

Daughter performance based buffalo bull ranking for boosting milk production in Pakistan

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ABSTRACT: The first lactation milk yield records of 2329 daughters of 180 bulls, (11 batches) during 1983-2005 were used in this study. BLUP breeding values for male and female were computed using DFREML. The fixed effects like herd-year-season and batch number of bulls had significant effect on milk yield as determined by HARVEY Model-1. In addition to these fixed effects, age at first calving was included in the model as covariate to estimate the BLUP breeding values (EBV) for milk yield. The year-wise least square means of milk yield for Nili Ravi buffaloes showed a sharp increase from 1984 to 1989 and then a significant yearly variation with the slight decrease in overall milk production under field conditions at private farmers door step. Among these candidate bulls 92 bulls were positive for milk yield EBV. The overall milk production was (Mean±S.E) 2481.82±493.33 Kg. The heritability of milk yield was 0.15. There is wide variation over the years making the overall regression line ($Y = -146944 + 74.349X$) for milk yield negative. This emphasizes to review the policy of semen usage and production of candidate young bulls for future generations. Recently born male calves had better breeding values showing the positive regression line ($Y = 142.77 + 22.065X$).

Key words: Animal model, Rural population, Progeny testing, Nili-Ravi buffalo.

INTRODUCTION - Development of indigenous animal genetic resources is required for their conservation through sustainable utilization. Nili-Ravi buffalo breed of Pakistan is a unique animal genetic resource and main dairy animal of the country. It is mainly concentrated in the central and southern districts of Punjab where some efforts have already been made to harness the potential of this local breed. Pakistan Agricultural Research Council under PL-480 programme (1984-1990) initiated a project for production of progeny tested bulls to improve buffalo milk production in mid nineteen-eighties. Under this program, 27 AI sub-centers were established and essential data recording for production and reproduction performance initiated at farmers door step.

In genetic improvement, the contribution of sire is more than fifty percent as a large number of progeny can be obtained through one bull. If the bull will be genetically superior, one can expect higher milk production in the following generation. Breeding programs such as

progeny testing program for long term genetic improvement are in their inception (Chaudhry, 2002). Bulls being used have been ranked on simple models such as those based on contemporary comparison. Individual animal models have been used in the past but database was limited due to small size of recorded population (Khan, 1998). The objective of this paper is to rank first eleven batches of Nili-Ravi bulls under the progeny testing program through animal model.

MATERIAL AND METHODS - The production and reproduction performance data at the farmer doorstep in the 27 subcentres in district Okara, Pakpattan, Faisalabad and Sahiwal was recorded and collected from Livestock Production Research Institute, Bahadurnagar. The data collected included animal ID, date of birth, date of first calving, date of drying, lactation length and milk yield.

Statistical analysis

The data on milk yield (MY), age at first calving (AFC) and lactation length (LL) was statistically analyzed to estimate the magnitude of various genetic and environmental sources of variation in these traits. Incomplete lactations for any recorded reason or lactations showing any abnormality were not utilized. The data were analyzed for fixed effects (year of birth (YOB), year of calving (YOC), season of calving (SOC), batch number (B) and location (LOC)) using a Harvey Model-I. The model can be represented as follows:

$$Y = \mu + F_i + E_{ij}$$

Where,

Y = dependent variable (milk yield,)

μ = over all mean

F_i = i^{th} fixed effect, $i = 1$ to 5 (LOC (1-27), YOB (1979-2001), YOC (1983-2005), SOC (1-4), B (1-11))

E_{ij} = random error associated with j^{th} observation under i^{th} fixed effect.

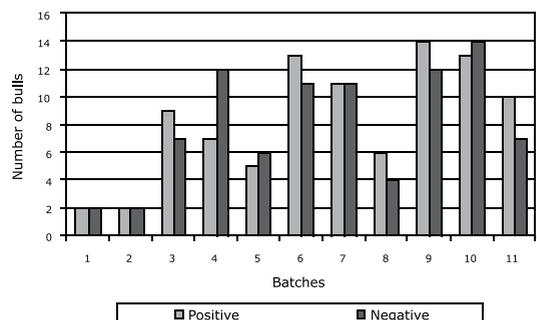
The genetic evaluation, using (animal model) Derivative Free Restricted Maximum Likelihood Estimation computer software, DFREML of each animal was completed.

RESULTS AND CONCLUSIONS - A

progeny testing programme for Nili Ravi buffaloes in four districts (Okara, Faisalabad, Sahiwal and Pakpattan) of Punjab was initiated in 1984. One hundred and eighty bulls alongwith 2329 daughters records comprising eleven batches were analysed using DFREML (Meyer, 1997). Batch-wise number of positive and negative bulls is presented in Figure 1.

The total number of positive bulls were 92. About 1.5 million semen doses were produced by these bulls. Considering two services per conception, about 0.75 million

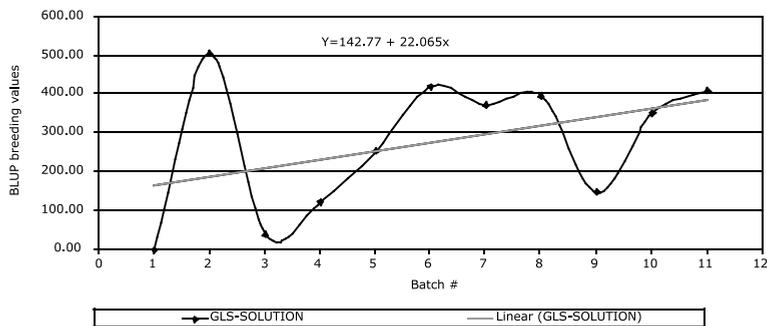
Figure 1. Batch wise Nili-Ravi Buffalo Bulls.



animals were produced over 17 years which seems to be negligible in the sense of contribution towards genetic improvement.

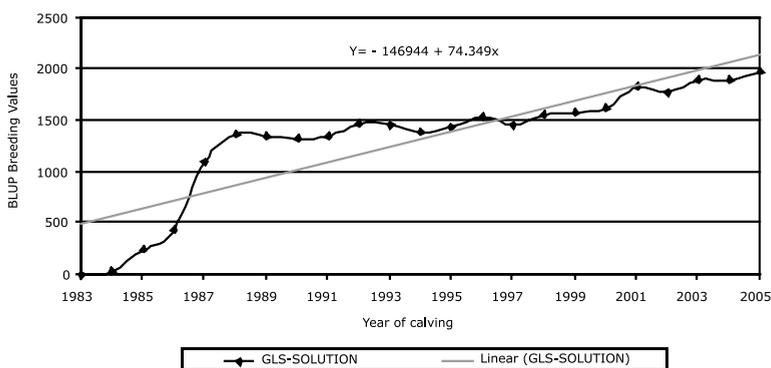
Most buffaloes are still naturally mated. Cady et al. (1983) analyzed data from two farms of Nili-Ravi buffaloes in Pakistan (Qadirabad and Bahadurnagar) and predicted breeding values of sires. Within herd ranking of sires was done on the basis of Best Linear Unbiased Predictors (BLUP) of one-half additive genetic merit for daughters' production in 250 to 305-day of lactation length. Sire values ranged from -172 to 260 kg. Small average difference among sires and fewer numbers of daughters were predicted to entail high risk and slow improvement in the breed. These studies were the basis of starting the progeny testing program in Nili-Ravi buffaloes. The batch-wise genetic trend is given in Figure 2.

Figure 2. Genetic trend across the batches of Nili-Ravi sires.



It appears that more recently born male calves have higher genetic merit than those born earlier in the study. The regression line showed that, on average, 22.065 kg of milk increased per batch of bull tested. The genetic trend in the female population is given in Figure 3.

Figure 3. Genetic trend in milk yield of daughters.



Based upon the breeding values for year of calving, 74.35 kg of milk increased per year. The additive genetic variance and related parameters are given in Table.1.

Table 1. Genetic and phenotypic variances and heritability of first lactation milk yield.

Parameters	305 days MY
Additive genetic σ^2	30965.09
Error σ^2	167067.55
Phenotypic σ^2	198032.64
Heritability	0.1564

According to the recorded data under the progeny testing of bulls, the rural buffalos have yielded an average of 2593 litres of milk for 2627 records with lactation length of 305 days. The average production of elite buffaloes is 3523 litres for 305 days (20th Annual Report, 1999). Though the production performance is promising yet wide variation in performance of individuals suggest problem-oriented research in various disciplines to create an ideal triple purpose animal for milk, meat and draught power. The study of the genetic and environmental factors influencing the production performance of Nili-Ravi buffaloes and selection of bull dams and bull sires on the basis of these parameters can boost the production performance of buffaloes to a considerable extent.

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