Phenotypic and genetic trends for milk production in Egyptian buffaloes

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Abstract: A total of 3495 records collected from 904 buffalo cows progeny of 174 sires and 470 dams through period from 1990 to 2008 in all Stations belonging to Animal Production Research Institute, Ministry of Agriculture were used to estimate the phenotypic and genetic trends for total milk yield. LSM for total milk at different year of calving ranged between 1334 kg and 1692 kg, 1028 kg and 1561 kg, 1209 kg and 1633 kg, 1355 kg and 1415 kg and 1137 kg and 1355 kg for El-Nattafe El-Gidid (NG), El-Nattafe El-Kadim (NK), Mahalet Mousa (MM), Gemiza (G) and Sids (S) stations, respectively. Estimates of the positive breeding value (BV, %) at different year of calving ranged between 40 % and 52 %, 31 % and 52 %, 40 % and 56 %, 37 % and 55 % and 45 % and 59 % for NG, NK, MM, G and S stations, respectively. Annual phenotypic trend for milk production ranged between -11.7 kg and +36.7 kg for S and NK stations, respectively. While, the annual genetic trend ranged between -0.16 kg and +0.6 kg for G and NG stations, respectively. The results of the present study showed that there are increased of improvement of phenotypic and genetic trend in all MM farms from 1990 until now. [Journal of American Science. 2010;6(11):143-147]. (ISSN: 1545-1003).

Keywords: buffalo, phenotypic trend, genetic trend, breeding value and milk production

1. Introduction

The Egyptian buffaloes occupies an important role among the domestic animals as a provider of dairy produce beef. It contribution about 70 % of total country milk production, although the population of dairy animals (8.5 million) is almost equally divided between cows and buffaloes. Milk yield in buffaloes is affected by several genetic and non-genetic factors, that modulate the expression of the genetic merit (Khattab and Mourad, 1992 and Mourad *et al*., 2005).

Since the productivity of the Egyptian buffaloes in nearly similar to that of other buffalo breeds, the introduction of foreign breed of buffalo will not contribute significantly in improving the genetic make up of the Egyptian buffaloes as in case of the native cattle. Therefore, improving the productivity of the buffalo done through selection. Open nucleus herd system (Steane, 1990) were applied from 1997 until now and established in El-Nattafe El-Gidid. Objectives of the present study were to estimate genetic and phenotypic trends in a five herds over 18 years and genetic evaluation of nucleus scheme.

2. Material and Methods

The data were collected from Stations : El-Nattafe El-Gidid, El-Nattafe El-Kadim, Mahalet Mousa (Kafr El-Sheikh Governorate), Sids (Bani Sewafe Governorate) and Gemiza (Gharbia Governorate) belonging to Animal Production Research Institute, Ministry of Agriculture. A total of 3495 records collected from 904 buffalo cows' progeny of 174 sires and 470 dams and their sires having 5 progeny or more through period from 1990 to 2008 were used to estimate the phenotypic and genetic trend for total milk yield.

Buffaloes were kept in open sheds and grazed on berseem from December to May. They were hand-milked twice daily. Heifers were served for the first time when they reach 330 kg and / or 24 mo.. The cows should be dried off two months before the calving date, and they served not before two months after calving.

The Animal model (derivative - free restricted maximum likelihood: DFREML, Meyer, 1997) used to prediction of buffaloes breeding value for total milk yield according to the following model:

$$\mathbf{y = Xb + Z_a\, a + Z_c\, c + e}$$

where: y = Vector of observations, X = Incidence matrix relating fixed effects to y, b = Vector of an overall mean and fixed effects (parity, year, season of calving and lactation period as a covariable), Z_a = Incidence matrix relating direct additive genetic effects to y, a = Vector of random effect (direct additive genetic associated with the incidence matrix Za, Z_c = Incidence matrix for permanent environmental effect, c = Vector of permanent environmental effect associated with the incidence matrix Zc and e = Vector of random residual effects N (0, Iσ^2e); I is an identity matrix. The variance-covariance of the random effects was as follows

$$Var\begin{bmatrix} a \\ c \\ e \end{bmatrix} = \begin{bmatrix} A\sigma^2 a & 0 & 0 \\ 0 & I_c\sigma^2 c & 0 \\ 0 & 0 & I_n\sigma^2 e \end{bmatrix}$$

Where: A = Numerator relationship matrix, I_c, I_n = Identity matrix with order equal to number of animals and number of records, respectively.

The phenotypic trends were measured as the regression of least squares means on calving years. Also, the genetic trends were measured as the regression of breeding value on calving years.

$$\mathbf{Y = a + Xb}$$

Where: Y = total milk yield or breeding value, A = Intercept, X = Calving Year and b = the regression coefficient for Y on X.

3. Results and Discussion

Least square means for TMY, LP and BV (TMY) (mean, minimum, maximum and percentage of positive) are presented in Table 1. The present estimate of TMY is lower than those reported by Soliman *et al.* (1985) and Badran *et al.* (1991) (2159 and 2241 kg, respectively) on Egyptian buffaloes. But similar to those reported by Khattab *et al.* (1985) 1456 kg, otby *et al.* (1989) 1292 kg, Ashmawy (1991) 1564 kg, Khalil *et al.* (1992) 1249 kg, Khattab and Mourad (1992) 1309 kg, Khalil (1993) 1249 kg, Mansour *et al.* (1993) 1363 kg, Abd El-Raoof (1995) 1505 kg and Mourad *et al.* (2005) 1581 kg, on Egyptian buffaloes.

The differences between the estimates in present study and other studies may be attributed to the herds size, climatic and managerial conditions and / or different genetically make up. The percentage of positive for BV (TMY) ranged from 40 to 52 %, from 31 to 52 %, from 40 to 56 %, from 40 to 50 %, from 37 to 55 %, from 45 to 59 % and from 41 to 50 % in NG, NK, MM, All MM, G, S and All stations, respectively (Table 1).

Table (2) shows the intercept (a), regression coefficient (b) and accuracy (R^2) for TMY and BV (TMY) on calving years. The accuracy ranged from 55 to 79 % for TMY and from 51 to 72 % for BV (TMY).

Table (3) showed the amount of phenotypic and genetic change for TMY. The annual phenotypic change ranged from -11.7 to +36.7 kg in S and NK farms, respectively. While, the annual genetic change ranged from -0.16 to +0.6 kg in G and NG farms, respectively. Also NK farm have a good annual phenotypic and genetic change (+36.7 and +0.57 kg, respectively). The experimental stations in all MM were best annual phenotypic change (+26.0 kg). But, different in Sids and Gemiza farms (-11.7 and +2.3 kg, respectively). While, the experimental stations in all MM and Sids farms were best annual genetic change (+0.58 and +0.54 kg, respectively). But, different in Gemiza farm (-0.16 kg). The differences between the experimental stations may be attributed to different nutritional level, climatic conditions and management practices in different herds.

Very limited literature on phenotypic and genetic trend for TMY in Egyptian buffaloes. Khattab and Mourad (1992) reported that the phenotypic and genetic trends for TMY in all MM farms from 1966 to 1987 were +16.2 and -1.6 kg, respectively. These results were lower than the estimates in this study. The results of the present study showed that there are increased of improvement of phenotypic and genetic trend in these farms from 1987 until now.

Fig. (1). showed the phenotypic and genetic trend for TMY in all farms. Increases of both trends for all farms except in Sids and Gemiza farms for phenotypic and genetic trend, respectively. This results explain clearly, the importance of genetic – environmentally interaction effect on milk yield traits.

From the present study we recommended that, construct selection indexes to increase genetic and phenotypic improvement of milk yield traits in Egyptian buffaloes. The importance of genetic – environmentally interaction effect in all milk production traits.

Table (1). LSM±SE for total milk yield (TMY), lactation period (LP) and mean, minimum, maximum and % of positive for breeding value (BV, TMY) at different birth year.

Farm	TMY (kg)	LP (Day)	BV (TMY, kg)			
	LSM±SE	LSM±SE	Mean	Min.	Max,	% of positive
NG : (955)*						
1993	1368±76	220±11.2	-0.28	-99.61	189.85	44
1996	1334±42	216±6.00	-3.66	-187.65	232.78	40
1999	1606±46	217±5.00	-1.30	-222.65	220.11	47
2002	1580±45	209±4.80	5.73	-260.72	328.53	47
2005	1692±37	208±4.20	4.26	-279.10	339.51	50
2008	1667±31	209±3.70	6.12	-268.23	326.63	52
NK : (721)*						

1993	1028±112	182±18.6	0.06	-57.24	176.73	31
1996	1147±61	192±9.20	-2.38	-100.12	194.24	48
1999	1521±43	206±5.90	-4.62	-152.61	258.97	48
2002	1492±42	204±4.50	3.53	-243.64	226.16	52
2005	1561±41	204±4.40	4.05	-248.44	238.38	49
2008	1555±41	204±4.40	6.30	-352.31	243.11	51
MM : (830)*						
1993	1209±103	209±15.0	-1.17	-111.27	115.62	40
1996	1300±68	214±9.90	-0.79	-197.20	182.56	56
1999	1628±58	232±7.00	-1.76	-265.14	362.82	41
2002	1633±45	222±5.10	5.79	-280.98	394.36	47
2005	1619±41	217±4.50	5.51	-289.44	523.18	47
2008	1546±41	211±4.30	5.49	-289.58	556.45	47
All MM : (2506)*						
1993	1251±56	210±12.0	-0.48	-111.27	189.85	40
1996	1282±32	212±11.5	-2.64	-197.20	232.78	46
1999	1585±28	220±10.0	-2.49	-265.14	362.82	45
2002	1568±25	216±9.00	5.00	-280.98	394.36	49
2005	1626±23	222±9.80	4.66	-289.44	523.18	48
2008	1594±22	220±10.5	5.94	-352.31	556.45	50
G : (580)*						
1993	1366±76	284±11.6	-2.37	-85.84	101.10	37
1996	1355±44	264±7.40	2.49	-159.04	260.83	55
1999	1410±45	249±7.80	-3.97	-252.06	241.54	44
2002	1415±46	243±6.60	-3.99	-210.88	368.68	41
2005	1407±38	246±14.4	1.98	-335.97	552.10	48
2008	1381±33	241±4.00	-5.49	-279.21	601.08	46
S : (409)*						
1993	1355±82	278±16.0	2.12	-56.37	75.68	56
1996	1242±89	273±11.7	-1.99	-245.47	178.89	59
1999	1318±70	271±8.80	-4.33	-203.57	139.21	48
2002	1206±48	249±7.60	1.68	-253.59	148.61	57
2005	1229±29	248±6.40	7.56	-243	185.24	45
2008	1137±34	240±5.60	6.58	-241.69	176.47	53
All : (3495)*						
1993	1284±43	205±14.0	-0.62	-111.27	189.85	41
1996	1292±26	210±12.5	-1.65	-245.47	260.83	48
1999	1534±24	215±11.8	-2.89	-265.14	362.82	46
2002	1506±21	210±9.90	3.31	-280.98	394.36	48
2005	1513±18	215±12.0	4.89	-335.97	552.09	48
2008	1493±18	202±11.5	3.97	-352.31	601.08	50

NG: El-Nattafe El-Gidid NK: El-Nattafe El-Kadim MM: Mahalet Mousa
All MM: NG, NK and MM G: Gemiza S: Sids All: all farms
*: Number or records.

Table (2). Intercept (a), Regression coefficient (b) and accuracy (R^2) for Total milk yield (TMY) and breeding value (BV, TMY) on calving years.

Farm	TMY			BV (TMY)		
	A	b	R^2	a	b	R^2
NG	-46909	24.22	79	-1194.49	0.60	67
NK	-71930	36.65	77	-1116.07	0.56	56
MM	-48942	25.21	57	-1136.20	0.57	72
All MM	-50529	26.00	74	-1169.87	0.59	69
G	-3107	2.25	55	324.86	-0.16	51
S	24892	-11.82	71	-1083.29	0.54	53
All	-30571	16.00	60	-928.02	0.46	63

NG: El-Nattafe El-Gidid NK :El-Nattafe El-Kadim MM: Mahalet Mousa
All MM: NG, NK and MM G: Gemiza S: Sids All: all farms

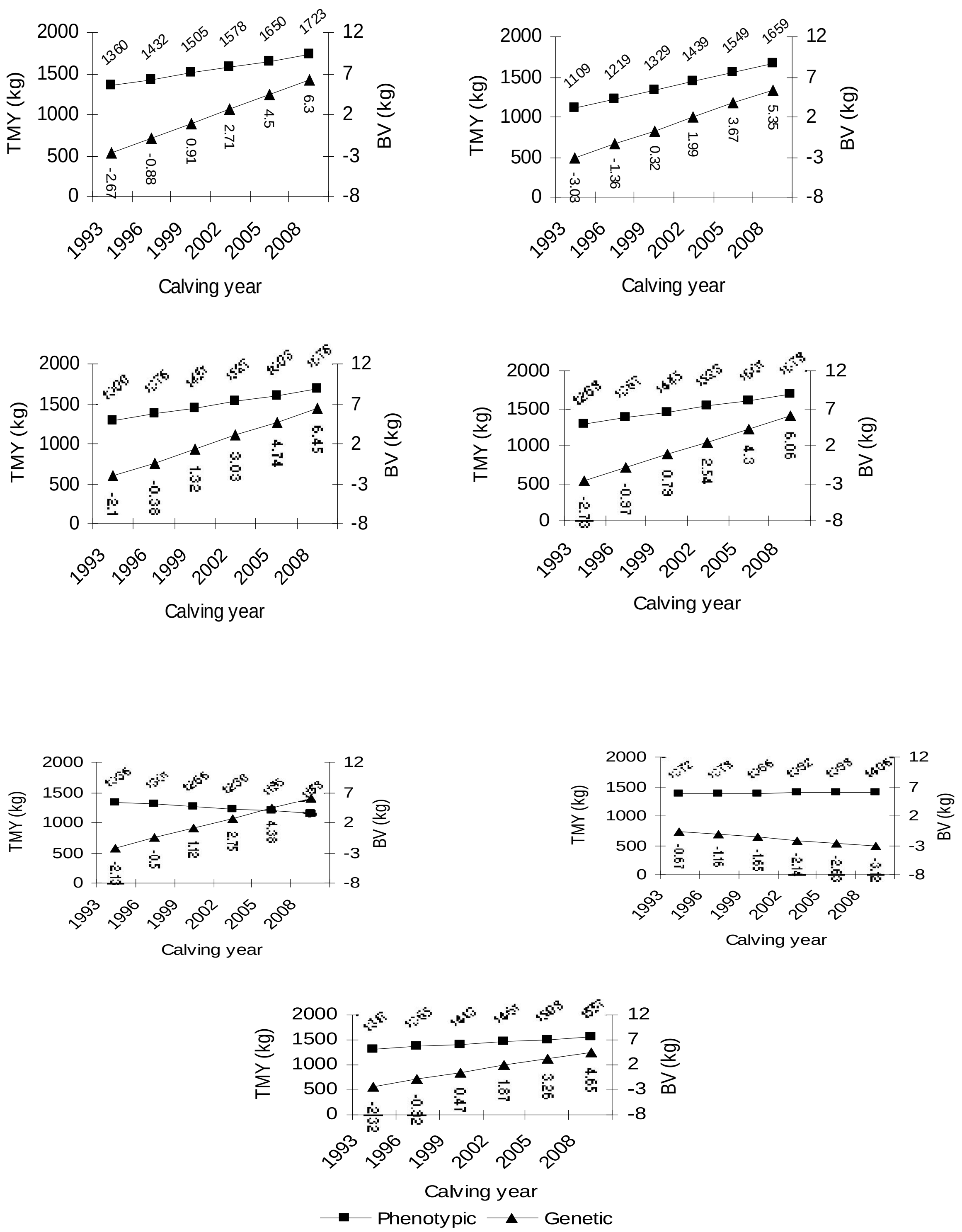

Fig. (1) Phenotypic and genetic trend for total milk yield in all farms
NG: El-Nattafe El-Gidid NK:El-Nattafe El-Kadim MM: Mahalet Mousa All MM: NG, NK and MM
G: Gemiza S: Sids All: all farms

Table (3). Amount of phenotypic and genetic change (kg) for total milk yield

	Phenotypic		Genetic	
Farm	**Change***	**Annual**	**Change***	**Annual**
NG	+73	+24.3	+1.80	+0.60
NK	+110	+36.7	+1.70	+0.57
MM	+76	+25.3	+1.70	+0.57
All MM	+78	+26.0	+1.75	+0.58
G	+7	+2.30	-0.49	-0.16
S	-35	-11.7	+1.63	+0.54
All	+48	+16.0	+1.40	+0.47

NG: El-Nattafe El-Gidid NK: El-Nattafe El-Kadim MM: Mahalet Mousa
All MM: NG, NK and MM G: Gemiza S: Sids All: all farms * Every 3 years

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