	–145.80	48.11	52.92	144.18	64.5
	PY + TD_{95}+ TD_{125}	–122.10	45.40	72.77	135.90	71.6
	PY + TD_{125} + TD_{155}	–134.95	63.04	86.07	113.51	75.8
	PY + TD_{155} + TD_{185}	–118.62	81.12	85.20	102.71	78.1
	TD_5 + TD_{35} + TD_{65}	89.06	7.75	65.11	184.14	54.0
	TD_{35} + TD_{65} + TD_{95}	–36.53	33.92	61.01	149.16	64.4
	TD_{65} + TD_{95} + TD_{125}	–50.17	54.90	63.54	136.69	72.1
	TD_{95}+ TD_{125} + TD_{155}	45.13	74.44	75.97	106.63	75.8
	TD_{125}+TD_{155}+ TD_{185}	188.30	98.88	59.25	95.01	77.6

based on first 3 to 6 sequential test day milk yields, taken at last day of each calendar month in Surti buffaloes, varied between 64.4 and 85.5%. Further, they also reported an increasing trend of R^2 when more number of test day observations were included in prediction equation. Joshi *et al*.(1996) also reported R^2 value in Hariana cattle ranging from 55.35 to 93.07% when 1 to 7 test day records were considered. However, little early prediction of LY with 75.8% accuracy can also be made using the following equation:

$$Lv = -134.95 + 63.04\ PY + 86.07\ TDY_{125} + 113.51\ TDY_{155}$$

The simple regression equation revealed that the peak yield alone can predict the LY with 49.9% accuracy and using multiple regression it can be predicted with 78% accuracy. But for early prediction of LY use of PY, TDY_{125} and TDY_{155} helped predicting with 75.8% accuracy.

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