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Observed and predicted first lactation milk yield in Surti buffaloes

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ABSTRACT

305FLMY was predicted from fortnightly, monthly and bimonthly test day milk yields using 2 sampling schemes (systematic and stratified random sampling) in Surti buffaloes maintained at Network Project on Surti buffaloes, Livestock Research Station, Vallabhnagar. The observed 305 days and total first lactation milk yield were 1,116.97 ± 13.49 and 1,155.16 ± 10.93 kg respectively. The predicted 305 days milk yield was higher than observed 305 days milk yield and showed increasing trend with increasing test day interval in both the sampling schemes. The effect of sire and season of calving was found to be highly significant on observed and predicted 305 days first lactation milk yield based on systematic and stratified sampling schemes with fortnightly, monthly and bimonthly sampling intervals. The heritability estimates for OMY305 and OMYT was high at 0.639 ± 0.181 and 0.669 ± 0.184 respectively. Similarly, the heritability estimates for predicted 305 days first lactation milk yield based on systematic sampling scheme with the interval of fortnightly, monthly and bimonthly were 0.584 ± 0.176, 0.587 ± 0.176 and 0.549 ± 0.172 respectively. The respective estimates based on stratified sampling scheme were 0.582 ± 0.175, 0.601 ± 0.177 and 0.378 ± 0.152. The genetic and phenotypic correlation coefficients of predicted milk yield based on both systematic and stratified random sampling schemes with OMY305 and OMYT were also positive, high and approaching to one. All the 5 measures, viz. average error, per cent average error, average absolute error, per cent average absolute error and variance of error under fortnightly interval were lower than monthly and bimonthly intervals in both the sampling schemes. The above measures of error were slightly lower for systematic sampling scheme as compared to stratified random sampling scheme. Keeping the cost and difficulty in data recording, both systematic and stratified random sampling with monthly interval can be used to predict 305 days first lactation milk yield with fairly accuracy.

Key words: Prediction, Stratified random sample, Systematic sample, Test day milk yield

The daily milk recording of dairy buffaloes involves heavy expenditure and is cost prohibitive under field conditions. The use of part and test day milk yield of daughters tends to shorten the time required to take the decision for early selection of sires and buffaloes and reducing the cost of recording. The information on the use of test day milk yield records for prediction of standard 305 days milk yield in Surti buffalo is lacking. Therefore, an attempt was made to predict the 305 days first lactation milk yield in Surti buffaloes using 3 test intervals and 2 sampling schemes.

MATERIALS AND METHODS

First lactation milk records of 453 Surti buffaloes maintained at Network Project on Surti Buffaloes, Livestock Research Station, Vallabhnagar, Udaipur, Rajasthan University of Veterinary and Animal Sciences, Bikaner, over a period of 29 years (1976–2004) were utilized for the present study. The 305 days first lactation milk yield (305FLMY) was predicted from fortnightly, monthly and bimonthly test day milk yields. Two sampling schemes, viz. systematic and stratified random sampling, were used for test day recording.

The milk yield for every part of lactation under both the above sampling schemes was estimated as under:

$$PMY = \sum_{i=1}^{N} (\text{Sampling space} \times \text{milk yield of sampled day}) + [\{(\text{actual lactation length}) - (\text{space of sampling schemes} \times \text{number of samples})\} \times \text{milk yield of last sample yield}]$$

The lactation less than 100 days was not considered and culling in the middle of lactation, abortion, stillbirth or any other physiological causes, which affects the milk yield, were considered as abnormalities and thus, such records were not included in the study.

The data being non-orthogonal were analysed by mixed model least-squares and maximum likelihood computer programme (Harvey 1990) considering period and season of calving as fixed effect and sire as random effect. The heritability and genetic correlations were computed by paternal half correlation method while the standard errors of these parameters were computed using the formula given by Swiger*et al*. (1964) and Robertson (1959) respectively.

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The phenotypic correlations were computed after Snedecor and Cochran (1968). The following mathematical model was used for genetic parameters estimation.

$$Y_{ijkl} = \mu + B_i + P_j + S_k + e_{ijkl}$$

where, Y_{ijkl} is the observation of l^{th} buffalo born from i^{th} sire, calved in k^{th} season and j^{th} period, μ is the overall mean assuming equal subclass numbers, B_i is the random effect of i^{th} sire, P_j is the fixed effect of j^{th} period of calving, S_k is the fixed effect of k^{th} season of calving and e_{ijkl} is the residual random error under standard assumption which make the analysis valid ie. NID (0, σ^2_e)

RESULTS AND DISCUSSION

The observed 305 days (OMY305) and total first lactation milk yield (OMYT) were 1116.97 ± 13.49 and 1155.16 ± 10.93 kg, higher than that observed by Nagarcenkar*et al.* (1985). On the other hand, higher first lactation milk yield was also reported by Tailor (1999 – 2004) than that observed in the present study. The coefficient of variation was 25.69 and 20.12%, respectively, for OMY305 and OMYT, which is lower than that obtained by Singh 2006 in Surti buffaloes.

The averages for predicted 305 days first lactation milk yield based on systematic sampling scheme with the interval of fortnightly, monthly and bimonthly in Surti buffaloes were 1142.79 ± 11.96, 1152.82 ± 12.05 and 1189.36 ± 14.65 kg respectively. The respective values based on stratified random sampling scheme were 1142.90 ± 12.04, 1151.44 ± 12.25, and 1192.29 ± 14.60 kg.The predicted milk yield was higher than observed 305 days milk yield and showed increasing trend with increasing test day interval in both the sampling schemes.The CV ranged from 22.28 to 26.22%, which is almost similar to observed milk yield.

The effect of sire and season of calving was highly significant on observed and predicted 305 days first lactation milk yield based on systematic and stratified sampling schemes with fortnightly, monthly and bimonthly sampling intervals. However, the effect of period of calving was nonsignificant on these traits. The results corroborated with the findings of Kothari (2004) and Singh (2006) on observed milk yield and Das and Sharma (2000) on predicted milk yield based on systematic and stratified random sampling schemes of 3 sampling intervals i.e. fortnightly, monthly and bimonthly.

The heritability estimates for OMY305 and OMYT were high at 0.639 ± 0.181 and 0.669 ± 0.184 respectively. Similarly, the heritability estimates for predicted 305 days first lactation milk yield based on systematic sampling scheme with the interval of fortnightly, monthly and bimonthly were 0.584 ± 0.176, 0.587 ± 0.176 and 0.549 ± 0.172 respectively. The respective estimates based on stratified random sampling scheme were 0.582 ± 0.175, 0.601 ± 0.177 and 0.378 ± 0.152. High estimates of heritability for observed 305 days first lactation milk yield were also reported by Tailor (1995) and Singh (2006) in Surti buffaloes. The heritability estimates of predicted milk yield were slightly lower in magnitude than observed milk yield in the present study. High estimates of heritability for first lactation milk yield (observed and predicted) indicated that sufficient additive genetic variation available in these traits for exploitation.

The genetic and phenotypic correlation coefficients of predicted milk yield based on both systematic and stratified random sampling schemes with OMY305 and OMYT were also positive, high and approaching to one. Similarly, Kooner and Pal (1971) and Kaura*et al*. (1983) also observed high association of predicted milk yield based on fortnightly and monthly milk yield with observed milk yield in buffaloes. The results indicated that the predicted milk yield under both the schemes would be expected to be as effective as selection on the basis of observed milk yield.

The 5 measures namely average error, per cent average error, average absolute error, per cent average absolute error and variance of error, were used in prediction of 305 days first lactation milk yield under 2 sampling schemes under 3 testing intervals and results are presented in Table 2. The measures of average error, per cent average error, average absolute error and per cent average absolute error in predicted 305 days first lactation milk yield under fortnightly systematic sampling scheme were 25.70 kg, 2.30%, 65.92 kg and 5.90% respectively.The corresponding measures of error in predicted 305 days first lactation milk yield under stratified random sampling scheme were 25.81 kg, 2.31%, 67.30 kg and 6.02%.

Table 1. Estimates of phenotypic and genetic correlations between predicted milk yield under systematic and stratified sampling schemes and OMY305 and OMYT

Name of sampling scheme/ intervals	Genotypic correlation		Phenotypic correlation	
	OMY305	OMYT	OMY305	OMYT
Systematic sampling scheme				
Fortnightly interval	0.999±0.010	0.997±0.017	0.941±0.016**	0.927±0.029**
Monthly interval	0.998±0.012	0.995±0.093	0.929±0.017**	0.901±0.073**
Bimonthly interval	0.992±0.028	0.972±0.065	0.848±0.025**	0.826±0.064**
Stratified sampling scheme				
Fortnightly interval	0.988±0.012	0.957±0.049	0.947±0.050**	0.919±0.058**
Monthly interval	0.999±0.11	0.971±0.097	0.929±0.051**	0.903±0.087**
Bimonthly interval	0.999±0.043	0.964±0.082	0.830±0.026**	0.818±0.039**

**, $P \leq 0.01$.

Table 2. Errors in estimation of 305 days first lactation milk yield under various sampling schemes

Name of sampling scheme/ intervals	R^2	Average error		Average absolute error		Variance of error	Relative efficiency
	%	kg	%	kg	%	$(kg)^2$	(%)
Systematic sampling scheme							
Fortnightly interval	88.5	25.70	2.30	65.92	5.90	8761.69	100
Monthly interval	86.3	34.34	3.07	82.67	7.40	11758.52	74.51
Bimonthly interval	71.9	72.27	6.47	145.37	13.01	31648.24	27.68
Stratified sampling scheme							
Fortnightly interval	89.7	25.81	2.31	67.30	6.02	8010.02	100
Monthly interval	86.3	35.72	3.20	81.65	7.31	11301.65	70.87
Bimonthly interval	68.9	75.19	6.73	151.67	13.58	32978.75	24.29

Youssef *et al*. (1961) obtained the errors due to estimation as 1.56% for recording at 2 weeks interval in Egyptian buffaloes, which is lower than values observed in the present study (> 2.0%). Rao (1979) reported that the average error in the estimation of lactation milk yield from test day yields recorded at 2 weekly intervals ranged from –1.52 to 0.63% in Sahiwal and its crosses and the percentage of average absolute error ranged from 2.01 to 3.62%, which is also lower than that observed in the present study.

The per cent average error and absolute error under monthly interval were 3.07% and 82.67 kg in systematic and 3.20% and 81.65 kg in stratified random sampling schemes respectively. Jaisorowski *et al*. (1966) found the absolute error of the estimation was 87.6 liters, which is almost similar to that observed in the present study. Vachal and Berea (1971) revealed that the error of estimation of individual lactation milk yield from monthly recording to be less than 1% of actual yield, which is lower than average and average absolute error observed in the present study under both the sampling schemes. Lee (1985) found that the range of average error varied from 0.04 to 5.65%, which is almost similar to the present results. The efficiency of systematic and stratified random sampling schemes with monthly testing interval were only 25.49 and 29.13% less efficient than fortnightly testing interval respectively (Table 2).

The measures of average error, per cent average error, average absolute error and per cent average absolute error in predicted 305 days first lactation milk yield were 72.27 kg, 6.47%, 145.37 kg and 13.01% under bimonthly systematic sampling scheme and 75.19 kg, 6.73%, 151.67 kg and 13.58% under stratified random sampling scheme respectively. The variance of error was 31648.24 and 32978.75 kg^2 under systematic and stratified random sampling schemes respectively. The relative efficiency of systematic and stratified random sampling schemes with bimonthly interval was only 27.68 and 24.29% efficient as compared to fortnightly testing interval respectively (Table 2).

Rao (1977) inferred that average error in the estimation of lactation milk from test day yields recorded at 8 weekly intervals with first test commencing in different weeks, ranged from -4.41 to 2.61% and absolute error ranged from 3.87 to 6.56% in Sahiwal and its crosses, which is lower than the values observed in the present study.

The results revealed that the average error, per cent average error, average absolute error and per cent average absolute error under monthly interval were higher than those obtained under fortnightly intervals. Similarly, the above measures were also higher under bimonthly interval than monthly interval. The comparison of error variances for same test interval under 2 sampling schemes indicated that all the 5 measures were slightly lower for systematic sampling scheme as compared to stratified random sampling scheme. It is therefore, concluded that the accuracy of prediction was better at shorter interval of milk recording under systematic and stratified random sampling schemes i.e., fortnightly interval was better than monthly and bimonthly interval and monthly interval were better than bimonthly interval under both the sampling schemes. Systematic and stratified random sampling schemes are almost equally efficient under all the 3 test day intervals of recording. However, systematic sampling scheme had upper edge over stratified random sampling scheme. Keeping the cost and difficulty in data recording both systematic and stratified random sampling with monthly interval can be used to predict 305 days first lactation milk yield with fairly accuracy.

Amble *et al*. (1959) and Amble and Rajagopalan (1960) reported that systematic sampling scheme was better than simple random sampling method for estimation of lactation yield from test records. Dass (1991) observed that the accuracy was better with shorter intervals. Gujar*et al*. (1996) concluded that recording once per month on a fixed date would be satisfactory under practical conditions. Cunningham and Vial (1968) found that bimonthly testing was little less accurate than monthly testing. These findings corroborated with the present results.

REFERENCES

Agrawal S B, Patel R K and Sharma K N S. 1987. Estimation of performance characteristics of Murrah buffaloes under village conditions. *Indian Journal of Dairy Sciences* **40** (2): 200–4.

Amble V N and Rajagopalan M. 1960. Further studies in sampling daily milk yields. *Indian Journal of Veterinary Science and Animal Husbandry* **30**: 272–86.

Amble V N, Rajagopalan M and Gill B S. 1959. Sampling of daily milk records for estimating lactation yield of cows. *Indian*

Journal of Animal Sciences **29**: 13–26.

Cunningham E P and Vial V E. 1968. Relative accuracy of different sampling intervals and methods of estimation for lactation milk yield. *Irish Journal of Agricultural Research* **7** (1): 49–60.

Dass Gopal. 1991. 'Efficacy of prediction of lactation yield in Murrah buffaloes based on test-day intervals.' M.Sc. Thesis submitted to NDRI, Karnal, Haryana.

Dass Gopal and Sharma R C. 2000. Effect of season and period of calving on predicted milk yield in Murrah buffaloes. *Indian Journal of Animal Research* **34** (1): 68–70.

Gaur G K, Rao M K and Bisht G S. 1996. Prediction of first lactation milk yield from part records. *Indian Veterinary Journal* **73** (12): 1247–52.

Harvey W R. 1990. User's guide for LSMLMW pc-2 version. Mixed model least squares and maximum like hood computer program. Ohio University Columbus, USA.

Jaisorowski H, Kossakowski J and Kurowska M. 1966. Studies on the accuracy and the possibility of simplifying milk recording. *IX International Congress on Animal Production.*

Kaura M K, Dhillon J S and Tiwana M S. 1983. Relative efficiency of different sampling procedures for estimating lactation milk yield in buffaloes. *Indian Journal of Dairy Science* **36** (3): 269–71.

Kooner D S and Pal R N. 1971. Periodicity of milk recording in buffaloes. *Journal of Research, Punjab Agricultural University* **7**: 414–16.

Kothari M S. 2004. 'Genetic evaluation of Surti buffalo.' Ph.D. Thesis submitted to MPUAT, Udaipur.

Lee K J. 1985. A study on different sampling intervals for estimating lactation milk yield. *Animal Breeding Abstract* **53**: 778.

Nagarcenkar R, Rao M K and Jogi R V K. 1985. Heritability of first lactation traits in Surti buffaloes under village conditions. *Proceedings of Ist World Buffalo Congress. Dec. 27–31. Cairo, Egypt (A.R.E.)* **5** : 1497–513.

Rao V P.1979. 'The role of genotype and environment in sire evaluation.' Ph.D Thesis, Kurukshetra University, Kurukshetra, India.

Robertson A. 1959. The sampling variance of the genetic correlation coefficient. *Biometrics* **15** : 469–85.

Singh B. 2006. 'Genetic evaluation of sires in Surti buffalo.' Ph.D. Thesis submitted to MPUAT, Udaipur.

Snedecor C W and Cochran W C. 1968. *Statistical Methods*. The Iowa state university Ames, Iowa, USA.

Swiger L A, Harvey W R, Everson D O and Gegory K E. 1964. The variance of interclass correlation involving groups with one observation. *Biometrics* **20** : 818.

Tailor S P. 1995. 'Genetic studies of first lactation traits for prediction of lifetime production and to develop suitable criteria in Surti buffaloes.' Ph.D. Thesis. GBPUA & T Pantnagar (UP).

Tailor S P. 1999–2004. *Annual Report, Buffalo Project.* Livestock Research Station, Vallabhnagar.

Vachal J and Berea C. 1971. Comparison between daily and monthly recording of milk production.Ciencies Agropecuaries.2. *Universidad de la Habena*. **2**: 9. (*fide Dairy Science Abstract* **37***:* 5334*).*

Youssef A A, Tolba Y M and Ahmad S D. 1961. Estimation of buffalo milk yield by recording at different intervals. *Journal of Animal Production* **1**: 75–82.