REPEATABILITY ESTIMATES OF SOME PRODUCTIVE AND REPRODUCTIVE TRAITS IN RED SINDHI CATTLE

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ABSTRACT

The breeding records of 179 Red Sindhi cattle maintained at the Livestock Experiment Station Hab Choki, Balochistan, during the years 1982-97 were used in the present study. An effort was made to estimate the repeatability for some productive and reproductive traits by using the Mixed model least squares and maximum likelihood procedures. The repeatability estimates for milk yield, lactation length, dry period, service period, gestation period and calving interval were 0.361 ± 0.05, 0.03 ± 0.05, 0.029 ± 0.06, 0.17 ± 0.06, 0.94 ± 0.55 and 0.167 ± 0.06, respectively in model 1, whereas in model 2 estimates for milk yield, lactation length, dry period, service period, gestation period and calving interval were 0.354 ± 0.05, 0.041 ± 0.05, 0.040 ± 0.06, 0.173 ± 0.06, 0.98 ± 0.056 and 0.165 ± 0.06, respectively. The repeatability estimates are used in determining the amount of culling that can be safely done on the basis of records. A high estimate of repeatability provides enough evidence for selection or rejection of the individual based on single record, whereas a low estimate of repeatability justifies accumulation of further records. A moderate estimate of repeatability (0.361) for lactation milk yield obtained in the present study indicates that the cows can be selected for milk yield on the basis of relatively lesser records in the present herd.

Key words: Repeatability, productive and reproductive traits, Red Sindhi cattle.

INTRODUCTION

The cattle occupy an important place in national economy of Pakistan. The cattle population in the country in 2000-2001 was approximately 22.4 million heads (Anonymous, 2000-2001) which contributes about 25% of the milk and 70% of the red meat produced in the country. There are mainly two milch breeds of cattle namely Sahiwal and Red Sindhi. The Red Sindhi cattle of Pakistan enjoy a world-wide reputation because of their wonderful power of adaptability to a variety of environmental conditions and diseases. In view of these characteristics, coupled with good potential for high milk production, they have been considered suitable for introduction into several countries. (Wahid, 1975).

Repeatability is the measure of correlation between the repeated records of the same animal and has practical application in the prediction of future performance on the basis of available records. Repeatability is usually calculated as an intra-class correlation within herd or as a correlation between records made by the same animal in different lactations (Falconer and MacKay, 1997). It is a wastage of genetic material to cull cows without giving them a fair trail and it is equally not wise to keep poor producers in a herd unnecessarily for a long period. So the repeatability estimates are needed for the selection of animals to bring about improvement in economic traits in the current generation. Genetic differences accompanied by temporary or non localized fluctuations are responsible for variations among estimates of repeatability for different breeds at different locations (Falconer and Mackay, 1997).

Relatively little information is available regarding repeatability estimates of various economic traits of Red Sindhi cattle in Pakistan. Therefore, the present study was planned to estimate the repeatability of various productive and reproductive traits including, milk yield (MY), lactation length (LL), dry period (DP), service period (SP), gestation period (GP) and calving interval (CI) of Red Sindhi cattle.

MATERIALS AND METHODS

The breeding records of 179 Red Sindhi cattle maintained at the Livestock Experiment Station Hab Choki, Balochistan, over a period of 15 years from 1982-97 were utilized for the present study. Repeatability estimates of various productive and reproductive traits including lactation milk yield (n=484), lactation length (n=485), dry period (n=364), service period (n=375), gestation period (n=462) and calving interval (n=377) were worked out.

Only normal and complete records of the cattle were included in the analysis. The records of milk yield, lactation length, dry period, service period, gestation period and calving interval out side ±3 standard deviations from the overall mean of the corresponding trait were excluded from the analysis.

Two different statistical models were tried for the analysis. Various fixed effects fitted in the first model included year of calving, season of calving and lactation number. Whereas instead of season of calving, month of calving was included in the second model. The statistical models for the analysis were:

$Y_{ijklm} = \mu + Cow_i + SOC_j + YOC_k + Lno_l + \varepsilon ijklm$ (Model 1)

$Y_{ijklm} = \mu + Cow_i + MOC_j + YOC_k + Lno_l + \varepsilon$ ijklm (Model 2)

Where:

Y_{ijklm} = measurement of a particular trait

μ = population mean

Cow_i = random effect of the ith cow (i=1, 2, 3.....179)

SOC_j = fixed effect of jth season of calving (Model 1) (j=1, 2, 3, 4)

MOCj = fixed effect of jth month of calving (Model 2) (j=1, 2, 3,.....12)

YOC_k = fixed effect of kth year of calving (k=1, 2, 3,.....15)

Lno_l = fixed effect of 1th lactation number (1 = 1, 2, 3.....8)

$\varepsilon ijklm$ = random error associated with individual observation. It was further assumed that ε ijklm was normaly and independently distributed with mean zero and variance σ_e^2.

The data were analysed by using the Mixed model least squares and maximum likelihood (LSMLMW) computer program. (Harvey, 1990).

RESULTS AND DISCUSSION

The least square mean values and the repeatability estimates for different productive and reproductive traits obtained from the breeding records of 179 Red Sindhi cattle maintained at the Livestock Experiment Station Hab Choki, Balochistan, during 1982-97 are given in Table 1.

The estimates of repeatability of lactation milk yield of 484 records were 0.361 ± 0.05 and 0.354 ± 0.05 in models 1 and 2, respectively. These repeatability estimates are in line with Wakhugu *et al.* (1991), who analyzed 3500 records of Sahiwal cattle in Kenya and reported the repeatability of lactation yield as 0.46 ± 0.02. Gandhi and Gurnani (1992) reported that the repeatability estimate of milk yield was 0.40 ± 0.12 for 8798 records of Sahiwal cattle in India. Bagnato and Oltenacu (1993) analyzed the data on Italian Friesians and reported the repeatability estimate of milk yield as 0.59 which is higher than the present study.

Repeatability of lactation length was 0.03 ± 0.05 and 0.041 ± 0.05 in the two models. These values are not in agreement with those reported by Sarwar (1991), who analyzed the data on two Red Sindhi herds and reported that the repeatability estimates of lactation length were 0.21 and 0.17, respectively. Gandhi and Gurnani (1992) investigated 8798 records on Sahiwal cattle and reported the repeatability estimate of 0.25 ± 0.01 for lactation length. Deshpande *et al.* (1992) and Murdia and Tripathi (1992) analyzed the records on Jersay cows in India and reported the repeatability estimates for lactation length as 0.11 and 0.12, respectively.

The repeatability estimates of dry period in models 1 and 2 were 0.03 ± 0.06 and 0.04 ± 0.06, respectively. These estimates are not in agreement with Sharma and Khan (1989), Alim (1990) and Deshpande *et al.* (1992). These workers reported the repeatability estimates for dry period as 0.31 ± 0.25, 0.34 and 0.17 ± 0.04, respectively.

These results indicate that all the productive traits included in this study e.g. milk yield, lactation length and dry period are greatly influenced by the temporary environmental conditions, such as management, nutrition and other physiological factors, including diseases control. The repeatability also varies due to number of observations, herd to herd, period to period and breed to breed (Falconer and Mackay, 1997).

The repeatability estimates of service period based on 375 records were 0.175 ± 0.06, 0.34 and 0.173 ± 0.061 estimated by models 1 and 2, respectively. These values are in close agreement with the findings of Reddy *et al.* (1991), who analyzed the data on Denoi-Holstein Friesian cattle and recorded the repeatability estimates of service period as 0.18. The findings of Hayes *et al.* (1992) that the repeatability estimate for service period was 0.08 for Holstein, was not in line with the present study.

Repeatability estimates of gestation period for the two models were 0.94 ± 0.005 and 0.98 ± 0.056, respectively. These estimates do not coincide with the Reddy and Nagarcenkar (1989) and Chaudhri *et al.* (1995), who reported that the repeatability estimates of Jersey, Sahiwal and their crossbred were 0.99 for the gestation period.

Table 1: Least squares means (±SE) and repeatability estimates (±SE) of various productive and reproductive traits in Red Sindh cattle

Traits	N	Model 1		Model 2	
		LSM ± SE	Repeatability ± SE	LSM ± SE	Repeatability ± SE
Milk yield (liter)	484	1531.02 ± 34.89	0.361 ± 0.05	1483 .15 ± 34.99	0.354 ± 0.05
Lactation length (Days)	485	277.36 ± 5.68	0.03 ± 0.05	281.10 ± 5.73	0.041 ± 0.05
Dry period (Days)	364	245.26 ± 11.98	0.029 ± 0.06	247.96 ± 12.43	0.040 ± 0.06
Service period (Days)	375	235.87 ± 14.05	0.17 ± 0.06	240.50 ± 14.25	0.173 ± 0.06
Gestation period (Days)	462	283.28 ± 0.65	0.94 ± 0.55	283 37 ± 0.65	0.98 ± 0.056
Calving interval (Days)	377	515.28 ± 13.84	0.167 ± 0.06	519.13 ± 14.07	0.165 ± 0.06

The repeatability estimates for calving interval based on 377 records by models 1 and 2 were 0.167 ± 0.06 and 0.165 ± 0.06, respectively. These values are in the lower tail of the estimates reported by the Sarwar (1991). The repeatability estimates for calving interval observed in the present study are in agreement with the Gandhi and Gurnani (1992), who reported the repeatability estimates for calving interval as 0.14 ± 0.01. Wakhungu *et al.* (1991) reported that the repeatability of calving interval was 0.39 ± 0.02. The deviation of the result of present study may be attributed to differences due to breeds and environmental conditions.

The model 2 seems to be more sophisticated than the model 1. In the model 2 the months of calving/birth were used which subdivided the environmental factors more than model 1 and reduced chances of error.

It has been observed in the present study that the repeatability estimates of reproductive traits were low, indicating that heritable causes together with the permanent environmental factors had less influence on these traits. Thus, the prediction of breeding values for these traits based on one record will not be very accurate and addition of records will add to the accuracy of prediction. In such situation of low repeatability, selection based on early records will not lead to better performance in later lactations. The cows should not be culled on single (or few) records. One has to wait for later lactations to arrive at some good decision.

However, a moderate estimate of repeatability (0.361) for lactation milk yield was obtained in the present study. It means that the cows can be selected for milk yield on the basis of relatively lesser records in the present herd. For the reproductive traits low estimates of repeatability justify accumulation of further records for selection.

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