J. Animal and Poultry Production, Mansoura University, Vol. 1 (7):275- 281, 2010

ESTIMATION OF GENETIC AND PHENOTYPIC TREND OF TOTAL MILK YIELD OF EGYPTIAN BUFFALO RAISED AT EXPERIMENTAL FARM IN EGYPT

Mohamed, S.A.M.[1]; Heba A. M. Mostafa[2]; Mahasen M. M. Abdel-Aziz[2]; S. A. M. Abdel-Salam[1]; M. A. M. Ibrahim[1] and R. R. Sadek[1]

1- Animal Production Department, Faculty of Agriculture, Cairo University, Giza, Egypt

2- Animal Production Research Institute, Ministry of Agriculture and Land Reclamation, Egypt.

ABSTRACT

The objective of this study was to estimate the genetic and phenotypic trend of total milk yield (TMY) of Egyptian buffalo. A total number of 3005 test day milk records for 401 Egyptian buffaloes, daughters of 54 sire covered the period from 1991 to 2002 were used in this study. Data were collected from Mahliet Mousa and El- Nattaf El-Kadeem farms in Kafr El-Sheikh. The two farms belong to Animal Production Research Institute, Ministry of Agriculture and Land Reclamation, Egypt.

The data were analyzed using the Least squares technique to examine the effects of year-season of calving, herd and parity on total milk yield.

The effects of year-season of calving, herd, and parity on TMY were all highly significant (P<0.001). The average TMY was 1429 Kg. The heritability estimate of TMY was 0.25. The regression of TMY on year of calving showed a positive trend (+67 kg per year of calving). Also, genetic trend was positive (+12.55kg per year of birth). In conclusion, although the trend in the estimated breeding values was positive, it still did not lead to adequate change required in the average milk production due, probably, to inadequate feeding and/or impaired management of the herds.

Keywords: Heritability, genetic and phenotypic trend, milk yield and Egyptian buffalo

INTRODUCTION

In Egypt, buffalo is considered the main dairy animal (Soliman, 2007) and buffalo milk is usually consumed fresh according to the Egyptian domestic market. Moreover, buffalo is an important source of red meat. Buffalo contributes about 56% of the national milk production produced in Egypt (Manal *et al.*, 2008).

Non genetic sources such as animal health, feeding, and reproduction and their management account for 75% of variation in herd performance, and the remaining 25% is due to genetic sources (Metry *et al.*,1994).

The ultimate goal in animal breeding is to rank breeding animals according to their genetic merit for the desired characters and to use them efficiently in breeding. The genetic evaluation of animals is, therefore, a key issue (Ahmad *et al.*, 2008).

Genetic trend is defined as a change in performance per unit of time due to change in the mean of breeding value, while phenotypic trend is a change in production per unit of time (Hebert and Bhatnaga, 1988). The trends are indicative of the progress or decline that has been attained using the breeding strategy in place (Ojango and Pollot, 2001).

In general, favorable phenotypic and genetic trends can be achieved if the environment and breeding management are improved. There is, a need to continuously evaluate the genetic and phenotypic parameters and trends in dairy cattle and buffalo to monitor whether the parameters and trends are desirable for each trait (Amimo *et al.*, 2007).

The present study was therefore, planned to estimate the breeding values to calculate the phenotypic and genetic trends for total milk yield of Egyptian buffalo raised at experimental farms in Egypt.

MATERIALS AND METHODS

The data used in this study comprised 3005 test day milk records for 401 Egyptian buffaloes, daughters of 54 bulls belong to Mahllet Mousa and El-Nattaf El-Kadeem farms in Kafr El-Sheikh. The two farms belong to Animal Production Research Institute (APRI), Ministry of agriculture and Land Reclamation. The data covered the period from 1991 to 2002.

The two herds were maintained according to feeding and management standards adopted by APRI. During winter and spring (December to May), buffaloes were grazed on Egyptian clover (*Trifolium Alexandrium*) as the only source of feed. During summer and autumn (June to November), buffaloes were kept under open sheds and fed concentrate mixture, wheat or rice straw, and a limited amount of clover hay when available. The buffaloes were milked by hand twice daily at 07:30 am. and 16:30 pm.

Once – a – month test day milk records were used to calculate total milk yield (TMY) using Test Interval Method (TIM) according to the ICAR (2008) as follows;

$$TMY=I_0M_1+I_1*(M_1+M_2)/2+I_2*(M_2+M_3)/2+.....+I_{n-1}*(M_{n-1}+M_n)/2+I_nM_n$$

Where:

TMY is the calculated total milk yield,

M_1, M_2, M_n are the weights in kilograms, given to one decimal place, of the milk yielded in the 24 hours of the recording day.

I_1, I_2, I_{n-1} are the intervals in days between recording dates,

I_0 is the interval, in days, between the lactation period start date and the first recording date, and I_n is the interval in days between the last recording date and drying off date.

The Derivative Free-Restricted Maximum Likelihood (DFREML) producer (Meyer, 1998) was used for estimating variance components, heritability (h^2), and breeding values.

The statistical model used was as follows:

$$Y_{ijkdm} = \mu + A_i + H_j + P_k + YSC_l + e_{ijkdm}$$

Where,

Y_{ijkdm} = Observation of total milk yield,

μ = Overall mean,

A_i = the random effect of animal additive genetic effect, A_i NID $(0,\sigma^2e)$

H_j = The fixed effect of the j^{th} herd, **where** i= 1,2 {1=(Mahllet Mousa),2= (El-Nattaf El-Kadeem)},

P_k = The fixed effect of the k^{th} parity, where j= 1,2,3,

YSC_l = The fixed effect of $_l^{th}$ year-season of calving, where k= 6 levels, and e_{ijklm} = random error assumed NID $(0,\sigma^2 e)$

Phenotypic trend was estimated as the regression of the total milk yield on the year of calving. The genetic trend was obtained by calculating the regression of the breeding value of animal on the year of birth (1986 – 1997).

RESULTS AND DISCUSSION

The average total milk yield (TMY) was 1429 Kg. This estimates was higher than that estimated by Ahmad *et al.*, (2009(Pakistan);1152Kg), and Khan *et al.*, (2008(Pakistan);1142Kg), but was lower than the estimates of Humberto *et al.*, (2008(Brazil);1533Kg), Seno *et al.*, (2010(Brazil);1594Kg) and Rosati and Van Vleck (2002(Italy);2287Kg)).

Analysis of variance of TMY is shown in Table 1. Herd, parity and year season of calving showed highly significant effects (P<0.01) on total milk yield. The year season of calving effect reflects the fluctuation in years and season variations especially in feed supply.

These results are in the same direction with those obtained on other studies on buffaloes (Ragab *et al.*,1973, Singh and yadav., 1987, Ahmad *et al.*, 1993,1995, and Javed *et al.*, 2001).

Table 1: Mean squares of total milk yield of Egyptian buffaloes (TMY)

Source of variance	d.f.	Mean squares	P value
Herd	1	6422386	0.0001
Parity	2	504462	0.0001
Year season of calving	5	3033267	0.0001
Residual	8	4185605	

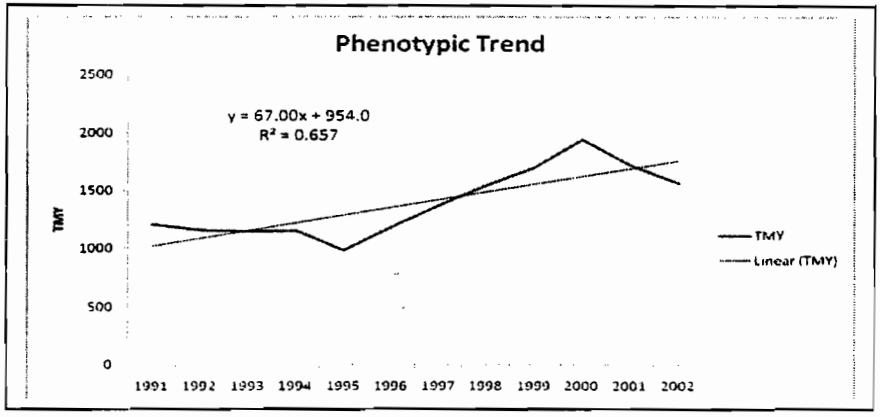
The heritability estimate of total milk yield was 0.25. This estimate was greater than those found in the literature (Rosati and van vleck (2002; 0.14), Humberto *et al.*, (2008; 0.20), Seno *et al.*, (2010; 0.20) and Khan *et al.*, (2008; 0.082)). The same estimate was obtained by Breda *et al.*, (2010; 0.25).

Difference in heritability estimates among various studies for the same trait could be attributed to differences in the number of records used, the correction for different non-genetic factors, the model used and the methodology used for estimation (Abou-Bakr, 2009).

Phenotypic trend for total milk yield of Egyptian buffaloes although showed a positive trend (Figure 1), the improvement in milk production of these animals could be achieved by better feeding as well as by improvement in management practices and breeding strategy etc. (Ahmad *et al.*, 2009).

It is pointed out that further improvement in potential of population could be attained by making selection of these animals in the proper direction, by selection of young bulls by consideration their breeding values and should avoid selection on the basis of milk yield of their dams only as a single criterion (Ahmad *et al.*, 2009). Moreover, the genetic improvement

could only be possible in a broader genetic base and a larger buffalo herds. In addition, the improvement through effective selection could be made by avoiding inbreeding and insuring accuracy in performance recording in the future.



TMY = Total Milk Yield, YC = Year of Calving

Figure 1: Phenotypic trend for total milk yield of Egyptian buffaloes

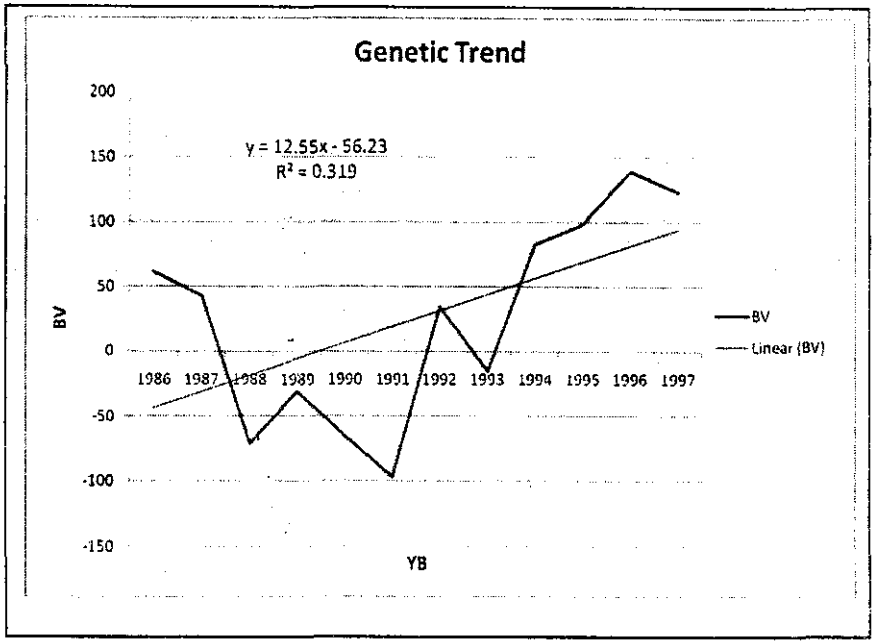
The breeding values of buffaloes for total milk yield according to years of birth from 1986 to 1977 ranged from -15 to 139 (Table 2).

Table 2: Estimates of breeding values of buffaloes for total milk yield

Year of birth	Breeding value
1986	62
1987	-43
1988	-71
1989	-31
1990	-65
1991	-97
1992	35
1993	-15
1994	84
1995	98
1996	139
1997	124

The genetic trend (Figure 2) with various ups and downs during different years presents a positive trend. There was a clear improvement in the genetic trend from 1994 which may indicate that some good sires were used in the preceding years. However, some limitations which may caused the slow improvement in genetic progress. These may include unavailability of selection/breeding techniques for the evaluation of animals, smaller herd size, inbreeding and lack of accuracy in performance recording (Ahmad M., 2007).

The value of accuracy (R^2) was 0.31 and this considers slightly low value but that because inadequate data used.



BV = Breeding Value, YB = Year of Birth

Figure 2: Genetic trend for total milk yield of Egyptian buffaloes

REFERENCES

Abou-Bakr, S. (2009). Genetic and phenotypic trend of 305-day milk yield of Holstein cows raised at commercial farm in Egypt. Egypt. J. Anim. Prod.,46(2): 85-92.

Ahmad, M.; M. S. Azhar and M. M. Aziz (2009). Performance of buffalo population using test day milk yield in progeny testing program areas of district Gujranwala. The J. Anim. Pl. Sci., 19(1): 10-12.

Ahmad, M.; A. Parveen; A. Ghaffar and M. M. Aziz (2008). Estimated breeding values and genetic trend for 305-day milk yield in buffalo herd at LES Chak Katora. Pakistan J. Agri. Sci., 45(2): 212-214.

Ahmad, M. (2007). Estimated breeding values and genetic trend for milk yield in Nili Ravi buffaloes. Italian J. Anim. Sci., 2(6): 393-396.

Ahmad, M.; M. Shafiq; M. A. Khan and K. Bashir (1995). Environmental factors affecting peak milk yield and persistency of lactation in Sahiwal cows. The J. Anim. Pl. Sci., 5(2): 7-8.

Ahmad, S. S.; M. A. Khan; A. Ali and M. S. Muhammad (1993). Effect of some environmental factors on lactation curve, 305-day milk yield and persistency in Nili-Ravi buffaloes. The J. Anim. Pl. Sci., (3): 110-112.

Amimo, J.O.; J.W. Wakhungu; B.O. Inyangala and R.O. Mosi (2007). The effects of non-genetic factors and estimation of genetic and phenotypic parameter and trends for milk yield in Ayrshire cattle in Keneya. Livestock Res. Rural Development, 19(1):1-9.

Breda F.C.; L.G. Albuquerque; R.F. Euclydes, A.B. Bignardi, F. Baldi, R.A. Torres, L. Barbosa and H. Tonhati (2010). Estimation of genetic parameters for milk yield in Murrah buffaloes by Bayesian inference. J. Dairy Sci., 93: 784-791.

Herbert, S. and D.S. Bhatnagar (1988). Genetic trends of economic traits in dairy cattle. A review. Agric. Rev., 9:200-216.

Humberto Tonhati, Mário Fernando Cerón-Muñoz; João Ademir de Oliveira; Lenira El Faro; André Luís Ferreira Lima and Lucia Galvão de Albuquerque (2008). Test-day milk yield as a selection criterion for dairy buffaloes. Genetics and Molecular Biology, 31(3): 674-679.

ICAR, (2008) Guidelines for buffalo milk recording for low to medium and medium to high input production system.

Javed, K.; M. Afzal; M. Ahmad and R. Hussain (2001). Genetic studies on Cholistani cows: I. Production traits. The J. Anim. Pl. Sci., 11(2): 48-52.

Khan M.S.; G.Bilal; I.R. Bajwa; Z.Rehman and S.Ahmed (2008). Estimation of breeding values of Sahiwal cattle using test day milk yield. Pakistan Vet. J., 28(3): 131-135.

Manal M.; T.A. Fooda and I.A. Gebreel (2008). Estimation of direct genetic and maternal effects for weaning traits in Egyptian buffalo. Egyptian J. Anim. Prod., 45 Suppl. Issue, Dec.,1-9 .

Metry, G. H.; K. A. Mourad; J. C. Wilk and B. T. McDaniel (1994). Lactation curves for first lactation Egyptian buffalo. J. Dairy Sci., 77:1306-1314.

Meyer, K. (1998). DF-REML (The Derivative Free-Restricted Maximum Likelihood) Package. Version 3.1.6th world cong. Genetic Appl. Livest. Prod. Armidal, Newsouthwales, Australia.

Ojango, J.M. and G.E. Pollott (2001). Genetic of milk yield and fertility traits in Holstein-Friesian cattle on large-scale Kenyan farms. J. Anim. Sci., 79:1742-1750.

Ragab. M. T.; A. S. Abdel-Aziz and A. Kamal (1973). Effect of farm, parity and season of calving on the lactation curve in buffaloes. Egypt. J. Anim. Prod., 13:123.

Rosati, A. and L. Dale Van Vleck (2002). Estimation of genetic parameters for milk, fat, protein and mozzarella cheese production for the Italian river buffalo. Livestock Production Science, 74 :185–190

Seno, L. O.; V. L. Cardoso; L. El Faro; R. C. Sesana; R. R. Aspilcueta-Borquis; G. M. F. de Camargo and H. Tonhati (2010). Genetic parameters for milk yield, age at first calving and interval between first and second calving in milk Murrah buffaloes. Livestock research for rural development 22(2).

Singh, C. V. and M. C. Yadav (1987). Non-genetic factors affecting daily milk yield in Murrah buffaloes. Indian J. Anim. Sci., 57:56.

Soliman, I. (2007). Economic feed utilization for dairy buffalo under intensive agricultural system. J. Anim. Sci., Vol. 6, (Suppl. 2): 1367-1375.

تقدير الاتجاه الوراثي والمظهري لانتاج اللبن الكلي للجاموس المصري في المزراع التجريبية في مصر

سامي أبو بكر محمود محمد[1]، هبه أحمد محمد مصطفى[2]، محاسن معوض محمد عبد العزيز[2]، سامح عبد الفتاح محمد عبد السلام[1]، محمد عبد العزيز محمد ابراهيم[1] و ربيع رجب صادق[1]

[1] قسم الانتاج الحيواني- كلية الزراعه- جامعة القاهره

[2] معهد بحوث الانتاج الحيواني – وزاة الزراعه واستصلاح الاراضي – مصر

أجري هذه الدراسة بهدف تقدير الاتجاه الوراثي والمظهري لإنتاج اللبن الكلي في الجاموس المصري . استخدم في هذه الدراسة ٣٠٠٥ سجل يوم اختبار لعدد ٤٠١ جاموسة بنات ٥٤ ذكر جاموس مصري في الفترة مابين عام ١٩٩١ إلى عام ٢٠٠٢ ، وتم جمع البيانات من محطتي محلة موسى والنطاف القديم بكفرالشيخ التابعتين لمعهد بحوث الانتاج الحيواني – وزارة الزراعه .

تم تحليل البيانات بإستخدام طريقة المربعات الصغرى لدراسة تأثير موسم الولادة وموسم الحليب والمزرعه على انتاج اللبن الكلي.

وكانت أهم النتائج كالتالي :

١-متوسط انتاج اللبن الكلي ١٤٢٩ كجم لبن.س

٢-تأثير كل من موسم الولادة وموسم الحليب والمزرعة كان معنوي بدرجة كبيرة ($P<0.0001$) على الانتاج الكلي للبن .

٣-قيمة العمق الوراثي لانتاج اللبن الكلي ٠,٢٥.

٤-كان الاتجاه المظهري لانتاج اللبن الكلي موجباً وقيمته (+ ٦٧ كجم / سنة) وكان الاتجاه الوراثي لنفس الصفة موجباً وقيمته (+ ١٢,٥٥ كجم / سنة) .

نستنتج من الدراسة انه بالرغم من ان الاتجاه الوراثي للصفة موجب إلا انه لم يؤدي إلى التغير الكافي والمطلوب في متوسط انتاج اللبن وذلك قد يكون بسبب عدم كفاية التغذية و/ أو ضعف نظم رعاية القطيع.

قام بتحكيم البحث

أ.د / ناظم عبد الرحمن شلبى — كلية الزراعة – جامعة المنصورة

أ.د / على عطية نجم — كلية الزراعة – جامعة القاهرة