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Some Aspects of Reproductive Performance of Crossbred Cattle in Egypt

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This work was carried out on data collected during the period from August 1977 to May 1984 from native cattle «Baladi» (BAL) and their crosses with Red Angler (1/2 RA), Braunvieh (1/2 BV), Deutsches Braunvieh (1/2 DBV), Grauvieh (1/2 GV) and Friesian (1/2 FR). Animals used were located at Omar Makram Farm, South Tahreer, Egypt.

The main results are (Numbers of animals in brackets) :

1) Genotype had significant effects on the number of services required for the first ($N = 120$, $P < 0.05$) and 2nd pregnancy ($N = 92$, $P < 0.01$). The 1/2 FR required the highest number (3.2) while halfbreds of RA and DEV required the lowest (1.7 services). The 1/2 FR, also, had the highest mean for 2nd pregnancy (4.4), significantly different from all other genotypes. The overall mean NSPC increased with advance in order of parity (2.3, 2.4 and 3.1 services for the 1st, 2nd and 3rd pregnancy, respectively).

2) Genotypic differences were significant ($P < 0.05$) in the service period (SP = number of days elapsed from 1st to conception service) for both 1st ($N = 120$) and 2nd ($N = 92$) pregnancy. The 1/2 FR required the longest SP for both 1st ($x = 134$ days) and 2nd ($x = 215$ days) pregnancy. The length of SP increased with advance in order of parity (73, 90 and 132 days for 1st, 2nd and 3rd pregnancy, respectively).

3) All crosses delivered their 1st calf earlier than the Baladi. Means obtained for age at 1st calving ($N = 118$) were 36.1, 30.8, 34.5, 33 3, 32.7 and 34.8 months for the BAL, 1/2 RA, 1/2 BV, 1/2 DBV, 1/2 GV and 1/2 FR, resp. Differences, however, were insignificant. Year of birth effect on age at first calving was significant ($P < 0.01$).

4) Friesian halfbreds showed the longest first calving interval and were the oldest at second calving. Means obtained for first calving interval (N = 92) were 470, 485, 486, 513, 466 and 598 days and corresponding means of age at second calving (N = 92) were 50.1, 47.7, 49.3, 49.0, 46.3 and 52.2 months for the above mentioned genotypes, respectively. Year of first calving affected significantly ($P < 0.01$) age at second calving

Key words : Production, Crossbreeding, Cattle, Egypt

Crossbreeding and grading up native cattle in Egypt with European or American breeds can effectively be used to improve genetically the indigenous animals. The adoption of an exotic breed for crossing purposes should be based on the economic evaluation of the reproductive performance of its crosses, the potentiality for milk and meat production and the rate of survival.

Several studies conducted in the tropics and dry subtropics have indicated the advantage of the crosses between native and European breeds over the native mates in several aspects of breeding efficiency with emphasis on age at calving (El-Itriby and Asker, 1958; Galal *et al.* 1977; Van Duc and Taneja, 1984 and Mostageeer *et al.*, 1987).

Season and year of calving and parity of the dairy cow have been reported as major sources of variation in various reproductive traits (El-Sheikh and El-Fouly, 1962; McDowell *et al.*, 1976; El-Wishy *et al.*, 1983; Morsy *et al.*, 1984 and Van Duc and Taneja, 1984).

The present study was carried out to evaluate some aspects of reproductive performance of the Egyptian Baladi cattle and their crosses with five European breeds, namely, Red Angler, Braunvieh, Deutsches Braunvieh*, Grauvieh and Friesian. The study aimed also at evaluating influences of season and year of birth and calving on the reproductive performance of the Baladi and its crosses.

Material and Methods

Data used in this work were collected on the Baladis and their crosses,

* This is the F_1 cross between Braunvieh and Brown Swiss.

produced by a joint crossbreeding project* during the period from August, 1977 to May, 1984. Experimental animals were located at Omar Makram farm, South Tahreer, West of the Delta Region. Animls were the progeny of a herd of Baladi dams artificially inseminated with semen of Baladi (BAL) and five of the Central European Breeds, namely, the Red Angler (RA), Braunvieh (BV), Deutsches Braunvieh (DBV), Grauvieh (GV) and Friesian (FR).

Baladi and F_1 heifers were inseminated for the first time on the basis of their age (not less than 15 months) and body weight (not less than 250 kg). F_1 crossbred heifers were backcrossed to their respective foreign breeds by using frozen semen from at least three bulls of each breed, while their Baladi mates were inseminated by semen from six Baladi bulls.

Animals were kept loose under semi-open sheds, all the year round. All cows were fed concentrates along with Egyptian clover *(Trifolium alexandrinum)* during winter and spring months. Concentrates were given to make up the nutritional requirements, During summer and autumn months only concentrates were available. Rice straw was available all the year round.

The reproductive traits studies were (total numbers of observations in brackets) : (1) age at first calving (AFC, N = 118), (2) post-partum service interval (PPSI, N = 153) expressing the period from calving to the first subsequent service, (3) service period (SP, N = 273) taken as the period between first service and conception, (4) days open (DO, N = 153), the period from parturition to subsequent conception, (5) number of services per conception (NSPC, N = 273), (6) gestation length (GP, N = 118), (7) first calving internal (FCI, N = 92), the interval between the first two calvings and (8) age at second calving (AC, N = 92).

The statistical analyses of data were carried out using the least squares method (Harvey, 1960). Duncan multiple range test was used to test differences among means (Duncan, 1955).

Four statistical models were used; the first model was used in the analyses of NSPC, PPSI, SP and DO and included the single main effect of genotype (BAL, 1/2 RA, 1/2 BV, 1/2 DBV, 1/2 GV and 1/2 FR).

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The second model was used for analysing AFC by adding the effects of season of birth (1 = winter, 2 = spring and 3 = summer + autumn) and year of birth (1 = 1977, 2 = 1978 and 3 = 1979 + 1980 + 1981).

The third model used for analyses of FCI and ASC was developed from the second model where season and year of birth were replaced by season of first calving (classified as season of birth) and year of calving (1 = 1980 and 2 = 1981).

The fourth model was used for analysing GP and included the main effects of genotype (as classified above), sex of carried calf (1 = male and 2 = female) and season of calving (classified as season of birth in the second model).

Results and Discussion

Number of services per conception (NSPC)

Least squares means and mean squares of number of services per conception (NSPC) are shown in Table 1. The overall number of services increased with advance in the order of parity and averaged 2.3, 2.4 and 3.1 services for the first, second and third pregnancy, respectively. El-Sheikh and El-Fouly (1964) reported that Friesian heifers required 0.46 less services per conception than cows. Means of NSPC obtained in the present study are comparable to the estimates obtained by El-Sheikh (1960) and by El-Sheikh and El-Fouly (1964) for Frieesian cattle in the Tahreer Province (2.5 and 2.7, resp.).

The effect of genotype of cow inseminated on number of services was significant in the first ($P < 0.05$) and in the second pregnancy ($P < 0.01$). The FR halfbreds required the highest number of services for both first (3.2) and second pregnancy (4.4), significantly different from means of 1/2 RA and 1/2 DBV in the first and from all other genotypes in the second pregnancy. Nigm (1976) reported 1.22 and 1.81 as the numbers of services required for the first and second pregnancy (resp.) by the Friesian halfbreds. The Baladi required 2.3, 2.6 and 3.3 services for first, second and third pregnancy, respectively. Morsy *et al.* (1984) reported 1.84 doses per conception in a Baladi herd.

Post-partum-service interval (PPSI)

Means and mean squares of post-partum-service interval (PPSI) are presented in Table 1. Means obtained were 122 and 125 days after the first and second calvings, respeectively, relatively higher than estimates reported for the same trait by Egyptian investigators (68.9 days for Friesian by El-Sheikh 1960; 75.3 days for Baladi cattle by Oloufa, 1968, 88.6 days for Friesian by El-Sheikh and El-Fouly, 1963 and 91.2 days for Friesian halfbreds reported by Nigm, 1976).

Differences in PPSI due to genotype did not reach the level of statistical significance in any of the parities considered. The Baladis, however, had the shortest intervals 90 and 74 days) and the ½ DBV showd the longest intervals 156 and 158 days) after the first and second parturitions. El-Sheikh and El-Fouly (1963) attributed the prolongation of PPSI to one or more of the following causes :

(1) delayed involution of the uterus which may be due to abnormal parturition and/or retained placenta;

(2) post-partum anestrus and

(3) an inefficient heat observation.

Service period (SP)

Least squares overall mean of service period increased markedly with advance in order of parity. Means obtained were 73, 90 and 132 days for the first, second and third conception, respectively.

Genotypic differences in SP were significant ($P < 0.05$) for both frist and second pregnancy but not for the third. The 1/2 FR had the longest SP for both first and second pregnancies (134 and 215 days, respectively) which were significantly different from the means of 1/2 RA and 1/2 DBV (for the heifers) and from the means of all other genotypes (for the first parity). It should be noted, also, that FR halfbreds had the highest NSPC in both heifers and first calvers (Table 1) exerting the same significant genotypic differences detected in SP.

Days open (DO)

Days open (DO) from parturition to subsequent conception has a close relation with both breeding efficiency and milk production. The overall mean increased markedly from the first to the second parity (212 and 257 days, respectively, Table 1). Means obtained in the present study are much higher

TABLE 1 : Least squares means (± S.E.) and mean squares of postpartum service interval (PPSI, day), service period (SP, day), days open (DO, day) and number of services per conception (NSPC) required for the first three cenceptions.

Genotype	N	NSPC		PPSI (day)		SP (day)		DO (day)	
		X'	S.E.	X'	S.E.	X'	S.E.	X'	S.E.
Heifers :									
Overall	120	2.3	0.2	...	...	73	12	...	...
BAL	10	2.3ab	0.6	...	...	62ab	40	...	...
1/2 RA	28	1.7a	0.3	...	...	30a	24	...	...
1/2 BV	25	2.6ab	0.3	...	...	114bc	25	...	...
1/2 DBV	23	1.7a	0.4	...	...	47ac	26	...	...
1/2 GV	13	2.3ab	0.5	...	...	54ab	35	...	...
1/2 FR	21	3.2b	0.4	...	...	134b	27	...	...
Source of variance :	d.f.	....				Mean squares	....		
Genotype	5	7.7*		...		38605*			
Residual	114	3.0		...		15568			
Parity I :									
Overall	92	2.4	0.2	122	7	90	15	212	15
BAL	10	2.6a	0.6	90	20	97a	41	187	43

1/2 RA	24	1.8a	0.4	125	13	63a	27	188	28
1/2 BV	19	2.2a	0.4	116	14	78a	30	194	31
1/2 DBV	18	2.0a	0.4	156	15	63a	31	219	32
1/2 GV	8	1.6a	0.6	146	22	26a	46	172	48
1/2 FR	13	4.4b	0.5	97	17	215b	36	312	37
Source of variance:	d.f.	....	....	....	....	Mean squares	....	....	....
Genotype	5	13.6**		9042		53910*		33716	
Residual	86	3.1		3907		16988		18096	
Parity II :									
Overall	61	3.1	0.3	125	12	132	23	257	27
BAL	4	3.3	1.2	74	42	77	78	151	92
1/2 RA	19	2.8	0.5	114	19	110	36	224	42
1/2 BV	10	3.0	0.7	149	27	148	49	297	58
1/2 DBV	13	1.8	0.6	158	23	57	43	215	51
1/2 GV	5	4.0	1.0	116	38	241	70	357	83
1/2 FR	10	3.8	0.7	141	27	157	49	298	58
Source of variance:	d.f.	....	....	....	....	Mean squares	....	....	....
Genotype	5	6.3		6573		31137		33772	
Residual	55	5.4		7120		34097		24170	

1. Means followed by different letters differ significantly.

* ($P < 0.05$) ** ($P < 0.01$)

X' = Mean

than corresponding estimates obtained by Oloufa (1968), Morsy *et al.* (1984) and Ragab and Sourour (1963) for Egyptian Baladi cattle (95.3, 114.8 and 127.9 days, respectively); Ragab and Sourour (1963) and El-Sheikh (1960) for Friesian cattle in Egypt (114.3 and 130.9 days, respectively) and by Nigm (1976) for Friesian halfbreds (132.3 days).

Genotypic differences in days open were statistically insignificant after both first and second calvings. The Baladi tended to have lower means of days open (187 and 151 days) where the FR halfbreds showed higher estimates after first and second calving (312 and 298 days, respectively). Though having the least number of DO after first calving (172 days), the 1/2 GV showed the

TABLE 2 : Least squares means (± S.E.) and mean squares (M.S.) of first and second gestation length (days).

Classification	N	1st gestation X' ± S.E.		N	2nd gestation X' ± S.E.	
Genotype :						
Overall mean	118	281	±0.9	92	280	±1.0
BAL	10	284	±2.7	10	282	±2.8
1/2 AR	27	281	±1.7	24	277	±1.8
1/2 BV	24	282	±1.8	19	280	±2.0
1/2 DBV	23	282	±1.9	18	280	±2.1
1/2 GV	13	281	±2.4	8	284	±3.1
1/2 FR	21	277	±1.9	13	277	±2.5
Season of calving :						
Winter	44	282	±1.4	30	280	±1.7
Spring	54	280	±1.2	31	280	±1.6
Summer + Aut.	20	281	±2.0	31	280	±1.6
Sex of calf :						
male	62	282	±1.2	43	282	±1.4
female	56	280	±1.2	49	278	±1.3
Source of variance :	d.f.	M.S.		d.f.	M.S.	
Genotype	5	101.7		5	84.7	
Season of Calving	2	19.6		2	5.7	
Sex of calf	1	62.9		1	302.7	
Residual	109	72.4		83	78.7	

X' = Mean

highest estimate (357 days) after the second one. The differences in DO, ranging from 140 days after first to 206 days after second calving, are of considerable economic importance regardless of the lack of statistical significance.

Gestation period length (GP)

Means and mean squares of first and second gestation period length are given in Table 2. The overall means of the two gestations are very close (281 and 280 days, respectively). These estimates are comparable to those reported by Morsy *et al.* (1984) and by Tantawy and Ahmed (1953) and Oloufa (1968) for Egyptian Baladi cattle (280.5 days, 289 and 289 days, respectively) and by Nigm (1976) for FR halfbreds (280.3 days).

No differences between genotypes could be observed in parity groups, and differences between the two means of each genotype are actually negligible. In general, differences due to the factors examined (genotype, season calving and sex) were all statistically insignificant. These results agree with those reported by Nigm (1976), Morsy *et al.* (1984) and McElhenney *et al.* (1985).

Age at first calving (AFC), first calving interval (FCI) and age at second calving (ASC)

Least squares means and mean squares of age at first calving (AFC), first calving interval (FCI) and age at second calving (ASC) are shown in Table 3. The discrepancy observed when means of AFC, FCI and ASC are combined is attributed to the differences in the numbers of observations used to estimate each trait.

The overall mean of AFC is 33.7 months. The differences among genotypes were not significant. However, the Baladi scored the highest age at first calving (36.1 months) and the RA halfbreds scored the lowest (30.8 months). Apart from the RA halfbreds, genotypes did not differ significantly from each other. The most marked differences existed between RA halfbreds and both BV and FR halfbreds. These results concerning the effect of breed of sire on AFC is in agreement with those reported by Galal *et al.* (1977) on Baladi (36.1 months) and its crosses with both Shorthorn (34.9 months) and Jersey (29.6 months). The mean age at first calving of the Baladi obtained in the present study is lower than the 42.4 months obtained by El-Itriby and Asker (1958) and the 41.5 months reported by Mostageer *et al.* (1987), though higher than the 34 months given by Ragab and Sourour (1963) for the same breed. Year of birth had a significant effect ($P < 0.01$) on AFC reflecting probably the different levels of management during the various years of birth.

TABLE 3 : Least squares means[1] (±S.E.) and mean squares (M.S.) of age at first calving (AFC, month), first calving interval (FCI, day) and age at second calving (ASC, month).

Classification	N	AFC[2]	N	FCI[3]	ASC[3]
		X' ± S.E.		X' ± S.E.	X' ± S.E.
Overall mean	118	33.7±0.9	92	503±18.7	49.1±0.7
Genotype :					
BAL	10	36.1±2.3	10	470±44.6	50.1±1.8
1/2 RA	27	30.8±1.3	24	485±30.8	47.7±1.2
1/2 BV	24	34.5±1.4	19	486±32.5	49.3±1.3
1/2 DBV	23	33.3±1.5	18	513±37.1	49.0±1.5
1/2 GV	13	32.7±1.9	8	466±48.5	46.3±1.9
1/2 FR	21	34.8±1.5	13	598±40.1	52.2±1.6
Season :					
Winter	76	33.5±0.8	35	515±26.2	48.3±1.0
Spring	8	35.3±2.3	42	510±23.4	48.2±0.9
Sum. + Aut.	34	32.2±1.4	15	484±37.5	50.8±1.5
Year :					
I	61	29.9±1.2a	72	473±19.0	44.1±0.8a
II	36	32.3±1.2a	20	534±31.1	54.1±1.2b
III	21	38.9±1.6b	...	...	...
Source of variance:	d.f.	M.S.	d.f.	M.S.	
Genotype	5	64.1	5	29221	45.8
Season	2	27.7	2	4614	35.8
Year	2	502.1**	1	54516	1461.9**
Residual	108	37.4	83	18318	29.0

1. Means followed by different letters differ significantly at 5% level.

2. Season of birth. Year groups of birth (I = 77, II = 78 and III = 79 + 80 + 1981).

3. Season of first calving. Year groups of first calving (I = 1980 and II = 1981 + 1982).

** (P < 0.01)

X' = Mean

TABLE 4 : Least Squares means[1] (± S.E.) and mean squares (M.S.) of age at first calving (AFC, month), first calving interval (FCI, day) and age second calving (ASC, month).

Classification	N	AFC[2]	N	FCI[3]	ASC[3]
		X'±S.E		X'±S.E.	X'±S.E.
Overall mean	118	33.7±0.9	92	503±18.7	49.1±0.7
Genotype :					
BAL	10	36.1±2.3	10	470±44.6	50.1±1.8
1/2 RA	27	30.8±1.3	24	485±30.8	47.7±1.2
1/2 BV	24	34.5±1.4	19	486±32.5	49.3±1.3
1/2 DBV	23	33.3±1.5	18	513±37.1	49.0±1.5
1/2 GV	13	32.7±1.9	8	466±48.5	46.3±1.9
1/2 FR	21	34.8±1.5	13	598±40.1	52.2±1.6
Season :					
Winter	76	33.5±0.8	35	515±26.2	48.3±1.0
Spring	8	35.3±2.3	42	510±23.4	48.2±0.9
Sum. + Aut.	34	32.2±1.4	15	484±37.5	50.8±1.5
Year :					
I	61	29.9±1.2a	72	473±19.0	44.1±0.8a
II	36	32.3±1.2a	20	534±31.1	54.1±1.2b
III	21	38.9±1.6b	...	...	...
Source of variance	d.f.	M.S.	d.f.	M.S.	
Genotype	5	64.1NS	5	29221NS	45.8NS
Season	2	27.7NS	2	4614NS	35.8NS
Year	2	502.1**	1	54516NS	1461.9**
Residual	108	37.4	83	18318	29.0

1. Means followed by different letters differ significantly at 5% level.

2. Season of birth. Year groups of birth (I = 77, II = 78 and III = 79 + 80 + 1981)

3. Season of first calving. Year groups of first calving (I = 1980 and II = 1981 + 1982)

** Significant at the 1% level. NS = Not significieant

X' = Mean

Galving interval acquires its importance as economic trait from combining PPSI, SP and GP in one single indicative measure. None of the three assumed sources contributed significantly to the variation in calving interval. The FR halfbreds had a mean 16 weeks higher than both RA and BV halfbreds. The pure Baladi together with the GV halfbreds scored the lowest means. The estimate obtained for the Baladi in the present study (470 days) is higher than those reported by Oloufa (1968), Morsy *et al.* (1984) and Galal *et al.* (1977), (382, 401 and 442 days, respectively), though lower than that found by Mostageer *et al.* (1987) (604 days) for the same breed. With respect to the F_1 crosses, the FCI of the crossbreds obtained in the present study are higher than those given by Galal *et al.* (1977) on Baladi × Shorthorn and Baladi × Jersey (414 and 475 days, respectively) and by Mostageer *et al.* (1987) on Baladi × Friesian (442 days).

With respect to the age at second calving (ASC) and apart from the FR halfbreds, all genotype means were not statistically different from each other, with the Baladi averaging 50.1 months. The FR crosses had a mean of 52.2 months which was higher than that of RA and GV halfbreds. This marked delay of FR halfbreds in delivering their second calf while having relatively shorter post-partum-service interval is due to the highest estimates scored by the FR crosses in number of services per conception, service period and days open.

Differences in ASC between seasons of first calving were not significant, but those between the two years groups under investigation proved to be highly significant (Table 4), the difference between them amounted to 10 months.

Except for the FR crosses, all crosses delivered their first two calves at younger ages than pure Baladi dams, due probably to the relatively retarded growth and body development of the Baladi females. However, the Baladis performed as efficient as most of the crosses in the other aspects of reproduction investigated in this study.

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بعض نواحى الكفاءة التناسلية فى الأبقار الخليطة فى مصر

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أجرى هذا البحث على بيانات جمعت خلال الفترة من أغسطس ١٩٧٧ الى مايو ١٩٨٤ على الأبقـــار البلدية وهجنها مـــع الرد انجلر والبرانفيه والبراونفيه الألمــانى والجراوفيه والفريزيان بمزرعـــة عمر مكرم بجنـــوب التحرير وكانت أهم النتائج المتحصل عليها كما يلى :

١ ـ أثر التركيب الوراثى معنويا على عدد التلقيحات اللازمة للحمل وفترة التلقيح وكانت المتوسطات المحسوبة بطريقة الحد الأدنى للمربعـــات لعدد التلقيحات اللازمة للحمل ٢ر٧ ، ١ر٢ ، ٦ر٢ ، ٨ر١ ، ٥ر٢ ، ٨ر٣ للبلدى وهجنه مـــع الانجلر والبراونفيه والبراونفيـــه الألمـــانى والجرافيه والفريزيان (على الترتيب) وكانت المتوسطات لطـــول فترة التلقيح ٨٥ ، ٦١ ، ١١٢ ، ٥٧ ، ٨٥ ، ١٦٨ يوما للمجاميع المذكورة (على الترتيب) ٠

٢ ـ كانت متوسطات الفترة من الوضع حتى التلقيح التالى لها ٦٤ ، ١٠٢ ، ٩٠ ، ١٢٨ ، ١٠٦ و٨٨ يوما وكانت الفروق معنوية عـــلى مستوى معنوية ٥٪ بينمـــا كانت متوسطات الفترة من الولادة حتى التلقيـــح المخصب التا لىها ١٥٣ ، ١٨٢ ، ١٨٦ ، ١٨٢ ، ٢١٣ ، ٢٧٤ يوما للمجاميع المذكورة (على الترتيب) وكانت الفروق غير معنوية ٠

٣ ـ كانت متوسطات العمر عند الوضع الأول ١ر٣٦ ، ٨ر٣٠ ، ٥ر٣٤ ، ٣ر٣٣ ، ٧ر٣٢ ، ٨ر٣٤ شهرا للبلدى وهجنه مع الانجلر والبراونفيه والبراونفيه الألمـــانى والجراونفيه والفريزيان (على الترتيب) وكانت الفروق غير معنوية ٠

٤ ـ سجلت هجن الفريزيان أطول فترة بين الوضعين الأول والثانى وكانت الأكبر عمرا عند الوضـــع الثانى وكانت المتوسطات ٤٧٠ ، ٤٨٥ ، ٤٨٦ ، ٥١٣ ، ٤٦٦ ، ٥٩٨ يوما للفترة بين الوضـــعين و ١ر٥٠ ، ٧ر٤٧ ، ٣ر٤٩ ، ـــر٤٩ ، ٣ر٤٦ ، ٢ر٥٢ شهرا للعمر عند الوضـــع الثانى للبلدى وهجنه مع الانجلر والبراونفيه والبراونفيه الألمـــانى والجراوفيه والفريزيان (على الترتيب) ٠