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Performance of production traits in Nili-Ravi buffaloes

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ABSTRACT

The data on production performance of 1479 Nili Ravi buffaloes, born out of 86 sires, spread over from 1990 to 2006, were analyzed to estimate the effects of sire, parity, season, period and sex of calf using mixed model. Effects of sire, parity, season and period were significantly contributing to the variation in most of the production traits. The estimates of heritability and repeatability of production traits were low. The phenotypic and genetic trends ranged from -4.92 days (LL) to 17.19 kg (305 MY) and -46.39 kg (TLMY) to 4.24 days (LL), respectively. The phenotypic and genetic correlations ranged from –0.152 to 1.0 and –0.061 to 0.909, respectively. The endeavour to conserve this breed and to produce Nili Ravi bulls to inseminate female Nili Ravi population in their home tract is in right direction. These findings will help to plan better breeding programme for Nili Ravi buffaloes in India.

Key words: Genetic trend, Heritability, Milk yield, Nili Ravi, Repeatability

Murrah and Nili Ravi are important superior breeds of buffaloes in India in terms of their performance. Though, Murrah has taken a centre stage in research on genetic analysis of production traits yet such attention on Nili-Ravi buffaloes are lacking resulting in declining of this fine germplasm at a faster rate in their home tract in India (Anonymous 2006). Regional station of Central Institute for Research on Buffaloes at Nabha, Punjab, established the only organized herd of Nili Ravi buffaloes in India, for improvement of Nili Ravi buffaloes, and has been working on the improvement and conservation of this breed since 1987. The present study is undertaken on economic traits of Nili Ravi buffaloes to study the genetic and non-genetic factors affecting production traits in Nili-Ravi buffaloes.

MATERIALS AND METHODS

The data on production performance of 1479 Nili Ravi buffaloes, born out of 86 sires, maintained at the only organized farm of Nili Ravi buffaloes in India, located at the regional station of the institute, were spread over from 1990 to 2006. Buffaloes were reared under loose housing system and standard management practices. Wallowing was also provided 3 times in a summer to all the milking buffaloes and heifers. Records on first lactation 305days' milk yield (FLMY), total lactation milk yield (TLMY), 305 days' milk yield (305 MY), lactation length (LL), peak yield (PY) and days to attain PY (DPY), milk yield per day LL (MY/LL) and milk yield per day calving interval (MY/CI) were analyzed to estimate the effects of sire, parity, season, period and sex of calf using mixed model. The duration were divided in to 4 periods, viz. period 1 (1990–93), period 2 (1994–97), period 3 (1998–01) and period 4 (2002–06), and the year was divided into 4 seasons, viz. 1,winter (Jan-Mar); 2, summer (Apr-Jun); 3, humid summer (Jul-Sep) and 4,autumn (Oct-Dec). The analysis of production traits was carried out using the following mixed model (Harvey 1990) except for 305MY where parity was excluded from the model.

The method of paternal half-sib correlation was used to estimate heritability of all the traits (Becker 1992). The standard error of heritability was estimated by using formula of Swiger *et al*. (1964).

The repeatability estimates (Becker 1992) were obtained by interclass correlation method for various economic production traits repeated in successive lactations of same animal as repeatability. The standard error of repeatability was calculated as per Swiger *et al.* (1964).

Analysis of variance and co-variance using the half sib data was carried out to estimate the genetic and phenotypic correlations among various first lactation traits (Becker 1992). Standard error of genetic correlation was estimated

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by using the formula given by Robertson and Rendell (1950)

The phenotypic trend was estimated as the linear regression of the performance of the population for a particular trait over the time.

The genetic trend per year was estimated based on (Smith 1962) the comparison of mean performance of paternal half sibs in different years. The environmental trend was estimated as the difference between phenotypic and the genetic trend and standard error was estimated.

RESULTS AND DISCUSSION

Factors affecting production traits

Least squares analysis using mixed model has been carried out and results are presented in Tables 1 to 3.

First lactation 305 days' milk yield (FLMY): The mean first lactation 305 days' milk yield (FLMY) in this herd (Table 1) was lower than the observations reported by Babar *et al.* (1998) and Reddy and Taneja (1984) in Nili-Ravi buffaloes.

Least squares analysis revealed that the effect of all the non-genetic factors on FLMY was nonsignificant in this study (Table 2), however, effect of sire was significant (P<0.05). The present findings on period are in agreement with those reported by Shabade *et al.* (1993) in Murrah buffaloes, whereas, significant effect of period was observed in Nili Ravi buffaloes by Suhail *et al.* (1998), Syed *et al.* (1996), Khan *et al.* (1997) and Babar *et al.* (1998). Khan *et al.* (1991) and Babar *et al.* (1998) also reported nonsignificant effect of season of calving, whereas, significant effect of season of calving on FLMY was reported by Syed *et al.* (1996) and Parveen *et al.* (1996) in Nili Ravi buffaloes.

The effect of age at first calving on FLMY was nonsignificant in this study which was similar to the reports by Ipe and Nagarcenkar (1992) in Murrah buffaloes, whereas, significant effect of AFC on FLMY was reported by Reddy and Taneja (1984) in Nili Ravi buffaloes.

Total lactation milk yield: Least squares mean of total lactation milk yield (TLMY) of this herd (Table 1) was higher than the mean reported for TLMY by Dutt and Yadav (1988a) in Nili Ravi buffaloes.

Parity of lactation had significant effect (P<0.01) on TLMY of this herd (Table 3). Lowest TLMY was estimated in the first lactation which increased as parity progresses and highest was in third lactation. Significant effect of parity on TLMY and increasing trend up to the third lactation was reported by Patel (1992) in Surti buffaloes. Similarly, increasing trend up to second lactation (Tailor and Jain 1987) and upto fourth lactation (Jain and Kothari 1983) was reported for medium sized buffaloes.

Period of calving had highly significant (P<0.01) effect on TLMY as revealed by the present study. Similar observations were made by Vij and Tiwana (1986b) in Murrah buffaloes and Tailor *et al.* (1992) in Surti buffaloes.

The influence (P<0.01) of season of calving on TLMY was significant in this study. Buffaloes that calved during winter (January to March) and in autumn (October to December) gave better performance with regard to TLMY and those calved in summer including humid-summer showed poor performance. Nonsignificant influence of season of calving on TLMY was also reported by Dutt and Yadav (1988b) in Nili-Ravi buffaloes and Tailor *et al.* (1992) in Surti buffaloes. However, similar observations were made

Table 1. Least square means±SE for lactation traits of Nili Ravi buffaloes

Effects	No. obs.	FLMY (kg)	TLMY(kg)	305MY (kg)	LL (Day)	PY (kg)	DPY(Day)	MY/LL (kg)	MCI (kg)
Mean	462	1636.4±23.9	1997.9±66.2	1916.3±50.0	301.2±8.6	10.5±0.3	35.9±1.9	6.8±0.2	4.7±0.1
Parity-1	464		1843.7±69.7	1657.0±52.9	347.0±9.1	8.1±0.3	44.5±2.1	5.3±0.2	3.7±0.1
Parity-2	257		2051.2±67.5	1924.1±51.1	327.8±8.8	10.1±0.3	42.2±2.0	6.3±0.2	4.2±0.1
Parity-3	145		2091.1±69.6	1976.9±52.8	313.0±9.1	10.8±0.3	38.3±2.1	6.7±0.2	4.7±0.1
Parity-4	89		2079.3±75.4	1995.5±57.4	309.7±9.9	11.2±0.3	36.1±2.4	6.8±0.2	4.8±0.1
Parity-5	58		2034.3±84.3	1986.8±64.4	293.9±11.1	11.0±0.3	33.5±2.8	7.1±0.2	5.0±0.2
Parity-6	38		1995.4±97.2	1937.4±74.5	292.7±12.8	10.6±0.4	32.7±3.3	7.1±0.2	4.9±0.2
Parity-7	23		2028.2±116.8	1973.2±89.9	290.2±15.4	10.6±0.5	33.6±4.1	7.2±0.3	5.1±0.2
Parity-8	10		1866.6±165.8	1826.0±128.0	271.4±21.9	10.8±0.6	33.2±6.0	7.1±0.4	5.3±0.3
Parity-9	3		1991.0±288.8	1970.1±223.5	264.8±38.3	11.6±1.1	29.0±9.7	7.7±0.6	4.9±0.5
Season-1	146	1648.8±48.6	2089.8±75.7	1972. 7±57.6	314.9±9.9	10.7±0.3	36.8±2.4	6.8±0.2	4.7±0.1
Season-2	136	1639.6±47.8	1931.5±77.5	1876.0±59.0	295.4±10.2	10.7±0.3	36.5±2.5	6.8±0.2	4.7±0.1
Season-3	486	1583.6±30.3	1936.5±67.9	1864.1±51.5	295.5±8.9	10.3±0.3	33.3±2.0	6.7±0.2	4.8±0.1
Season-4	319	1673.4±37.1	2033.6±69.5	1952.5±52.7	299.3±9.1	10.4±0.3	37.0±2.1	7.0±0.2	4.8±0.1
Period-1	60	1443.7±95.1	1859.7±106.2	1761.2±81.5	305.1±14.0	10.7±0.4	37.2±3.7	6.5±0.2	4.5±0.2
Period-2	216	1628.7±57.8	2096.0±75.7	1975.6±57.6	316.2±9.9	10.8±0.3	38.7±2.4	6.9±0.2	4.7±0.1
Period-3	340	1730.6±66.4	1962.1±69.6	1920.3±52.8	289.7±9.1	10.9±0.3	35.7±2.1	6.9±0.2	4.8±0.1
Period-4	471	1742.5±70.4	2073.6±84.0	2008.2±64.1	293.7±11.0	9.8±0.3	32.5±2.8	7.0±0.2	4.9±0.2
Male	555	1640.6±29.3	2020.9±67.8	1928.8±51.4	302.8±8.9	10.6±0.3	35.9±2.0	6.9±0.2	4.7±0.1
Female	532	1632.1±29.3	1974.8±67.8	1903.8±51.4	299.5±8.9	10.5±0.3	35.9±2.0	6.8±0.2	4.8±0.1

Table 2. Heritability±SE, repeatability±SE and trends of production traits in Nili Ravi buffaloes

Traits	Heritability	Repeatability	Genetic trend	Phenotypic trend	Environmental trend
FLMY	0.175±0.135	0.124±0.046	–0.21	16.11±3.44	16.32
TLMY	0.160±0.069	0.202±0.071	–46.39	7.78±4.14	63.58
305MY	0.148±0.068	0.114±0.066	–22.40	17.19±3.34	30.18
LL	0.153±0.068	0.240±0.072	4.24	–4.92±0.54	–9.16
PY	0.252±0.082	0.254±0.072	–0.35	–0.02±0.01	0.32
DPY	0.051±0.054	0.066±0.062	2.17	–0.08±0.02	–2.25
MY/LL	0.219±0.077	0.106±0.065	–0.20	0.11±0.01	0.31
MY/CI	0.142±0.067	0.281±0.073	–0.15	0.10±0.02	0.25

Table 3. Genetic (upper triangle) and phenotypic (lower triangle) correlations among production traits in Nili Ravi buffaloes

	FLMY	TLMY	305MY	LL	PY	DPY	MY/LL	MY/CI
FLMY		1.000	0.987	0.661	0.576	0.307	0.775	0.813
TLMY	0.909		1.000	0.722	0.622	0.376	0.646	0.806
305MY	1.000	0.909		0.613	0.606	0.371	0.782	0.781
LL	0.453	0.707	0.450		0.233	0.189	–0.122	0.538
PY	0.612	0.508	0.610	0.090		0.921	0.762	0.220
DPY	0.083	0.095	0.084	0.067	0.076		0.599	–0.152
MY/LL	0.644	0.510	0.642	–0.061	0.522	0.066		0.597
MY/CI	0.054	0.449	0.534	0.078	0.420	0.064	0.449	

by Patel (1992) in Surti buffaloes.

Significant effect (P< 0.01) of sire on TLMY was estimated in the present study. Similar effects were obtained by Joshi and Tripathi (1987b) in Murrah buffaloes. The higher contribution of sires could be useful for ranking sires accurately which is the most important part of any breeding programme.

305 day milk yield: Least square means of 305 day milk yield (305MY) in the present study was 1916.3±50.0 kg (Table 1). Lower mean 305MY was observed by Saxena and Tomar (1984) in Murrah buffaloes. However, higher 305MY than the present study was reported by Vij and Tiwana (1986b) in Murrah buffaloes.

Parity showed highly significant (P< 0.01) effect on 305MY in this study. Highest milk yield was produced in fourth parity (1995.5±57.4 kg), and lowest performance was found in the first parity (1657.0±52.9 kg). Significant effect of parity on 305MY was reported by Vij and Tiwana (1986b) in Murrah buffaloes. Season of calving significantly (P< 0.01) influenced the 305MY at this sub campus. Winter calvers performed better than summer calvers. Similar findings were reported by Patel (1992) in Surti buffaloes. In this study, period had highly significant (P< 0.01) effect on 305MY (Table 3). Similar observations were made by Patel (1992) in Surti buffaloes.

Lactation length: This estimate of lactation length (LL) was higher (Table 1) than the report in Murrah buffaloes by Basu and Ghai (1978). Higher lactation length was reported by Umrikar and Deshpande (1985) in Murrah buffaloes.The influence of parity of lactation on lactation length was significant (P< 0.01) in the present study. The significant influence of parity on LL was observed by Umrikar and Deshpande (1985) in Murrah buffaloes and Jain and Kothari (1983) in Surti buffaloes.

Period of calving influenced this trait (P< 0.01) in the present study (Table 3). Period 1 and 2 had higher lactation length than other 2 periods (Table 1). Significant effects of period of calving on LL were reported by Garcha and Tiwana (1980) in Murrah buffaloes, whereas, Syed *et al.* (1996) reported significant effect of period on first lactation length in Nili Ravi buffaloes. Season of calving influenced LL in the present study. Reports of Umrikar and Deshpande (1985) in Murrah buffaloes, Khan and Akhtar (1998) in Nili Ravi buffaloes are in agreement with the present findings.

Significant influence (P<0.01) of sire on LL was estimated in the present study (Table 3). Similar findings were observed by Tailor *et al.* (1992) in Surti buffaloes.

Peak yield: Least squares mean peak yield (PY) in the present study was 10.5±0.3 kg (Table 1). This was similar to the estimates of PY obtained by Gajbhiye and Tripathi (1988) in Murrah buffaloes. Present estimate was higher than those reported by Singh *et al.* (1986) in Mehsana buffaloes. Murthy *et al.* (1985) in Surti buffaloes reported the lower peak yield than the present investigation. Effect of parity was highly significant (P< 0.01) on peak yield in the present study (Table 3). Lowest PY was observed in the first lactation, increasing trend up to fourth lactation and was declined thereafter up to seventh lactation. Significant influence of parity on PY was observed by Prakash and Tripathi (1987) in Murrah and Biradar (1990) in Surti buffaloes. On the contrary to the present results, nonsignificant influence of parity on PY was observed by Chowdhary and Chowdhary (1981) in Mehsana buffaloes.

Highly significant effect (P< 0.01) on PY of season of calving was observed in this study (Table 3). Similar findings were reported by Gajbhiye and Tripathi (1988) in Murrah buffaloes and Singh *et al.* (1986) in Mehsana breed. We observed that the buffaloes calved during first and second season gave equal peak yield and slight difference was observed in third and fourth season of PY.

Nonsignificant effect of season of calving was reported by Prakash and Tripathi (1987) in Murrah buffaloes, Jain *et al.* (1982) in Surti buffaloes and Chowdhary and Chowdhary (1981) in Mehsana buffaloes.

Highly significant effect (P< 0.01) of period of calving on PY was observed in this study. The PY was more during first 3 periods and declined during the fourth period. Significant effect of period of calving on PY was reported by Gajbhiye and Tripathi (1988) in Murrah buffaloes and Biradar (1990) in Surti buffaloes. However, nonsignificant effect of period of calving was reported by Prakash and Tripathi (1987) in Murrah buffaloes and Murthy *et al.* (1985) in Surti buffaloes.

Highly significant effect (P< 0.01) of sire on PY was observed in this study. Similar findings were observed by Garcha and Tiwana (1980) for Murrah buffaloes.

Days to attain peak yield: Least squares mean days to attain peak yield (DPY) in Nili Ravi buffaloes was estimated at this farm as 35.9±1.9 days as observed in the study (Table 1). However, Vij and Tiwana (1986b) and Gajbhiye and Tripathi (1988) reported higher DPY in Murrah buffaloes.

Parity had highly significant effect (P< 0.01) on DPY of Nili Ravi buffalo at this farm. First calvers took longer time to attain peak yield and reduced as the parity increased, lowest in ninth parity. Significant effect of parity on DPY was reported by Gajbhiye and Tripathi (1988) in Murrah buffaloes, while, Garcha and Tiwana (1980) observed a declining trend over lactations. Nonsignificant influence of parity on DPY was observed by Chowdhary and Chowdhary (1981) in Surti buffaloes.

Significant effect (P< 0.01) of season of calving on DPY of Nili Ravi buffaloes was observed in this study. Buffaloes calving during humid summer (July to September) reached peak yield earlier in their lactation than the buffaloes calving in winter, summer and autumn (36–37 days).

Significant effect of season of calving on DAPY was reported by Gajbhiye and Tripathi (1988) in Murrah buffaloes. Govindaiah and Rai (1987) found that March calvers had lower and June calvers had longer DPY, while off season (March-August) calvers had longer DPY (Garcha and Tiwana 1980).

Significant (P<0.05) effect of season on DPY was observed in this study (Table 3), which was contrary to the reports by Chowdhary and Chowdhary (1981) in Surti buffaloes, Singh *et al.* (1986) in Mehsana breed and Vij and Tiwana (1986b) in Murrah buffaloes.

Period of calving did not influence DPY (Table 3) in the present study, which was similar to the reports by Gajbhiye and Tripathi (1988) in Murrah buffaloes. However, significant effect of period of calving on DPY was reported by Vij and Tiwana (1986b) in Murrah buffaloes. Present finding showed that sire did not influence DPY, however, reports are not available to compare this finding in buffaloes.

Milk yield per day lactation length: Least squares means of milk yield per day lactation length (MY/LL) is lower (Table 1) than the reports on Murrah buffaloes by Vij and Tiwana (1986b), however, higher than the findings of Singh *et al.* (1989) in Nili Ravi buffaloes and Patel (1992) in Surti buffaloes.

Highly significant effect (P<0.01) of parity on MY/LL was observed in this study (Table 3). Lowest MY/LL was produced in first lactation while there was an increasing trend of MY/LL up to ninth lactation. Vij and Tiwana (1986b) observed that Murrah buffalo showed increase in MY/LL up to second lactation and subsequent gradually declined. Patel (1992) observed that MY/LL increased up to fifth lactation in Surti buffaloes. However, nonsignificant influence of parity on MY/LL was observed by Patel (1992) in Surti buffaloes.

Season of calving influenced the MY/LL significantly (P< 0.01) in this study (Table 3). Highest MY/LL was produced by the buffaloes calving during autumn than calving during winter, summer and humid summer. Significant effect of season on MY/LL was reported by Patel (1992) in Surti buffaloes. On the other hand, nonsignificant influence of season of calving on MY/LL was reported by Vij and Tiwana (1986b) in Murrah buffaloes.

Period of calving did not influence on MY/LL in this study (Table 3). However, significant observation was made by Vij and Tiwana (1986b) in Murrah buffaloes and Patel (1992) in Surti buffaloes. Highly significant effect (P< 0.01) of sire on MY/LL was observed in this study, however, reports are not available to compare this finding in buffaloes.

Milk yield per day calving interval: Least squares mean milk yield per day calving interval (MY/CI) in Nili Ravi buffaloes was 4.7±0.1 kg at this farm (Table 1). This was similar to reported by Vij and Tiwana (1986b) in Murrah buffaloes. Parity of lactation had highly significant (P< 0.01) effect on MY/CI in the present investigation (Table 3). Lowest value was in first calvers and showed increasing trend thereafter. Significant effect of parity on MY/CI was recorded by Vij and Tiwana (1986b) in Murrah buffaloes and Patel (1992) in Surti buffaloes. The increasing trend in Murrah buffaloes was observed up to second lactation Vij and Tiwana (1986b).

In the present study, season/period of calving and sex of calf did not influence on MY/CI in Nili Ravi buffaloes at this farm (Table 3). Present findings are in agreement with the reports on season and period (Vij and Tiwana, 1986b), however, significant effect of period calving on MY/CI was observed by Sahana (1993) and Shabade *et al.* (1993) for the first lactation in Murrah buffaloes.

It was observed that sire had highly significant (P< 0.01) effect on MY/CI (Table 3). Similar effect was observed by Joshi and Tripathi (1987b) for other breeds of buffaloes.

Genetic parameters of economic traits in Nili Ravi buffaloes: The genetic parameters, viz. heritability, repeatability, phenotypic/genetic correlations and genetic/ phenotypic/ environmental trends of various economic traits of Nili Ravi buffaloes at this farm were estimated.

The heritability estimate of FLMY was 0.175±0.135 for Nili Ravi buffaloes (Table 2). This finding was comparable to those reported by Thevarmanaoharan (2000) and Khan *et al*. (1997) in Nili Ravi buffaloes. Lower estimates of heritability were reported by Chakravarty and Rathi (1989) and Dass and Sharma (1993) in Murrah buffaloes. The higher heritability estimates of FLMY were reported than present finding by Dutt and Yadav (1988a) in Nili Ravi buffaloes. Results indicated that FLMY are low heritable and thus can be improved by better management practices.

The heritability estimates of TLMY was 0.160±0.069 in the present study, which was similar to the estimates obtained by Jawarkar and Johar (1975) in Murrah buffaloes, whereas, low heritability estimate of TLMY was observed by Singh and Yadav (1989) in Nili Ravi buffaloes and higher heritability estimates were reported by Sharma (1982) in Murrah buffaloes.

The LL was low heritable (0.153±0.068) in the present study, which was similar to those reported by Verma and Yadav (1989) in Nili Ravi buffaloes, Jawarkar and Johar (1975) in Murrah buffaloes and Tailor *et al.* (1992) in Surti buffaloes. However, low heritability was reported by El-Arian (1986) in Murrah buffaloes and higher heritability estimate of LL was reported by Khan *et al.* (1996) in Nili Ravi buffaloes.

The PY was moderately (0.252±0.82) heritable in Nili Ravi buffaloes. High estimate of heritability of PY in Nili Ravi buffaloes was reported by Babar *et al.* (1996). However, low estimate of heritability of PY was reported by Prakash and Tripathi (1987) in other buffaloes. The DPY was very low heritable (0.05±0.054) in the present study for Nili Ravi buffaloes. Vij and Tiwana (1987) also observed very low by heritable DPY in Murrah buffaloes.

The heritability estimates of MY/LL was observed moderate (0.219±0.077) in this study (Table 2), which was similar to those reported by Javek *et al.* (1990) in Nili Ravi buffaloes and Joshi and Tripathi (1987a) for lactation milk yield of Murrah buffaloes. However, heritability of MY/LL in the present study was lower than those reported by Singh *et al.* (1989) for Nili Ravi buffaloes and Vij and Tiwana (1986b) for Murrah buffaloes.

Heritability of MY/CI in this study was 0.142±0.067 for Nili Ravi buffaloes (Table 2), which was comparable to the estimate by Singh *et al.* (1989) and Verma and Yadav (1989) in Nili Ravi buffaloes. However, higher estimate of MY/FCI were reported by Javek *et al.* (1990) in Nili Ravi buffaloes and Vij and Tiwana (1986b) in Murrah buffaloes. The estimate of repeatability of first lactation of 305 days milk yield (FLMY) was 0.124±0.46 in this study (Table 2). This estimate was lower than those reported by Khan *et al.* (1997) in Nili Ravi buffaloes. However, higher estimates were reported by Vij and Tiwana (1989) in Murrah buffaloes.

The TLMY showed repeatability of 0.202±0.071 (Table 2), which was lower than those reported by Khan *et al.* (1987) and Babar *et al.* (1996) in Nili Ravi buffaloes. However, higher repeatability estimates were reported by Vij and Tiwana (1989) in Murrah buffaloes.The repeatability estimate of LL was 0.240±0.072 at this farm. The lower repeatability was reported by Syed *et al.* (1996) in Nili Ravi buffaloes. However, higher estimate of repeatability of lactation length were found by Babar *et al.* (1996) in Nili Ravi buffaloes.The PY was moderately repeatable in this study (0.254±0.072). Babar *et al.* (1996) also estimated that the peak yield had high repeatability in Nili Ravi buffaloes. However, lower estimate of repeatability for peak yield were reported by Prakash and Tripathi (1987) in Murrah buffaloes.

Repeatability of DPY was very low (0.066±0.062) in the present study. Very low repeatability was also estimated by Vij and Tiwana (1989) in Murrah buffaloes.The MY/LL were estimated to have repeatability of 0.106±0.065 in this study. Lower estimate was reported by Prakash and Tripathi (1987) in Murrah buffaloes. However, high estimates were reported by Vij and Tiwana (1989) in Murrah buffaloes.The MY/CI were estimated to have repeatability of 0.281±0.073 (Table 2). The lower estimate of repeatability was reported by El-Arian (1986) in Murrah buffaloes. However, higher estimates were reported by Vij and Tiwana (1989) in Murrah buffaloes.

The phenotypic trend (change) in FLMY per annum was estimated as 16.11±3.44 kg which is a desirable trend. Vij and Tiwana (1986a) and Sahana (1993) estimated positive trend of FLMY in Murrah buffaloes. The genetic trend for FLMY in the present study was –0.21. The negative genetic and positive phenotypic trend implies that milk production at this farm has mainly achieved through better management. Negative genetic trend could be attributed to culling of animals with superior genetic makeup due to poor health (mastitis, metritis, repeat breeding etc.) conditions. Vij and Tiwana (1986a) and Sahana (1993) reported positive genetic trend in Murrah buffaloes. The environmental trend of FLMY at this farm was 16.32 kg for Nili Ravi buffaloes, which was similar to the report of Patel (1992) in Surti buffaloes. The positive environmental trend indicated that climatic conditions feed, management and health care of the herd was superior.

Phenotypic trend of TMLY was 7.78±4.14 kg at this farm

(Table 2). Positive phenotypic trend of TLMY was observed by Sahana (1993) in Murrah buffaloes. However, Patel (1992) observed negative phenotypic trend of TLMY in Surti buffaloes. Genetic trend estimated for TLMY was –22.40 kg in this study. However, positive genetic trends were reported by Sahana (1993) in Murrah buffaloes and Patel (1992) in Surti buffaloes. However, negative genetic trend was estimated by EL-Arian (1986) in Murrah buffaloes. Environmental trend (30.18 kg) of TLMY was positive in this study. Positive environmental trend was estimated by Patel (1992) in Surti buffaloes. Positive environmental trend indicated that the management, feeding, health care of herd was maintained properly at this farm.

Phenotypic trend of LL observed in this study was –4.92±0.54 days. Shorter lactation length is a concern to the breeder throughout India. Similar trends were reported by Vij and Tiwana (1986a) and Patel (1992) in different breeds of buffaloes. However, positive trends of LL were also reported by Reddy (1980) in Nili Ravi buffaloes, Sharma and Singh (1988) and Sahana (1993) in Murrah buffaloes. Genetic trend of LL in Nili Ravi buffaloes was 4.24 days in this study. Nearly positive genetic trend of LL was reported by Sharma and Singh (1988) in Murrah buffaloes. However, negative genetic trends were reported by Reddy (1980) in Nili Ravi buffaloes and Sahana (1993) in Murrah buffaloes. Negative environmental trend of LL was observed (–9.16 days) in this study. Negative phenotypic and environmental and positive genetic trends indicated that by improving managemental LL, can be increased to an extent since genetic potential for longer LL exist.

There was a decrease in peak yield and estimated by per annum. Higher decrease in PY per annum than present study was reported by Patel (1992) in Surti buffaloes. However, Sahana (1993) estimated positive phenotypic trend of PY in Murrah buffaloes. Genetic trend estimated in the present study was (–0.35 kg). Similarly negative genetic trends in PY were investigated by Patel (1992) in Surti buffaloes. However, positive genetic trends were estimated by Sahana (1993) in Murrah buffaloes. The environmental trend in PY was 0.32 kg in this study. This was similar with the finding of Patel (1992) in Surti buffaloes.

The phenotypic trend for DPY was –0.08±0.02 days per annum in this study and the genetic trend estimated was 2.17 days. The positive genetic was beneficial for herd average. The environmental trend was also found –2.25 days.The phenotypic trend of MY/LL was 0.11±0.01 kg in this study. Significant increase in MY/LL per annum in Murrah buffaloes was reported by Sahana (1993). Reddy (1980) estimated nonsignificant positive phenotypic trend in Nili Ravi buffaloes. Patel (1992) observed a negative phenotypic trend in Surti buffaloes. Genetic trend of MY/LL was in an undesirable direction (–0.20 kg) in this study. Similarly negative genetic trend was estimated by Reddy (1980) in Nili Ravi buffaloes. However, Patel (1992) reported positive genetic trend of MY/LL in Surti buffaloes. The environmental trend for MY/LL was positive (0.31 days) at this farm for Nili Ravi herd.

Phenotypic trend of MY/CI was 0.10 kg per annum at this farm. Positive phenotypic trend of MY/CI was reported by Reddy (1980) in Nili Ravi buffaloes. However, Patel (1992) estimated negative phenotypic trend of MY/CI in Surti buffaloes. Negative genetic trend of MY/CI was obtained (–0.15) in this study. Negative genetic trend in MY/CI was also observed by Reddy (1980) in Nili Ravi buffaloes. However, Patel (1992) estimated positive genetic trend of MY/CI in Surti buffaloes. Environmental trend MY/CI in this study was 0.25 kg/annum.

Phenotypic and genetic correlations: The phenotypic correlations among different production traits are mostly positive except the same for LL vs MY/CI (–0.061). The phenotypic correlations were more than 0.90 between FLMY, 305MY and TLMY. The phenotypic correlations of production traits with DPY were lower (0.064 to 0.095). Positive phenotypic correlation indicates that any one of the traits could be taken care of to achieve improvement in other. Similarly for negative correlations, the breeder has to optimize the performance of both since improvement in one may negate in other. Higher correlations between FLMY, TLMY, 305MY, PY and LL are expected. Sharma and Basu (1985) also reported higher phenotypic correlation between FLMY vs 305MY (0.960) and TLMY vs LL (0.65) in Nili Ravi buffaloes. In Murrah, the phenotypic correlation was quite high (0.830 to 0.930) as reported by Vij and Tiwana (1987) and El-Arian (1986) and Gajbhiye and Tripathi (1988). Lower value of phenotypic correlation between PY and DPY (0.46 to 0.68) was reported by Vij and Tiwana (1986b) and Patel (1992) as compared to this study (0.921).

Higher genetic correlations (> 0.642) were observed between TLMY vs FLMY (0.909), FLMY vs MY/LL (0.644) and 305MY vs MY/LL (0.642). Sharma and Basu (1985), however, observed higher (0.99) correlation between FLMY and MY/LL in Nili Ravi buffaloes, as compared to our findings (0.644) and Vij and Tiwana (1986b) also reported higher value (0.94) in Murrah buffaloes.

The Nili Ravi buffalo could not retain its true characteristics due to the lack of a planned breeding program, and presently hardly any animal with all 5 extremities being white is seen in their breeding tract (Vij and Tantia 2005). Buffaloes with 2–3 white extremities have a lower market price when compared to pure Nili Ravi or black buffaloes. There is a definite market preference towards the Murrah type black animals while the population of pure Nili has declined considerably in spite of its milk yield being not less than that of the Murrah. This trend needs to be checked to prevent the erosion of this gene pool in India. There is a need to provide semen of typical Nili Ravi bulls in its breeding tract so as to produce progeny true to its characteristics and propagate the breed. The endeavour to conserve this breed and to produce Nili Ravi bulls to inseminate female Nili Ravi population in their home tract in addition to the nominated mating at this herd is in right direction. These findings will help to plan better breeding programme for Nili Ravi buffaloes in India.

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