

## EFFECT OF LEVEL OF MILK PRODUCTION ON PROFITABILITY IN LACTATING EGYPTIAN BUFFALOES

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### ABSTRACT

A total of 1012 lactation records of 426 Egyptian buffalo cows mated by 118 sires maintained at Mahallet Mousa Experimental farms of Animal Production Research Institute (APRI), were analyzed to estimate the economic value of some productive and reproductive traits under different levels of milk production from year 2000 to 2012. Traits studied were total milk yield (TMY, kg), lactation period (LP, day), dry period (DP, day), days open (DO, day) and calving interval (CI, day). Data divided into three levels of milk production: L1 (low level), L2 (medium level) and L3 (high level). The average of TMY, LP, DP, DO and CI in the three levels of milk production were 990 kg, 191.75 d, 262.87 d, 136.64 d and 454.63 d, respectively in the L1, 1662 kg, 202.05 d, 253.48 d, 138.57 d and 455.77 d, respectively in the L2 and 2228 kg, 206.06 d, 246.53 d, 135.56 d and 452.59 d, respectively in the L3. Least squares analysis of variance showed a significant ( $P < 0.05$  and  $P < 0.01$ ) effect of all factors on all traits studied except the effect of level of milk production on dry period, days open and calving interval was non-significant. Economic evaluations indicated that the annual variable cost were (EGP) (Egyptian pound= 0.11 USD and = 0.09 EUR) 6980, 8860 and 10038 of L1, L2 and L3, respectively. However, the annual gross margin of L3 was higher than that of L2 and L1 by 79.55 % and 276.94 %, respectively, and the benefit /cost ratio was 1.11, 1.19 and 1.29 for L1, L2 and L3, respectively. The profit per buffalo cow during the lifetime production of L3 was 88.56% (5342 EGP) and 349.92 % (8846 EGP) more than of L2 and L1, respectively. The present results indicated that high milk producers buffaloes (L3) with longer lactation period but shorter dry period, days open and calving interval are more profitable than those have shorter lactation period and longer dry period, days open and calving interval.

**Key words:** *benefit/cost ratio, gross margin, milk levels, economic traits, buffalo.*

### INTRODUCTION

Buffalo is considered the main dairy animal in Egypt. The total numbers of buffaloes nearly about 3.95 million buffaloes (MARL, 2015). The domestic buffalo is an important animal in the agricultural economy of many countries like Egypt. Most of buffaloes are owned by small holders and it depended nearly 65 to 70 of total milk in the country.

Productive and reproductive traits are affected by non-genetic factors. Evaluation of non-genetic effects provides basic information for developing breeding and management programs for genetic improvement. It helps in selecting sires and dams with superior genetic merits (**Hintz et al., 1978**). Milk yield is the most important trait of a dairy animal. Higher milk yield increases the profitability and decreases the rearing cost of dairy animals (**Zafar et al., 2008**).

High milk production plays an important role in this aspect. And great economic importance under Egyptian environments where there is a large variability in terms of feed quality and quantity feed effect in developing productive and reproductive traits. Buffaloes, because of their higher milk fat content than cattle, are extensively reared in Pakistan on small scale for family consumption of milk, with the surplus milk being sold to compensate the family budget.

Total losses due to under-managed health, nutrition and reproduction coupled with the hostile marketing system causes an annual loss of US\$ 10 billion to the Pakistan's economy (**Qureshi et al., 2002**). The aim of the present study was to estimate the profitability of buffalo cow kept at Mahallet Mousa farms with different levels of milk production.

## **MATERIALS AND METHODS**

### **Data and management**

Data of 1012 lactation records of 426 Egyptian buffalo cows mated by 118 sires raised at Mahallet Mousa Experimental farms (El-Gaded, Main Mahallet Mousa (Main M. Mousa) and El-Kadem) of Animal Production Research Institute (APRI), Ministry of Agriculture, Egypt, were used in the present study. Records covered the period from 2000 to 2012. Buffalo cows were mated naturally. Pregnancy was detected by rectal palpation 60 days after the last service. Data divided into three levels: L1 (low level = 122 records), milk production per day was up to 6 kg or less, L2 (medium level = 709 records), milk production per day was more than 6 to 10 kg and L3 (high level = 181 records), milk production per day was more than 10 kg. Traits investigated in the present study were some productive traits such as: total milk yield (TMY, kg), lactation period (LP, day), and dry period (DP, day) and some reproductive traits such as: days open (DO, day) and calving interval (CI, day).

Animals were kept under semi-open sheds. Lactating buffaloes were milked by hand or machine twice daily at 7.00 a.m and 4.00 p.m throughout the lactation period, and milk production was recorded daily. Buffaloes were kept under the routine feeding with according to level of production and managerial system in Mahallet Mousa Experimental farms. The Animals were grazed on Egyptian clover

**(Trifolium Alexandrinum)** during December to May with concentrate mixture and rice straw. While during June to November, animals were fed on concentrate mixture, rice straw and limited amount of clover hay or (silage). Animals were feed according to their live weight, milk production and reproductive status. The concentrate feed mixture was given twice daily before milking, while rice straw was offered once daily at 9.00 a.m, whereas clover hay or (silage) in Summer was offered at 11.00 a.m, animals were allowed to drink water three times a day or free from water troughs. Multi mineral licking blocks were available for animals in the stalls.

### Statistical analysis

Data were analyzed using fixed model least squares and maximum likelihood computer program of **Harvey (1990)**, to determine the main effects. The statistical model included month (1 to 12) and year (2000 to 2012) of calving, parity (1 to 9) and levels of milk production (1 to 3). The following full fixed model was used:

$$Y_{ijklm} = \mu + M_i + Y_j + P_k + L_l + \beta \text{ (AFC)} + e_{ijklm}$$

Where:

- $Y_{ijklm}$  = observation of the productive and reproductive traits;
- $\mu$  = the overall mean;
- $M_i$  = fixed effect of  $i^{th}$  month of calving;
- $Y_j$  = fixed effect of  $j^{th}$  year of calving;
- $P_k$  = fixed effect of  $k^{th}$  parity;
- $L_l$  = fixed effect of  $l^{th}$  level of milk production;
- $\beta \text{ (AFC)}$  = linear and quadratic regression coefficients of the traits studied on age at first calving and
- $e_{ijklm}$  = random error term.

### Technical confidents and assumptions

Data were statistically analyzed to estimate the productive and reproductive technical coefficients of the three levels of milk production.

Table (1): Assumptions adopted in calculating farm budget

Items	Levels		
	LMY(L1)	MMY(L2)	HMY(L3)
Number of records (1012)	122	709	181
Average mature body weight (kg)	550	600	650
Average of age at first calving (mo.)	37.41	36.50	37.29
No of service per conception	2.5	2.5	3
Average calf sale price at birth (EGP)	3500	3500	3500
Average cost of an insemination (EGP)	40	40	40
Average annual veterinary care cost (EGP)	150	150	200
Average annual manure production per head (m <sup>3</sup> )	14	15	17
Average price of m <sup>3</sup> manure (EGP)	70	70	70
Average rectal palpation / time (EGP)	50	50	50
Average sale price of 1 kg milk in farm (EGP)	5	5	5

\* The prices of inputs are based on the current market price.

\* The prices of outputs are based on the current farm price.

\* Gross margin is one of the more realistic measures to evaluate farm profitability (**Barnard and Mix, 1993**). To compare among three levels, the annual gross margins as well as, discounted measure, benefit/cost ratio (present worth of benefits divided by present worth of costs) were used as economic tools for comparing the three levels studied (**EI-Awady, 2013**).

## RESULTS AND DISCUSSION

### Statistical descriptive

The overall means, standard deviation (SD) for different traits studied are presented in Table (2). Means of TMY, LP, DP, DO and CI were 1682 kg, 202 day, 253 day, 138 day and 455 day, respectively.

Table (2): Means and standard deviations for productive, reproductive and lifetime production traits for the three levels investigated

Trait	All lactation	Levels		
		L1 (LMY)	L2 (MMY)	L3 (HMY)
<b>Productive traits</b>				
Daily milk yield (M/D, kg)	8.31±0.19	4.99±0.86	8.17±1.04	11.07±0.69
Total milk yield (TMY, kg)	1682±562	990±386.00	1662±834.55	2228±541.75
Lactation period (LP, day)	202±43	191.75±41.27	202.05±42.33	206.06±46.71
Dry period (DP, day)	253±109	262.87±90.28	253.48±108.07	246.53±126.43
Annual milk yield (AMY, kg)	1349	795	1331	1797
<b>Reproductive traits</b>				
Days open (DO, day)	138±98	136.64±79.12	138.57±98.46	135.56±109.90
Calving interval (CI, day)	455±98	454.63±78.99	455.77±98.42	452.59±109.89
Age at first calving (AFC)	36.75±6.54	37.41±6.76	36.50±6.50	37.29±6.54
<b>Lifetime production traits</b>				
No. of lactations complete (NLC)	2.87±0.64	3.10±0.64	2.93±0.63	2.59±0.64
Lifetime milk yield (LTMY, kg)	10304	6792	10590	13062
Number of records	1012	122	709	181

The present results of total milk yield was higher than obtained by **Mourad et al., (2005)** and **EI-Azab, (2006)** in Egyptian buffaloes, they found that the mean of total milk yield was 1581 and 1245 kg, respectively. **Mourad and Khattab, (2009)** reported that the lactation period was 184 days in Egyptian buffaloes. **Hussain et al., (2006)**; **Mentiel et al., (2013)** and **Sanker et al., (2014)** estimated the average mean of dry period was 143.88, 144.34 and 205.34 days, respectively. **Barros et al., (2013)** and **Mentiel et al., (2013)** found that calving interval was 423 and 430 days in different breeds of buffaloes. While was lower than those obtained by, **Khan et al., (2008)** showed that average for three levels, L1 was (2630 kg and 291 day), L2 was (2682 kg and 289 day) and L3 was (2836 kg and 291 day) for total milk yield and lactation period, respectively. In Egyptian buffaloes, **Abu El-Naser, (2008)** reported that the average mean of milk yield was 2054 kg, while **EI-Awady, (2009)** on the other sets of this data found that total milk yield (TMY) was 2055 kg. Also, **Abo Gamoos, (2012)** was 2070 kg. Another authors (**Aziz et al., 2001**; **Mahdy et al., 2001**; **EL-Azab, 2006** and **Khattab and Mourad, 2007**) in Egyptian buffaloes, found that longer

lactation period than in the present study were 208.6, 254.6, 296 and 282 days respectively. **Ahmad et al., (2013)** and **Barros et al., (2014)** found the lactation period was 246.3 and 269.57 day in Nili-Ravi and Brazilian buffaloes, respectively.

In Egyptian buffaloes, **Aziz et al., (2001)** found that longer dry period than in the present study (307.3 day) and days open (199 day). In addition the present mean of dry period is nearly that estimated by **Khan et al., (2007)** in Pakistan (250 day) and **Thiruvankadan et al., (2010)** in India (250.5 day). **Mahdy et al., (2001)** in Egyptian buffaloes, found that longer calving interval than in the present study (528 day). **Khan et al., (2007)** calculated the calving interval (540 day) in Pakistani buffaloes. In addition the present mean of calving interval is nearly to that estimated by **Sanker et al., (2014)** in Murrah buffaloes (450 day).

Least squares analysis of variance showed significant ( $P < 0.05$  and/or  $P < 0.01$ ) effect of all factors on all traits studied except the effect of level of production on dry period, days open and calving interval was non-significant (Table 3). These results agree with those in Egyptian buffaloes, reported by **El-Azab, (2006)** and **Abo Gamoos, (2012)** reported that the month or season and year of calving had highly significant ( $P < 0.01$ ) effect on milk yield. In addition, **Mourad et al., (1990)**; **Khalil et al., (1992)** and **Awad and Hassan, (2006)**, they also reported that month or season and year of calving had highly significant ( $P < 0.01$ ) effect on lactation period.

Table (3): Least square analysis of variance for total milk yield (TMY), lactation period (LP), dry period (DP), days open (DO) and calving interval (CI) in Egyptian buffaloes

S.O.V	d.f	F – Significance *				
		TMY	LP	DP	DO	CI
Month of calving	11	3.64**	4.18**	3.30**	2.39**	2.40**
Year of calving	12	5.69**	6.27**	9.82**	8.26**	8.37**
Parity	8	6.31**	2.76**	22.62**	28.00**	27.54**
Level of milk production	2	96.79**	3.40*	0.43 <sup>ns</sup>	0.02 <sup>ns</sup>	0.01 <sup>ns</sup>
Residual, M.S.	881	1565.36	1507.17	8744.17	6888.59	6885.77

\* Significant at  $P < 0.05$ , \*\* significant at  $P < 0.01$ , ns = not significant.

**Aziz et al., (2001)** and **Awad and Hassan, (2006)** in Egyptian buffaloes, reported that the season of calving had highly significant effect ( $P < 0.01$ ) on days open, dry period and calving interval. In addition, **Abu El-Naser, (2008)**; **El-Awady, (2009)** and **Abo Gamoos, (2012)** reported that the parity had significant effect ( $P < 0.01$ ) on the total milk yield.

### Economical assessment

Income (gross output) of L3 was more than that L2 and L1 as about 23.68 % and 67.38 % respectively, while L2 was more than L1 by about 35.32 %. This may be attributed to the higher milk revenues. Milk yield is considered the major source of farm revenues. The current study showed 51.19 %, 63.33 % and 69.12 % of the total gross output for L1, L2 and L3, respectively (Table 4).

Annual variable cost per buffalo cow of L3 was higher than those of L2 and L1 by about 13.29 % and 43.81 % respectively, while L2 was higher than L1 by about 26.93 %. This difference among the three levels can attributed mainly to the extra feeds to cover extra milk production, the labor and insemination cost for breeding.

Table (4): Analysis of the annual gross output (income) (EGP) and variable costs (EGP) per buffalo cow of the three levels

Item	Levels		
	LMY (L1)	MMY (L2)	HMY (L3)
<b>Gross output (income)</b>			
Milk	3975	6655	8984
Calves	2810	2803	2823
Manure	980	1050	1190
<b>Total gross output</b>	<b>7765</b>	<b>10508</b>	<b>12997</b>
<b>Variable cost (outcome)</b>			
Feeding	6055	7935	8968
Labor	550	550	600
Insemination	100	100	100
Palpation	125	125	125
Veterinary care	150	150	200
<b>Total variable cost</b>	<b>6980</b>	<b>8860</b>	<b>10038</b>
<b>Gross margin</b>			
Benefit / cost ratio	1.11	1.19	1.29
Annual gross margin (consider L1 as the unit)	1.00	2.1 (L2 vs L1)	1.8 (L3 vs L2) 3.8 (L3 vs L1)

Feeding represented the major element of the variable cost. It represented 86.74 %, 89.56 % and 89.34 % for L1, L2 and L3, respectively on out of the total variable costs for levels of milk production (Table 4). Annual gross margin of L3 increased by 79.55 % high rate from L2 and 276.94 from L1, it contributing 785, 1648 and 2959 for L1, L2 and L3, respectively. Also benefit/cost ratio increased in L3 by 8.40 and 16.2 % than L2 and L1, respectively.

Results of the financial analysis per buffalo cow during its lifetime production are presented in Table (5). As economical evaluation, the overall variable cost for the whole lifetime production of L3 exceeded that of L2 by 18.99 % (6159 EGP) and exceeded that of L1 by 71.68 % (16111 EGP), and L2 was higher than L1 by about 44.28 % (9952 EGP). While, the total gross output of L3 exceeded those of L2 and L1 by 29.90

% (11501 EGP) and 99.81 % (24957 EGP) respectively, while L2 was higher than L1 by about 53.81 % (13456 EGP).

The profit per cow during the lifetime of L3 was more than L2 and L1 by about 88.56 % (5342 EGP) and 349.92 (8846 EGP), respectively, and L2 was higher than L1 by about 138.60 (3504 EGP).

Table (5): Financial analysis (EGP) for lifetime production per cow of the three levels and percentages of difference among levels investigations

Item	Levels			% difference between levels		
	LMY (L1)	MMY (L2)	HMY (L3)	L3 vs L2	L3 vs L1	L2 vs L1
Gross output	25003	38459	49960	+ 29.90 (11501 EGP)	+99.81 (24957 EGP)	+53.81 (13456 EGP)
Variable cost	22475	32427	38586	+18.99 (6159 EGP)	+71.68 (16111 EGP)	+44.28 (9952 EGP)
Gross margin	2528	6032	11374	+88.56 (5342 EGP)	+349.92 (8846 EGP)	+138.60 (3504 EGP)

**Ahmad, (2002)** in a study to estimate the economics of rearing of Buffalo, Sahiwal and Crossbred heifers in Pakistan, reported that the total cost per buffalo was Rs. 11158 (968.36 EGP) while, the total revenue was Rs. 14860 (1289.64 EGP) and the profit per animal was Rs. 3702 (321.28 EGP) and output input ratio was (1.33:1). He recommended that: 1. The buffalo heifers needs pond for wallowing in summer which is necessary it will decrease labor utilized for sprinkling water on the animals and 2. Rearing of heifers on concentrate ration for milk production is a profitable business.

**Khan et al., (2008)** in a study to estimate the effect of pregnancy on lactation milk value in dairy buffaloes, found a decrease in the milk yield with the increasing service period. However, Lactation milk value by (Rs) showed a declining trend. It suggested that an animal conceiving at an earlier stage of lactation returns better in monetary terms than those conceiving later, which contradicts the prevailing opinion among the conventional farmers, who desire to delay breeding for the loss of milk with the onset of pregnancy. They added, although in shorter term there is an immediate saving in milk but prolonged lactation and calving interval the financial returns are reduced in late conceivers. Calving interval increased with delayed conception, showing a consistent trend, in the low, moderate and high yielding buffaloes. There was a consistent decline in milk yield per day of calving interval with delayed conception, associated with prolonged calving interval. An animal conceiving at a later stage of lactation showed a decline in financial returns by 24 to 27% than those conceiving early.

**Ebrahim, (2012)** in a study of Friesian cows under semi intensive farming system in Egypt, reported that extension of medium milk

producer cows with ideality period for calving interval, days open and dry period but shorter lactation period are more profitably than those have shorter and longer calving interval and days open. Additionally, **El-Awady, (2013)** on Friesian cows, conclude that under the intensive production system in Egypt, high milk producer cows with long calving interval are more profitably than those having regular calving every 12-13 months.

### CONCLUSION

The present results indicated that high milk producers buffaloes (L3) with longer lactation period but shorter dry period, days open and calving interval are more profitable than those have shorter lactation period, longer dry period, longer days open and longer calving interval. The present results suggests, under the Egyptian conditions, the buffalo which produces less than 6 kg milk per day must be called from breeding either large farms or small holder because they costed more than return it particular in the resent years under increasing prices of feed animals.

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### الملخص العربي

## تأثير مستوى انتاج اللبن على الربحية فى الجاموس المصرى الحلاب حسن غازى العوضى<sup>1</sup>، عاطف يوسف سالم<sup>1</sup> و على شعيب<sup>1</sup> 1-قسم الانتاج الحيوانى - كلية الزراعة - جامعة كفر الشيخ - مصر

تم تحليل بيانات بعض الصفات الانتاجية والتناسلية لـ 1012 سجل لبن للجاموس المصرى التابع لمحطة بحوث الانتاج الحيوانى بمحلة موسى التابعة لمعهد بحوث الانتاج الحيوانى - وزارة الزراعة وذلك خلال الفترة من 2000 وحتى 2012م لتقدير التأثير الاقتصادى لمستويات انتاج اللبن على الصفات الانتاجية والتناسلية. تتضمن الصفات المدروسة محصول اللبن الكلى، فترة الحليب، فترة الجفاف، فترة الايام المفتوحة والفترة بين ولادتين. قسمت البيانات الى ثلاث مستويات من انتاج اللبن: المستوى المنخفض، المستوى المتوسط والمستوى العالى.

كانت متوسطات محصول اللبن الكلى، فترة الحليب، فترة الجفاف، فترة الايام المفتوحة والفترة بين ولادتين كالتالى 1682 كجم، 202 يوم، 353 يوم، 138 يوم و 455 يوم على التوالى. بينما كانت المتوسطات فى مستويات الانتاج هى:- للمستوى الاول 990.44 كجم، 191.75، 262.87، 136.64 و 454.63 يوم والثانى 1661.91 كجم، 202.05، 253.48، 138.57 و 455.77 يوم والثالث 2227.67 كجم، 206.53، 246.53، 135.56 و 452.59 يوم لنفس الصفات على التوالى. أوضح تحليل التباين أن هناك تأثير معنوى عند 5%، 1% لكل العوامل على كل الصفات المدروسة فيما عدا تأثير مستوى الانتاج على فترة الجفاف، فترة الايام المفتوحة والفترة بين ولادتين فكان غير معنوى.

التقييم الاقتصادى أوضح أن مقدار التكلفة السنوية بالجنيه المصرى كانت 10038، 8860، 6980 بالنسبة للمستوى الاول، الثانى، الثالث على التوالى، بينما الايرادات السنوية كانت للمستوى الثالث أكبر من المستويين الثانى والاول بنسبة 79.55%، 276.94% على التوالى. نسبة الربح إلى التكلفة كانت 1.11، 1.19، 1.29 بالنسبة للمستوى الاول، الثانى، الثالث على التوالى، أما العائد من الجاموسة طول حياتها الانتاجية فكانت فى المستوى الثالث أكثر من المستوى الثانى بـ 5342 جنيه ومن المستوى الاول بـ 8846 جنيه على التوالى.

أوضحت النتائج أن الجاموس من المستوى الثالث والذى يمتلك فترة حليب أطول وفترات أقصر من الجفاف، الايام المفتوحة والفترة بين ولادتين تكون أكثر ربحية من المستويين الاخرين (الاول والثانى) والتي تمتلك فترة حليب أقصر وفترات أطول من الجفاف، الايام المفتوحة والفترة بين ولادتين.