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Genetic Analysis of Reproductive Traits in Egyptian Buffaloes

E.A.Afifi*, M.H.Khalil*, L.H. Bedeir and S.M.Zeidan****

** Department of Animal production, Faculty of Agriculture at Moshtohor, Zagazig University, Banha Branch, Qalyoubia Governorate , Egypt ** Animal Production Research Institute, Ministry of Agriculture, Dokki, Cairo, Egypt.*

REPRODUCTIVE performance records of an Egyptian buffalo herd raised in Egypt were collected in the period from 1970 to 1985. Data on 2946 records including 430 buffalo cows (Paternal half sisters) representing 51 sires were used to estimate the genetic and phenotypic parameters of age at first Calving (AFC), birth weight of calf (BW), Calving to service interval (CFS), insemination period (IP), days open (DO) and calving interval (CI). Averages of AFC and BW were 38 month and 35kg, while averages of CFS, IP, DO and CI were 166, 37, 203 and 500 days, respectively. Most reproductive traits (*e.g.* CFS, IP and DO) decreased linearly as parity advanced. Parity had significant ($P < 0.001$) effects on CFS, IP, DO and CI. Season of calving affected significan by ($P<0.05$ on $p<0.001$) CFSA, Do and CI. Winter and spring calvers had shorter CFS and DO along with longer CI compared to other seasons. Differences between year of calving were highly significant ($P < 0.001$) for CFS, IP, DO and BW. All reproductive traits studied decreased in a curvilinear manner as age of cow advanced and the differences were significant ($P < 0.001$) for most traits. Sire of the cow did not affect all reproductive traits of first lactation (expect CFS) and across all lactations (except BW). Differences in all reproductive traits due to effects of cow within sire were significant. Estimates of repeatability were low for CFS, IP and DO (estimates ranged from 0.02 to 0.05) or moderate for BW and CI (0.23 and 0.24, respectively). Estimates of heritability for most reproductive traits were low and ranged between 0.0 to 0.25. Phenotypic correlations between DO and CFS or IP were positive and high while estimates between CFS and IP were negative and moderate. For most cases, phenotypic correlations between CI or BW and each of CFS, IP and DO were positive and low.

Key words : Buffalo, Genetic parameters, Reproductive performance.

In spite of the major advantages of buffalo as a dairy animal in Egypt, it is faced by some problems concerning its full utilization as a milk and meat producer. However, the main factors limiting the full utilization of this species in the agricultural production in Egypt, besides nutrition, are the lack of improved breeding stock and the low reproductive efficiency. Most of the Egyptian and non- Egyptian studies reported that the major causes of low reproductive efficiency in buffalo are the relatively late onset of puberty and consequently the delayed age at first calving in addition to long periods of post-partum service and days open (Rao, *et al* 1973; Johari and Bhat, 1979). The problem of silent heat (quiet ovulation) in buffaloes is much more prevailing than in cattle and consequently is considered as one of the causes that lengthen the post-partum service interval and days open followed by long calving interval and a delay in age at calving.

Information on the genetic aspects of some reproductive traits in Egyptian buffaloes is scarce (Khalil et al, 1991). Without knowledge of the genetics of this species, effective improvement cannot be achieved. Therefore, the main objectives of this study were : (1) to investigate some non- genetic factors affecting reproductive performance of the Egyptian buffaloes, and (2) to estimate some genetic and phenotypic parameters of such economic traits in this type of buffalo.

Material and Methods

This work was carried out using the productive and reproductive records of the Egyptian buffalo herd raised at Mehallet Mousa Experimental Farm, Animal Production Research Institute, Ministry of Agriculture, Egypt. This farm is located in the northern part of Nili- Delta in kafer El- Sheikh Governorate. Management, feeding and breeding plan were represented by Khalil *et al* (1992).

Bulls were assigned to mate the females naturally at random. Artificial insemination was only practised when there was a probability for veneral disease infection. Buffalo-heifers were served for the first time when they reached 24 months or 330 kg, while buffalo-cows (calvers) were usually served two months post-partum. Pregnancy was detected by rectal palpation 60 days after the last service. Buffaloes that failed to conceive were rebred in the next heat period. Buffalo-bulls were chosen for breeding purposes at 2-3 years of age. They were evaluated before being used for body conformation and for semen characteristic . Each bull was used for breeding for about 3-7 years.

Data on 2946 reproductive records of 430 buffalo cows sired by 51 bulls were collected over a period of 16 years started by 1970. Reproductive traits investigated included age at first calving (AFC) in months, calf birth weight(BW), calving to first service interval (CFS),insemination period (IP),days open (DO) and calving interva (CI).

Statistical analysis

Data were analysed using Harvey's (1990) mixed model computer program. Age at first calving was analysed by fitting the effects of year and season of birth as fixed effects and sire of cow as random effect. Data of CFS, IP, BW, DO and CI of *1st* lactation were analysed by fitting the effects of year and season of calving as fixed effects, and sire as random effect along with age of cow as a covariate. Data across all lactations were analysed using a mixed model included the effects of year, season, parity and year x season interaction as fixed effects and sire and cow within sire as random effects along with age of cow as covariate. The absence of records in some subclasses did not permit the inclusion of all possible interactions.

Estimation of heritability and repeatability

By equating mean squares of random effects to their expectations, estimates of variance components, *i.e.* sire ($\sigma^2 s$), cow within sire ($\sigma^2 C{:}S$) and remainder ($\sigma^2 e$) were obtained. Paternal half-sib heritability ($h^2 s$) for different traits in first lactation were calculated as four times the ratio of $\sigma^2 s$ to the sum of $\sigma^2 s$ and $\sigma^2 e$. Heritability across all lactations were estimated by the paternal half-sib method as : $h^2 s = 4\sigma^2 s / (\sigma^2 s + \sigma^2 c{:}s + \sigma^2 e)$. Repestsbilety or intraclass correlation (t) estimated as : $t = (\sigma^2 s + \sigma^2 c{:}s)$ $(\sigma^2 s + \sigma^2 c : s + \sigma^2 e)$, where $\sigma^2 s + \sigma^2 c{:}s$ estimates the sum of genetic and permanent environmental variances among cows, and $\sigma^2 e$ estimates the temporary environmental effects associated with each lactation. Approximate standard errors for heritability and repeatability estimates were computed by the LSMLMW program of Harvey (1990).

Results and Discussion

Means and variation of uncorrected records

Means , standard deviations (SD) and coefficients of variation (CV) for reproductive traits of the first lactation and across all lactations in Egyptian buffaloes are presented in Table 1.

Mean of AFC (38.0 month) falls within the range of those estimates obtained on Egyptian buffaloes (Oloufa, 1979; Kotby et al, 1987; Zaki, 1988; Rashad, 1989), while this mean is lower than those reported on Indian and Pakistani buffaloes. Better management and feeding in Egypt than in India and Pakistan may be the main factor in this concern. Consequently, heifers which calved at younger age tended to have longer productive life than those calved at later age.

Means reported herein for BW, DO and CI fall within the ranges of those obtained for the Egyptian buffaloes (Mourad, 1978; Oloufa, 1979; Zaki, 1988; Rashad, 1989; Ashmawy, 1991; Khalil et al, 1991) and for the Indian buffaloes (Chaurasia et al, 1985; Jain and Taneja, 1982; Cady et al, 1983; Tailor and Jain, 1986).

Means of calving to post-partum first service interval (CFS) in the present study are similar to those obtained for different types of buffaloes (Bhalaru *et al*, 1981; Mourad *et al*, 1985; Youssef *et al* 1988). Also, means of IP in this work are similar to those reported in most of the Egyptian studies (*e.g.* El-Menoufy *et al*, 1984).

Long CFS, IP, DO and CI and delayed age at calving (Table 1) may be resultant of several factors, *e.g.* delayed onset of ovarian activity, silent heat or missing oestrus (due to weak symptoms) and the time elapsing before receiving a fertile service (Lundstrom *et al*, 1982). Also, it was well documented that poor oestrus detection is one of the most important factors involved in fertility problems in buffaloes (Aboul-Ela *et al,* 1987). Abdu and Aboul- Ela (1988) reported that the main factors responsible for poor fertility in Egyptian buffaloes as ovarian hypolasia, cystic ovaries, anoestrum (due to inactive ovaries, silent heat and persistent corpus luteum), infectious and non-infectious diseases (for ovaries and uterus) and other environmental factors.

TABLE 1. Means, standard deviations (s.d.) and coefficients of variation (CV%) of uncorrected reproductive traits in Egyptian buffaloes.

	First lactation				All lactations			
Trait	No	Mean	s.d.	CV%	No	Mean	s.d.	CV%
AFC (months)	430	38.0	5.3	13.9				
CFS (days)	430	208.4	121.5	51.2	1727	165.7	107.9	41.5
IP (days)	430	42.5	10.1	145.0	1727	36.9	8.7	148.0
DO (days)	430	250.9	135.4	45.4	1727	202.7	126.8	37.0
CI (days)	430	539.9	134.2	24.3	1344	500.3	121.7	17.7
BW (kg)	430	33.2	6.6	19.2	1756	35.0	6.8	16.2

Estimates of CV% given in Table 1 showed that variation in all reproductive traits studied were high. Poor management of buffalo herds in Egypt lead to such high variation in reproductive performance. Some Egyptian studies (*e.g.* Mourad *et al*, 1985; Khalil et al, 1991) and other Indian ones (*e.g.* Porwal *et al*, 1981) attributed such high variation in reproductive performance of buffaloes to the management decision and to the efficiency of heat detection together with the fact that no effective selection programme for reproductive performance was carried out.

Year of calving

Means of all reproductive traits in different years of calving are too numerous to be presented here. There was an increase in CFS, IP, DO and CI with advance of year of calving particularly in the last years of the study. This could possible be due to changes in the provided nutritional levels during the last years. F--ratios given in Table 2 showed that year of calving affected significantly ($P < 0.001$) most reproductive traits studied. It is clear that year effects represent primarily environmental (*e.g.* temperature and day light) or management rather than genetic changes, since the effect of sire was accounted for in the models of analyses.

Season of calving

Means for most reproductive traits studied in different seasons of calving did not show any specific trend (Table 3). Cows calved during winter and spring had shorter CFS, DO and longer CI compared to those calved in other seasons. There was a little variation among different seasons for IP and BW. These observations are in agreement with those reported by most Egyptian investigators (*e.g.* Mourad, 1978; El-Menoufy *et al*, 1984; Kotby *et al*, 1987; Zaki, 1988; Rashad, 1989). Seasonal or monthly variations in reproductive performance of Egyptian buffaloes could be attributed to changes in efficiency of either males or females. Also, photoperiodicity, temperature, level of nutrition and exercise appear to be the main factors responsible for the seasonal variation in reproductive performance of Egyptian buffaloes.

F-ratios given in Table 2 indicate that effects of season of calving on IP and BW were not significant, while significant effects on CFS, DO and CI were observed. These results are close to what reported by some Egyptian studies (El-Menoufy *et al*, 1984; Mourad *et al*, 1985 ; Rashad, 1989; Khalil *et al*, 1991).

Parity

Least squares means given in Table 3 lead to the conclusion that CFS, IP, DO and CI decreased linearly as parity advanced. The first parity had the highest means ($P<0.001$) for most reproductive traits studied. This could be attributed to a longer open period required by buffaloes which have still not reached mature size. Too high stocking rates, low level of nutrition, inactive ovaries in young buffalo cows, silent heat (quiet ovulation), late access to bulls, or inbreeding are all considered to be other possible explanations for these results (Khalil *et al.*, 1991). Other Egyptian studies (Mourad, 1978; Mostageer, *et al*, 1981; Sadek, 1984; Mourad *et al*, 1985; Kotby *et al*, 1987) and non- Egyptian ones (Ahmed *et al*, 1983; Tomar and Tripathi, 1986) have shown a curvilinear trend for parity effects on reproductive performance of buffaloes. Also, prolonged DO in first lactation of Egyptian buffaloes could be due to quiet ovulation, non-ovulatory oestrus and infertile services as reported by kotby *et al* (1987).

Age at calving

Across all lactations, partial linear and quadratic regressions given in Table 4 lead to the conclusion that all interval reproductive traits (CFS, IP, DO and CI) decreased in a curvilinear manner as age of the buffalo cow advanced . In first lactation, CFS and DO increased linearly ($P < 0.01$) as age of cow advanced. This trend was observed by many

TABLE 2. F-ratios of testing the significance of factors affecting reproductive traits of all lactations.

Source of variation	CFS		IP		DO		CI		BW	
	df	F-ratio	df	F-ratio	df	F-ratio	df	F-ratio	df	F-ratio
Sire+	50	1.1	50	1.1	50	1.2	50	0.7	55	1.4*
Cow within sire	435	1.2**	435	1.1**	435	1.1**	435	1.8***	440	1.9***
Year of claving	11	4.8***	10	6.1***	11	6.2***	12	1.4	11	5.0***
Season of calving	3	7.4***	3	0.2	3	5.2***	3	4.2**	3	2.2
Parity	3	46.6***	2	7.4***	3	70.9***	5	19.1***	5	0.4
Year X season	33	2.1***	30	0.9	33	2.0***	36	1.0	33	1.8**
Regression on age :										
Linear	1	20.2***	1	5.6**	1	47.7***	1	47.6***	1	1.1
Quadratic	1	102.1***	1	7.2**	1	158.5***	1	15.0***	1	11.1***
Remainder df	1189		1194		1189		800		1206	
Remainder meansquares		7913		6742		10331		10195		32.2
R^2 of model		0.58		0.53		0.58		0.58		0.44

+ Sire effect tested against cows within sire and other effects tested against remainder mean squares.
* = $p<0.05$; ** = $p<0.01$, *** = $p<0.001$.

TABLE 3. Least-squares means and their standard errors of season of calving and parity affecting reproductive traits in Egyptian buffaloes.

Independent variable	N	CFS mean.	CFS s.e.	DO mean.	DO s.e.	N	IP mean.	IP s.e.	N	CI mean.	CI s.e.	N	BW mean.	BW s.e.
Season of calving														
Autumn	511	228	6	285	7	511	53	6.0	410	548	12	517	34.7	0.5
Winter	625	201	6	259	7	625	54	5.6	466	568	11	640	35.1	0.5
Spring	406	198	7	261	8	406	59	6.3	328	601	14	412	35.9	0.6
Summer	185	230	9	292	11	185	56	8.5	140	566	16	187	34.6	0.7
Parity														
1st	422	383	17	522	19	422	86	10.9	421	868	35	430	35.1	1.8
2nd	427	254	7	333	8	427	56	5.7	313	746	26	436	35.4	1.0
3rd	314	159	7	192	9	878	25	7.4	234	636	17	321	35.2	0.6
4th	564	62	14	50	16				165	513	11	225	34.6	0.8
5th									94	398	20	145	35.0	1.1
≥6th									117	362	40	199	35.1	1.6

Egyptian investigators (*e.g.* Mourad, 1978; kotby *et al*, 1987). Cow's age in months, treated as a covariate, had significant effect on all reproductive interval traits studied (Table 2), which indicate that age of cow is considered as one of the most important factors affecting interval reproductive traits in buffaloes. These results are close to those reported by Mostageer *et al* (1981) and Khalil *et al* (1991).

TABLE 4. Partial linear and quadratic regression coefficients (b) and tests of significance of reproductive traits on age at calving.

	Linear (unit / month)		Quadratic (unit/ month^2)	
Trait	b	s.e.	b	s.e.
First lactation				
CFS	3.44**	1.26	0.026	0.130
IP	0.81	1.09	-0.098	0.112
DO	4.26**	1.46	-0.073	0.150
CI	2.41	1.47	-0.009	0.152
BW	-0.02	0.07	0.004	0.007
All lactations				
CFS	3.230***	0.72	-0.041***	0.004
IP	1.255**	0.53	-0.008**	0.003
DO	5.672***	0.82	-0.057***	0.004
CI	-9.380***	1.36	0.026***	0.007
BW	-0.06	0.05	-0.001***	0.001

** = $p<0.01$, *** = $p<0.001$.

Year x season interaction

The interaction between year and season of calving had a significant ($P < 0.01$ or $P < 0.001$) effect on CFS, DO and BW, while it had non-significant effect of IP and CI (Table 2). The biological and economic importance of this interaction is open to question.

Variance component estimates

Effects of sire of the cow on reproductive traits in the first lactation and across all lactations showed that sire of cow did not contribute significantly to the total variance of most reproductive traits studied (Table 2), *i.e.* sire of cow had little or no effect on most reproductive traits. Most of these findings are similar to those obtained on Egyptian buffaloes (*e.g.* Khalil *et al*, 1991) and on non- Egyptian buffaloes (*e.g.* Ahmed *et al*, 1983; Kornel and Parto, 1988). The proportion of variation (V%) attributed to the sire component of variance ranged from 0.0 to 6.2% for reproductive traits studied (Table 5). These estimates are somewhat lower than those reported by other Egyptian investigators (Sadek, 1984; Khalil *et al*, 1991). However, results of the present and other reviewed studies indicate that genetic improvement of reproductive traits in Egyptian buffaloes may not be possible through sire selection, but could be through better management.

TABLE 5. Variance component estimates (σ^2) and percentages of variation (V%) due to random effects for reproductive traits of first and all lactations.

Trait	Sire			Remainder		
	df	σ^2_s	V%	df	σ^2_e	V%
First lactation						
CFS	55	809.6	6.2*	360	12279	93.8
IP	55	a	0.0	360	9090	100.0
DO	55	406.9	2.4	360	16382	97.6
CI	55	a	0.0	360	16747	100.0
BW	55	0.68	1.7	360	40	98.3
AFC	55	a	0.0	359	27	100.0
All lactations						
CFS	50	34.7	0.4	1189	7913	94.9
IP	50	11.4	0.2	1194	6742	97.7
DO	50	65.8	0.6	1189	10331	96.7
CI	50	a	0.0	800	10195	75.9
BW	55	0.68	1.6*	1206	32	76.8

+ df, σ^2c : s and V% for cow-within -sire, respectively were 435, 389.5 and 4.7% for CFS, 435, 144 and 2.1% for IP, 435, 288 and 2.7% for DO, 435, 3230 and 24.1% for CI and 440,9.0 and 21.6% for BW.

[a] Negative estimate of sire component of variance set to zero ; * = $p<0.05$.

Differences in all reproductive traits due to cow effect (Table 2) were significant (P<0.01orP<0.001). The proportion of variance attributable to cow were low or moderate and ranged from 2.1% to 24.1% (Table 5). Similar to the present results, some investigators (Gurnani *et al*, 1976; Lundstrom *et al*, 1982; Ahmed *et al*, 1983; Khalil *et al*, 1991) have reported that the phenotypic value of reproductive traits in buffaloes is not only due to gene transmitted by the cow but also to her large maternal environment.

Repeatability estimates

Repeatability estimates for different reproductive traits were low or moderate and ranged from 0.02 to 0.24; all with standard errors around 0.02 (Table 6). Similar estimates were obtained by some Egyptian investigators (*e.g.* Ashmawy, 1991) and by non- Egyptian workers (Ahmed *et al*, 1983). On the other hand, high estimates of

TABLE 6. Estimates of repeatability (t) and heritability (h^2) and their standard errors (s.e.) for reproductive traits.

Trait	Repeatability		Heritability estimates			
			First lactation		All lactations	
	t	s.e.	h^2	s.e.	h^2	s.e.
CFS	0.05	0.02	0.25	0.15	0.02	0.03
IP	0.02	0.02	a		0.01	0.03
DO	0.03	0.01	0.10	0.12	0.03	0.03
CI	0.24	0.03	a		a	
BW	0.23	0.03	0.07	0.12	0.07	0.04
AFC			a			

[a] Negative estimates of sire component of variance set to sero.

repeatability for some reproductive traits were reported by Gurnani *et al* (1976) and Lundstrom *et al* (1982) for Murrah buffaloes.

Heritability estimates

Estimates of heritability based on paternal half-sib analyses for reproductive traits in the first lactation and across all lactations were low and ranged between 0.0 to 0.25 (Table 6). The low estimates of heritability for most traits reflect a larger environmental component of variance associated with the cow after calving , *i.e.* reproductive traits in buffaloes are influenced to great extent by environmental factors. The negative estimates are a reflection of low sample size which could be reduced by increasing the number of sires and the number of daughters (cows) per sire as well as using more information per sire instead of using more sires. Estimates of heritability in the present study for all reproductive traits were similar to those obtained by some Egyptian investigators (Mostageer *et al*, 1981; Sadek, 1984; Khalil *et al.*, 1991). Other non-Egyptian studies on different types of buffaloes showed low heritabilities for reproductive traits (Dutt *et al*, 1985; Kornel and Patro, 1988). The discrepancy between most estimates obtained in this study and the corresponding estimates reported in the literature may be attributed to the different types of buffaloes reared under particular environmental conditions during definite periods of time. Statistically, the wide range can be attributed to the use of small data sets with poor structure and to a variety of statistical models used. However, low estimates of heritability for reproductive traits in the present and reviewed studies indicated that improvement of such traits may not be possible through sire selection. Possibly, good management and feeding lead to much improvement for these traits in buffaloes.

Phenotypic correlation

Estimates of phenotypic correlation among different reproductive traits are presented in Table 7. Phenotypic correlations (rp) between DO and either CFS or IP were positive and high, *i.e.* phenotypic selection for shorter DO will lead to shorter CFS or IP. Consequently, any improvement in CFS or IP of the Egyptian buffaloes would be phenotypically associated with an improvement in DO. This result is in full agreement with that reported by Johari and Bhat (1979) on the Indian buffaloes and Khalil *et al* (1991) on the Egyptian buffaloes. On the other hand, CFS and IP were negatively moderately phenotypically correlated which indicating that selection for shorter CFS will lead to longer IP. Estimates of rp between either CI or BW and each of CFS, IP and DO were weak and generally positive (Table 7). Therefore, selection for interval traits measured from calving to conception (*i.e.* CFS, IP or DO) does not necessarily lead to an improvement in CI, *i.e.* shortening the DO would not be a goal in itself. The ultimate goal in selection for better reproductive performance should be to shorten DO or CI parallel with an improvement in conception rate.

TABLE 7. Estimates of phenotypic correlation among reproductive traits in either of the 1st lactation (above diagonal) or across all lactations (under diagonal).

Trait	CFS	IP	DO	CI	BW
CFS		-0.229	0.714	0.169	0.173
IP	-0.325		0.502	-0.028	-0.020
DO	0.636	0.520		0.129	0.138
CI	0.021	0.024	0.038		0.141
BW	0.015	-0.016	0.001	0.081	

Conclusion Reproductive efficiencies in Egyptian buffaloes are poor and that is probably due to managerial factors mainly nutrition (green fodder availability) and climatological factors together with the fact that no effective selection programme was carried out (Khalil *et al*, 1991).

Low repeatability for most reproductive traits (with estimates ranging from 0.02 to 0.24) indicate that culling of buffalo cows for reproductive perfromance based on a single production record, as commonly practiced in buffalo herds, would not be efficient from genetic standpoint and consequently assessment of several records are required before selecting buffalo cows for such traits.

Low genetic variation due to sires obtained here and the low heritability for most reproductive traits suggest that there is little scope for improving the reproductive performance of Egyptian buffalo through direct selection. However, the measures most likely to improve the reproductive efficiency in Egyptian buffaloes are the improvement of management and nutrition.

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التحليل الوراثى للصفات التناسليه فى الجاموس المصرى

عزت عطا عفيفى ، ماهر حسب النبى خليل ، ليلى حسن بدير *
وسهير محمود زيدان *

قسم الانتاج الحيوانى - كليه الزراعه بمشتهر - جامعه الزقازيق - مصر .
* معهد بحوث الانتاج الحيوانى - وزارة الزراعه - الدقى - القاهرة .

أجريت هذه الدراسة على سجلات اللبن لإحدى قطعان الجاموس المصرى خلال الفترة من سنه ١٩٧٠ حتى ١٩٨٥ . إستخدمت بيانات ٢٩٤٦ سجل تناسل لعدد ٤٣٠ جاموسة تمثل بنات ٥١ طلوقة وذلك لتقدير التباين الوراثى والمظهرى لبعض الصفات التناسليه المتمثلة فى عمر البقرة عند أول ولاده - وزن العجل عند الميلاد- الفترة من الولاده حتى أول تلقيحة تاليه - فترة التلقيح - فترة

الأيام المفترحة - الفترة بين ولادتين . تتلخص النتائج المتحصل عليها فيما يلى :

١- كانت المتوسطات لكل من وزن العجل عند الميلاد ، الفترة من الـولاده حتى أول تلقيحه ، فترة التلقيح ، فترة الايام المفتوحة (الفترة من الولاده للاخصاب) ، الفترة بين ولادتين وذلك لكل مواسم الادرار هى ٣٥ كيلو جرام ، ١٦٦ يوما ، ٣٧ يوما ، ٢٠٣ يوم ، ٥٠٠ يوما على التوالى فى حين كان متوسط عمر البقرة عند أول ولاده هو ٣٨ شهرا.

٢- تناقصت معظم الصفات التناسليه (على سبيل المثال الفتره من الولاده حتى أول تلقيحه تاليه ، فترة التلقيح ، فترة الأيام المفتوحه) مع تقدم موسم الادرار للجاموسه . وكانت الاختلافات بين مواسم الادرار لبعض الصفات التناسليه (الفترة من الولاده حتى أول تلقيحه تاليه ، فترة التلقيح ، فترة الايام المفتوحه ، الفترة بين ولادتين) معنوية عند مستوى ٠١ر٠.

٣- كان هناك تأثيرا معنويا لفصل السنه (عند مستوى ٠٥ر٠ أو ٠١ر٠) على كل من الفترة من الولاده حتى أول تلقيحه ، الفترة من الولاده الى التلقيحه المخصبه . كانت لولادات الشتاء والربيع أقصر فتره من الولاده حتى التلقيحه المخصبه التاليه ومن الولاده حتى أول تلقيحه وأطول فتره بين ولادتين.

٤- أتضح ان لسنه الولاده تأثيرا معنويا (على مستوى ٠١ر٠) على معظم الصفات التناسليه المدروسه.

٥- وجد أن لعمر الجاموسه عند الولاده تأثيرا معنويا (عند مستوى ٠١ر٠) على معظم الصفات التناسليه حيث لوحظ تناقص فى متوسطات الصفات بصوره خطيه انحنائيه وذلك بتقدم عمر الجاموسه.

٦- اتضح انه لا يوجد تأثير ملموس للطلوقه (أب البقرة) على كل الصفات التناسليه فى الموسم الأول من الإدرار وكذلك لكل المواسم مجتمعه معا فيما عدا وزن العجل عند الميلاد ، حيث اتضح

أن هناك تاثيرا معنويا (عند مستوى ٥٠ر٠) . فى الجانب الآخر وجد أن للبقرة تاثيرا معنويا على جميع الصفات التناسليه المدروسه (عند مستوى ١٠ر٠).

٧- كانت قيم المعامل التكرارى لمعظم الصفات التناسليه (الفتره من الولادة حتى أول تلقيحة ، فترة التلقيح ، فترة الايام المفتوحة) منخفضه القيمه وتراوحت بين ٠٢ر٠ الى ٠٥ر٠ فى حين كانت متوسطه القيمه لباقى الصفات التناسليه الاخرى وهى وزن العجل عند الولاده والفترة بين ولادتين حيث كانت القيم ٢٣ر٠ ، ٢٤ ر. على الترتيب.

٨- كانت قيم المكافىء الوراثى لجميع الصفات التناسليه المدروسه منخفضه القيمه وتراوحت بين صفر ، ٢٥ر٠.

٩- كان الارتباط المظهرى بين طول فترة الايام المفتوحة وكل من الفترة من الولاده حتى أول تلقيحه أو فتره التلقيح موجبا وعاليا القيمه ، كذلك كانت هناك ارتباطات مظهريه موجبه وضعيفه بين الفترة بين ولادتين أو وزن العجل عند الولادة وكل من فترة الايام المفتوحة وفترة التلقيح والفترة من الولاده حتى أول تلقيحه ، فى حين كانت الارتباطات بين الفترة من الولاده حتى أول تلقيحه وطول فترة التلقيح سالبه ومعتدله القيمة .