

4. RESULTS AND DISCUSSION

4.1 Non-Genetic Aspects

4.1.1 Productive Traits

Means and variation of uncorrected records:

The productive traits studied are 305-day milk yield (M305), total milk yield (TMY), lactation period (LP) and dry period (DP). Means, standard deviations and coefficients of variation for these productive traits in the first, second and third lactations are given in Table 18. These means show that M305 and TMY were slightly higher than those reported by Abdel-Ghani and Hathout (1966), Fahmy (1970) and Mokhtar (1971) with Friesian cattle raised in Egypt, while they were lower than those reported by El-Itriby and Asker (1958), Ragab and Sourour (1963), Ashmawy (1975), Badran (1978), Khattab and Ashmawy (1988). Also, these data indicate that LP of different lactations of this study was longer than those reported on the same breed in Egypt by Ashmawy (1975), Badran (1978) and El-Sedafy (1989); and shorter than those reported by Badreldin et al. (1960), Abdel-Ghani and Fahmy (1966), Morad (1967) and Ragab et al. (1973). In addition, means of DP were slightly higher than those obtained by Khattab and Ashmawy (1988) and El-Sedafy (1989) and slightly smaller than that estimated by Mohamed (1987) with Friesian cattle raised in Egypt.

Means of M305 and TMY revealed that milk yield increased with advance of parity from the first to the third lactation. This observation agrees well with those of Ragab et al. (1973), Adeyeye and Bamadurs (1977), Al-Rawi and Alani (1981) and Biswas et

Table 18. Means, standard deviation (SD) and coefficients of variation (CV %) of uncorrected records of different productive traits in Friesian cattle.

Lactation	M305 (Kg)	TMY (Kg)	LP (Days)	DP (Days)
First lactation:				
Mean	2149.3	2460.7	341.2	135.1
SD	620.1	920.5	104.1	101.0
CV %	27.4	33.7	23.3	67.8
Second lactation:				
Mean	2466.4	2747.2	342.9	112.2
SD	684.1	876.4	96.5	90.6
CV %	26.7	29.1	23.1	75.5
Third lactation:				
Mean	2669.2	2922.6	332.7	99.2
SD	869.6	1136.4	99.4	86.7
CV %	28.2	33.5	22.9	75.9

al. (1982). As expected, the averages of DP decreased from the first to the second and third lactation (Table 18).

Coefficients of variation in milk yield and lactation period of the first three lactations in this study (Table 18) were nearly the same and within the range of 12.5 - 38.8 % reported in the literature (Gorin et al., 1974; Garcia, 1976; Kliment et al., 1976; Novy and Psenica, 1977; Vankov and Peeva, 1979; Soliman and Khalil, 1989; Soliman et al., 1990).

The relatively high coefficients of variability for DP in the first three lactations (87.8, 75.5 and 75.9%) may lead to the fact that selection for DP and improving the managerial procedures may give a chance for Friesian breeders in Egypt to improve such trait.

Year of calving:

Least-squares means of M305 and TMY varied significantly ($P<0.01$) from a particular year of calving to another (Tables 22 & 23 & 24). These results agree well with the findings on Friesian cattle raised in Egypt as reported by Quawasmi (1971), Mohamed (1979), Ashmawy (1981), Abdel-Glil (1985), Arafa (1987) and El-Sedafy (1989). The same findings were also reported on Friesian cattle raised in other countries by Nagarcenkar (1964), Kabuga and Agyemang (1984) who found that year of calving was a highly significant ($P<0.01$) source of variation in M305 and/or TMY.

Values of R^2 (coefficient of determination) resulting from fitting year of calving as a fixed effect in the model of analysis of M305, TMY, LP and DP (Tables 23&23&24), indicate that the contribution of year of calving to the variation in M305, TMY and

LP was higher than the contribution of the same factor to the variation in DP of the three lactations studied.

Length of LP of the first and third lactations varied significantly ($P < 0.01$ or $P < 0.05$) with year of calving (Tables 22 & 23 & 24). In this respect, Ashmawy (1975), Arafa (1987), El-Sedafy (1989) and Soliman and Khalil (1989) found that year of calving was highly significant ($P < 0.01$) source of variation in LP. On the contrary, Arora and Sharma (1983), Pandey et al. (1983) and Kabuga and Agyemang (1984) showed that LP of Friesian cattle raised in countries other than Egypt was not significantly influenced by year of calving.

Year of calving did not show any significant effect on length of DP in the first three lactations (Tables 22&23&24). Similarly, Aboustate (1975) and Bhatnagar et al. (1979) showed that DP was not significantly influenced by year of calving.

Least-squares means for the effects of year of calving (Tables 19&20&21) indicate that milk yield in the last ten years (1976-1986) was higher than those of the years preceding that period, i.e. there was an upward trend in milk yield over the years. This upward trend is probably due in part to genetic improvement and partly to improved feeding and managerial procedures.

The maximum differences between years for LP were high (118.2, 213.3 and 284.4 days in the 1st, 2nd and 3rd lactation, respectively). In recent years, Friesian breeders in Egypt attempted to increase milk yield of their cows per unit of time by reducing the calving interval (through decreasing days open).

Table 19. Least-squares means and standard errors (SE) for factors affecting productive traits in 1st lactation.

Independent Variable	No.	M305 (Kg)	TMY (Kg)	LP (Days)	DP (Days)
		Mean $\pm$ SE	Mean $\pm$ SE	Mean $\pm$ SE	Mean $\pm$ SE
General mean	1653	2149.3 $\pm$ 761.4	2460.7 $\pm$ 1062.1	341.2 $\pm$ 109.4	135.1 $\pm$ 104.9
<u>Year of calving</u>					
1962	18	1637.6 $\pm$ 337.2	1989.3 $\pm$ 474.8	387.7 $\pm$ 45.5	45.4 $\pm$ 52.4
1963	76	1556.2 $\pm$ 270.3	1741.8 $\pm$ 380.5	328.6 $\pm$ 36.4	80.2 $\pm$ 41.9
1964	143	1283.2 $\pm$ 258.3	1523.1 $\pm$ 363.7	333.8 $\pm$ 34.8	91.4 $\pm$ 40.1
1965	90	1537.9 $\pm$ 259.9	1687.4 $\pm$ 365.9	325.6 $\pm$ 35.0	75.4 $\pm$ 40.3
1966	116	1285.4 $\pm$ 254.0	1628.3 $\pm$ 357.7	315.8 $\pm$ 34.2	102.6 $\pm$ 39.4
1968	85	1590.9 $\pm$ 213.5	1494.2 $\pm$ 300.6	299.9 $\pm$ 28.7	124.9 $\pm$ 33.1
1969	92	2127.8 $\pm$ 211.9	2088.3 $\pm$ 298.5	306.8 $\pm$ 28.5	135.1 $\pm$ 32.9
1970	92	1949.4 $\pm$ 200.6	2151.9 $\pm$ 282.5	336.3 $\pm$ 27.0	118.9 $\pm$ 31.1
1971	19	2152.5 $\pm$ 226.3	2546.0 $\pm$ 318.7	399.1 $\pm$ 30.5	104.1 $\pm$ 35.1
1972	54	2026.4 $\pm$ 191.7	2340.5 $\pm$ 270.0	398.4 $\pm$ 25.8	134.9 $\pm$ 29.7
1973	74	2045.4 $\pm$ 167.6	2427.2 $\pm$ 236.1	392.9 $\pm$ 22.5	120.6 $\pm$ 25.9
1974	98	2310.8 $\pm$ 159.5	2733.6 $\pm$ 224.7	393.1 $\pm$ 21.4	138.7 $\pm$ 24.7
1975	56	2621.7 $\pm$ 169.4	3072.5 $\pm$ 238.7	380.9 $\pm$ 22.8	126.9 $\pm$ 26.2
1976	88	2701.9 $\pm$ 158.4	3007.9 $\pm$ 223.1	366.0 $\pm$ 21.3	142.9 $\pm$ 24.5
1977	77	2591.1 $\pm$ 165.6	2980.1 $\pm$ 233.3	373.0 $\pm$ 22.3	145.3 $\pm$ 25.6
1978	88	2689.7 $\pm$ 164.9	3152.4 $\pm$ 232.4	329.9 $\pm$ 22.2	181.2 $\pm$ 25.5
1979	72	2969.4 $\pm$ 187.4	3423.9 $\pm$ 264.0	323.9 $\pm$ 25.2	202.7 $\pm$ 29.0
1980	70	2820.5 $\pm$ 186.9	3186.9 $\pm$ 263.2	311.8 $\pm$ 25.1	203.6 $\pm$ 28.9
1981	48	2478.2 $\pm$ 206.4	2848.9 $\pm$ 290.7	282.0 $\pm$ 27.8	243.8 $\pm$ 32.0
1982	59	2814.8 $\pm$ 199.1	3310.4 $\pm$ 280.3	324.6 $\pm$ 26.8	176.2 $\pm$ 30.9
1983	61	2964.6 $\pm$ 215.0	3409.7 $\pm$ 302.8	313.2 $\pm$ 28.9	189.9 $\pm$ 33.4
1984	53	2604.1 $\pm$ 224.4	2952.7 $\pm$ 315.9	306.2 $\pm$ 30.2	182.8 $\pm$ 34.8
1985	19	2777.7 $\pm$ 252.1	3159.3 $\pm$ 354.9	329.7 $\pm$ 33.9	149.7 $\pm$ 39.1
1986	5	2451.6 $\pm$ 339.6	2782.9 $\pm$ 478.2	280.2 $\pm$ 45.8	159.4 $\pm$ 52.8
<u>Season of calving</u>					
Autumn	300	2237.5 $\pm$ 45.7	2482.7 $\pm$ 64.8	320.0 $\pm$ 5.8	156.5 $\pm$ 6.6
Winter	385	2266.0 $\pm$ 41.3	2593.3 $\pm$ 58.7	341.7 $\pm$ 5.2	138.0 $\pm$ 5.9
Spring	602	2221.7 $\pm$ 37.5	2617.1 $\pm$ 53.5	354.3 $\pm$ 4.6	129.3 $\pm$ 5.3
Summer	366	2272.9 $\pm$ 42.3	2580.2 $\pm$ 60.1	340.6 $\pm$ 5.3	138.9 $\pm$ 6.1
<u>Reg. on age at calving in month</u>					
Linear	1653	18.015 $\pm$ 4.362	25.231 $\pm$ 6.140	1.812 $\pm$ 0.588	0.318 $\pm$ 0.679
Quadratic	1653	-0.233 $\pm$ 0.396	-0.530 $\pm$ 0.557	0.007 $\pm$ 0.053	-0.121 $\pm$ 0.062
<u>Reg. on days open</u>					
Linear	1653	0.516 $\pm$ 0.131	2.450 $\pm$ 0.184	0.458 $\pm$ 0.017	0.345 $\pm$ 0.020
Quadratic	1653	-0.003 $\pm$ 0.001	-0.005 $\pm$ 0.001	-0.001 $\pm$ 0.000	-0.0001 $\pm$ 0.000

Table 20. Least-squares means and standard errors (SE) for factors affecting productive traits in 2nd lactation.

Independent Variable	No.	M2305 (Kg)	TMY (Kg)	LP (Days)	DP (Days)
		Mean $\pm$ SE	Mean $\pm$ SE	Mean $\pm$ SE	Mean $\pm$ SE
<u>General mean</u>	1075	2466.3 $\pm$ 684.1	2747.2 $\pm$ 876.4	342.9 $\pm$ 96.5	112.2 $\pm$ 90.6
<u>Year of calving</u>					
1964	50	1592.8 $\pm$ 328.3	2088.2 $\pm$ 398.9	467.0 $\pm$ 39.5	127.3 $\pm$ 42.1
1965	55	1838.2 $\pm$ 311.4	2225.0 $\pm$ 378.4	414.9 $\pm$ 37.5	141.7 $\pm$ 39.9
1966	99	1893.6 $\pm$ 298.5	2269.7 $\pm$ 362.6	392.2 $\pm$ 35.9	128.1 $\pm$ 38.2
1967	97	1957.2 $\pm$ 291.8	2329.9 $\pm$ 354.5	396.8 $\pm$ 35.1	115.6 $\pm$ 37.4
1968	5	2501.2 $\pm$ 431.5	2844.9 $\pm$ 524.4	383.7 $\pm$ 51.9	124.9 $\pm$ 55.5
1969	49	2697.6 $\pm$ 224.4	2968.5 $\pm$ 272.6	378.8 $\pm$ 26.9	121.0 $\pm$ 28.7
1970	50	2798.3 $\pm$ 224.1	3129.9 $\pm$ 272.2	364.7 $\pm$ 26.9	133.1 $\pm$ 28.7
1971	96	3049.4 $\pm$ 205.7	3215.4 $\pm$ 249.7	350.4 $\pm$ 24.7	88.9 $\pm$ 26.3
1972	24	3084.4 $\pm$ 228.8	3204.6 $\pm$ 277.9	330.0 $\pm$ 27.5	126.2 $\pm$ 29.3
1973	29	2618.4 $\pm$ 241.6	2869.4 $\pm$ 293.5	346.5 $\pm$ 29.1	81.1 $\pm$ 30.9
1974	35	2235.7 $\pm$ 225.4	2481.1 $\pm$ 273.8	310.2 $\pm$ 27.1	128.1 $\pm$ 28.8
1975	53	2494.1 $\pm$ 224.5	2860.6 $\pm$ 272.7	309.5 $\pm$ 26.9	106.1 $\pm$ 28.7
1976	53	2667.4 $\pm$ 228.7	3118.6 $\pm$ 277.8	308.6 $\pm$ 27.5	97.9 $\pm$ 29.3
1977	50	1992.8 $\pm$ 219.5	2222.5 $\pm$ 266.6	293.6 $\pm$ 26.4	132.3 $\pm$ 28.1
1978	49	2411.6 $\pm$ 228.4	2775.3 $\pm$ 277.4	309.2 $\pm$ 27.5	124.6 $\pm$ 29.2
1979	51	3062.3 $\pm$ 219.7	3248.2 $\pm$ 266.8	292.8 $\pm$ 26.4	100.5 $\pm$ 28.1
1980	50	2801.4 $\pm$ 233.8	3002.7 $\pm$ 284.0	291.2 $\pm$ 28.1	95.3 $\pm$ 29.9
1981	54	2872.7 $\pm$ 233.8	3091.9 $\pm$ 283.9	301.5 $\pm$ 28.1	76.7 $\pm$ 29.9
1982	33	3149.3 $\pm$ 264.5	3351.5 $\pm$ 321.4	295.4 $\pm$ 31.8	109.4 $\pm$ 33.9
1983	41	2577.8 $\pm$ 255.8	2578.8 $\pm$ 310.7	253.7 $\pm$ 30.8	144.1 $\pm$ 32.8
1984	52	2702.5 $\pm$ 265.3	2701.6 $\pm$ 322.2	278.6 $\pm$ 31.9	82.4 $\pm$ 33.9
<u>Season of calving</u>					
Autumn	232	2536.1 $\pm$ 56.7	2728.9 $\pm$ 67.9	319.9 $\pm$ 6.5	118.4 $\pm$ 6.5
Winter	307	2487.9 $\pm$ 50.5	2777.4 $\pm$ 60.4	343.1 $\pm$ 5.8	105.9 $\pm$ 5.6
Spring	311	2496.9 $\pm$ 50.9	2809.3 $\pm$ 60.9	343.3 $\pm$ 5.8	116.0 $\pm$ 5.6
Summer	225	2574.2 $\pm$ 56.3	2842.1 $\pm$ 67.5	340.3 $\pm$ 6.5	113.9 $\pm$ 6.4
<u>Reg. on age at calving in month</u>					
Linear	1075	8.284 $\pm$ 6.098	11.306 $\pm$ 7.413	1.183 $\pm$ 0.735	-0.004 $\pm$ 0.785
Quadratic	1075	-0.933 $\pm$ 0.518	-1.018 $\pm$ 0.629	0.049 $\pm$ 0.062	0.026 $\pm$ 0.067
<u>Reg. on days open</u>					
Linear	1075	0.333 $\pm$ 0.209	1.968 $\pm$ 0.255	0.319 $\pm$ 0.025	0.264 $\pm$ 0.027
Quadratic	1075	-0.003 $\pm$ 0.001	-0.006 $\pm$ 0.001	-0.001 $\pm$ 0.000	0.000 $\pm$ 0.000

Table 21. Least-squares means and standard errors (SE) for factors affecting productive traits in 3rd lactation.

Independent Variable	No.	M305 (Kg)	TMV (Kg)	LP (Days)	DP (Days)
		Mean $\pm$ SE	Mean $\pm$ SE	Mean $\pm$ SE	Mean $\pm$ SE
General mean	683	2669.2 $\pm$ 805.4	2922.0 $\pm$ 1083.0	332.7 $\pm$ 97.2	99.2 $\pm$ 84.9
<u>Year of calving</u>					
1965	13	1982.8 $\pm$ 564.9	1499.3 $\pm$ 738.3	191.7 $\pm$ 57.0	188.5 $\pm$ 56.4
1966	25	1975.9 $\pm$ 470.2	1431.0 $\pm$ 610.1	226.7 $\pm$ 47.4	155.4 $\pm$ 46.9
1967	61	2379.7 $\pm$ 445.7	2173.3 $\pm$ 578.3	232.0 $\pm$ 44.9	146.5 $\pm$ 44.4
1968	77	2543.1 $\pm$ 437.8	2260.4 $\pm$ 568.0	211.2 $\pm$ 44.1	166.3 $\pm$ 43.7
1969	13	3127.4 $\pm$ 456.3	3072.2 $\pm$ 592.1	248.7 $\pm$ 46.0	136.6 $\pm$ 45.5
1970	21	2569.6 $\pm$ 386.4	2149.5 $\pm$ 501.1	197.5 $\pm$ 38.9	173.9 $\pm$ 38.5
1971	31	2928.9 $\pm$ 350.1	2594.9 $\pm$ 453.9	208.6 $\pm$ 35.2	178.5 $\pm$ 34.9
1972	36	2685.0 $\pm$ 336.6	2087.6 $\pm$ 436.3	183.9 $\pm$ 33.9	181.4 $\pm$ 33.5
1973	15	2738.2 $\pm$ 348.8	2495.4 $\pm$ 452.2	236.5 $\pm$ 35.1	126.2 $\pm$ 34.7
1974	15	3081.6 $\pm$ 356.4	3132.1 $\pm$ 462.0	284.8 $\pm$ 35.9	83.6 $\pm$ 35.5
1975	29	3303.1 $\pm$ 280.9	4207.9 $\pm$ 363.7	437.9 $\pm$ 28.2	45.8 $\pm$ 27.9
1976	40	3216.3 $\pm$ 294.2	3945.9 $\pm$ 381.0	393.2 $\pm$ 29.6	63.0 $\pm$ 29.2
1977	45	2704.5 $\pm$ 294.8	3428.5 $\pm$ 381.8	389.3 $\pm$ 29.6	77.5 $\pm$ 29.3
1978	40	1965.8 $\pm$ 299.2	2753.2 $\pm$ 387.6	427.6 $\pm$ 30.1	54.1 $\pm$ 29.7
1979	20	2338.2 $\pm$ 343.8	2991.2 $\pm$ 445.6	393.7 $\pm$ 34.6	46.5 $\pm$ 34.2
1980	40	2952.5 $\pm$ 320.7	3671.9 $\pm$ 415.6	423.8 $\pm$ 32.2	44.9 $\pm$ 31.9
1981	32	2830.1 $\pm$ 358.4	3470.0 $\pm$ 464.6	429.6 $\pm$ 36.1	53.2 $\pm$ 35.7
1982	34	2653.5 $\pm$ 377.9	3254.4 $\pm$ 490.1	425.5 $\pm$ 38.1	27.8 $\pm$ 37.6
1983	25	2902.3 $\pm$ 396.7	3586.2 $\pm$ 514.5	451.5 $\pm$ 39.9	71.9 $\pm$ 39.5
1984	29	2372.1 $\pm$ 396.0	3162.1 $\pm$ 513.7	468.3 $\pm$ 39.9	18.7 $\pm$ 39.5
1985	42	3045.2 $\pm$ 405.0	3688.0 $\pm$ 525.4	447.7 $\pm$ 40.8	38.4 $\pm$ 40.4
<u>Season of calving</u>					
Autumn	174	2721.7 $\pm$ 73.8	2944.4 $\pm$ 90.5	326.9 $\pm$ 6.8	118.8 $\pm$ 6.7
Winter	192	2593.1 $\pm$ 70.5	2836.9 $\pm$ 85.9	332.8 $\pm$ 6.4	97.3 $\pm$ 6.3
Spring	187	2707.1 $\pm$ 74.2	2959.5 $\pm$ 91.1	336.9 $\pm$ 6.8	88.6 $\pm$ 6.7
Summer	130	2701.3 $\pm$ 82.1	2888.7 $\pm$ 101.9	319.6 $\pm$ 7.7	91.3 $\pm$ 7.6
<u>Reg. on age at calving in month</u>					
Linear	683	14.563 $\pm$ 9.161	24.799 $\pm$ 11.904	1.704 $\pm$ 0.926	-1.779 $\pm$ 0.915
Quadratic	683	-0.586 $\pm$ 0.898	-0.790 $\pm$ 1.167	-0.074 $\pm$ 0.091	0.271 $\pm$ 0.089
<u>Reg. on days open</u>					
Linear	683	0.871 $\pm$ 0.367	3.538 $\pm$ 0.477	0.522 $\pm$ 0.037	0.349 $\pm$ 0.037
Quadratic	683	-0.005 $\pm$ 0.002	-0.003 $\pm$ 0.002	-0.000 $\pm$ 0.000	0.000 $\pm$ 0.000

Table 22. F-ratios and coefficients of determination (R^2) for factors affecting productive traits of the 1st lactation in Friesian cattle.

Source of variation	d.f	M305		TMY		LP		DP	
		F	R^2	F	R^2	F	R^2	F	R^2
Sire	193	1.53**	0.16	1.57**	0.15	1.29**	0.10	1.25**	0.12
Year of calving	23	4.04**	0.05	2.37**	0.03	1.70*	0.02	1.10	0.01
Season of calving	3	0.63	0.00	1.35	0.00	9.23**	0.01	4.37**	0.01
Reg. on age at calving									
Linear	1	17.05**	0.01	16.88**	0.01	9.47**	0.00	0.22	0.00
Quadratic	1	0.35	0.00	0.91	0.00	0.02	0.00	3.82	0.00
Reg. on days open									
Linear	1	15.58**	0.01	177.17**	0.09	674.47**	0.27	287.64**	0.14
Quadratic	1	20.68**	0.01	24.53**	0.01	59.99**	0.02	8.53**	0.00
Remainder	1429		0.76		0.71		0.57		0.71
Remainder mean squares		346360		686338		6312		8381	

* Significant at ($P < 0.05$)

** Significant at ($P < 0.01$)

Table 23. F-ratios and coefficients of determination (R^2) for factors affecting productive traits of the 2nd lactation in Friesian cattle.

Source of variation	d.f	M305		TMY		LP		DP	
		F	R^2	F	R^2	F	R^2	F	R^2
Sire	160	1.51**	0.20	1.45**	0.18	1.32**	0.16	0.95	0.13
Year of calving	20	3.97**	0.06	3.01**	0.05	1.28	0.02	1.55	0.03
Season of calving	3	0.73	0.00	0.68	0.00	3.85**	0.01	0.89	0.00
Reg. on age at calving									
Linear	1	1.85	0.00	2.33	0.00	2.59	0.00	0.002	0.00
Quadratic	1	3.24	0.00	0.002	0.00	0.62	0.00	0.15	0.00
Reg. on days open									
Linear	1	2.53	0.00	5.97**	0.05	159.9**	0.12	95.5**	0.08
Quadratic	1	6.05**	0.00	16.87**	0.01	53.5**	0.04	0.46	0.00
Remainder	887		0.72		0.70		0.66		0.76
Remainder mean squares		432864		639580		6289		7175	

* Significant at ($P < 0.05$)

** Significant at ($P < 0.01$)

Table 24. F-ratios and coefficients of determination (R^2) for factors affecting productive traits of the 3rd lactation in Friesian cattle.

Source of variation	d.f	M305		TMY		LP		DP	
		F	R^2	F	R^2	F	R^2	F	R^2
Sire	115	1.61**	0.22	1.32*	0.18	1.13	0.14	1.14	0.16
Year of calving	20	4.27**	0.10	3.44**	0.08	2.28**	0.09	1.04	0.03
Season of calving	3	0.90	0.00	0.47	0.002	1.14	0.00	4.28**	0.02
Reg. on age at calving									
Linear	1	2.53	0.00	4.34*	0.01	3.39	0.00	3.77	0.00
Quadratic	1	0.43	0.00	0.46	0.00	0.67	0.00	9.08**	0.01
Reg. on days open									
Linear	1	5.63*	0.00	55.06**	0.07	198.12**	0.21	91.06**	0.11
Quadratic	1	6.88**	0.00	2.13	0.00	1.55	0.00	0.05	0.00
Remainder	540		0.65		0.66		0.59		0.67
Remainder mean squares		567974		959098		5802		5675	

* Significant at ($P < 0.05$)

** Significant at ($P < 0.01$)

Season of calving:

Results in Tables 19&20&21 show that M305 and TMY varied with season of calving, but without any consistent trend in the three lactations. Also, LP and DP in all lactations of the study varied with season of calving, the longest lactation and dry periods were recorded by spring and autumn calvers, respectively. Asker et al. (1958), Ragab and Sourour (1963), Quawasmi (1971), Abdel-Glil (1985), Arafa (1987) and El-Sedafy (1989) found that the highest M305 and/or TMY was given by autumn- and winter-calvers. Rashad (1986) and Arafa (1987) reported that spring- and winter-calvers recorded longer LP than other calvers. Ashmawy (1975) and El-Sedafy (1989) reported that autumn-calvers recorded longer DP than calvers of the other seasons of the year.

Season-of-calving effects did not contribute significantly (R^2 ranged between 0.00 to 0.02) to the total variance of M305 and TMY all over the three lactations of the study (Tables 22&23 &24). This agree with the findings obtained on M305 and/or TMY given by Friesian cattle raised in Egypt by Asker et al. (1958), Quawasmi (1971), Abdel-Glil (1985), Arafa (1987) and El-Sedafy (1989). On the contrary, Abdel-Ghani and Hathout (1966) and Ashmawy et al. (1986) found that season-of-calving effects on M305 produced in Egypt by Friesian cattle were considerable and significant ($P<0.01$). Also, findings of Wood (1970), Nagpal and Achary (1971), Camoens et al. (1976), Nenadovic (1976) and Basu et al. (1982) with Friesian cattle raised in countries other than Egypt indicated that season of calving affected M305 and/or TMY significantly ($P<0.05$ or $P<0.01$).

Season-of-calving effects on LP were significant ($P < 0.01$) in the first and second lactations only (Tables 22 & 23 & 24). Similarly, season-of-calving effects contributed significantly ($P < 0.05$ or $P < 0.01$) to the total variance of length of LP of Friesian cattle raised in Egypt (Arafa, 1987; Mohamed, 1987) and of different breed groups of dairy cattle raised in other countries (Sharma and Singh, 1974; Lindstrom and Solbu, 1978; Nobre et al., 1984; Romcevic et al., 1984). On the contrary, Badran (1978) and El-Sedafy (1989) working on Friesian cattle in Egypt showed that season of calving did not influence length of LP.

Effects of season of calving on DP were found to be significant ($P < 0.01$) in both the first and third lactations. In agreement with these results, Ashmawy (1975), Basu and Ghai (1980), Nagarcenkar and Roa (1982) and Mohamed (1987) showed that season of calving exerted significant ($P < 0.05$ or $P < 0.01$) effects on length of DP. However, Arafa (1987) and El-Sedafy (1989) reported reverse results. They found that season of calving did not contribute significantly to the total variance in length of DP of Friesian cattle.

Values of R^2 for the effect of season of calving on DP in each of the first 3 lactations were of small magnitudes and indicating that the contribution of season of calving in the variance of DP was not considerable.

Age at calving:

Constants of partial linear and quadratic regression coefficients of M305, TMY, LP and DP on age at calving reveal, in general, that there was a positive linear association between age at

calving and each of the four traits studied. This trend seems to be more pronounced in the first lactation than in the second or the third lactation.

The partial linear regression coefficients of M305, TMY and LP on age at calving were significant ($P<0.01$) for first lactation only. Ragab and Sourour (1963), Mohamed (1979) and Arafa (1987) found highly significant regression coefficients for M305 and/or TMY on age at calving in Friesian cattle raised in Egypt. Also, El-Sedafy (1989) with cattle from the same breed obtained a significant ($P<0.05$) linear regression coefficient of LP on age of the cow. Linear regression coefficients of length of DP on age at calving were not significant (Tables 22&23&24). Similarly, Ashmawy (1975) with Friesian cows showed non-significant regression coefficient for DP on age at first calving. Also, Ragab et al. (1954) and Aboustate (1975) with Friesian cattle raised in Egypt concluded that effects of age at calving on length of DP was not important.

Days open:

Constants of partial linear regression coefficients reveal that each one day increase in days open (over its average) was associated with an increase of 0.52, 0.33 and 0.67 Kg in M305 of the first, second and third lactation, respectively as well as of 2.45, 1.97 and 3.54 Kg in TMY of the same order of lactations (Tables 19&20&21). These results indicated that milk yield traits increased curvilinearly with the increase of days open. From the economic point of view, however, it would not be desirable to prolong the days open. Also, these constants show that each one

day increase in DO (over the average) has resulted in an increase of 0.46, 0.32 and 0.52 days in the length of LP of first, second and third lactation, respectively and of 0.35, 0.26 and 0.35 days in length of DP of the same lactation in the same order. In agreement with these findings, Khattab and Ashmawy (1988) with Friesian in Egypt reported that each additional day in days open until 90 days added an extra day of lactation to 305-day and total lactation. Also, other non-Egyptian investigators (Johansson, 1947; Bhasin, 1967; Kavitkar et al., 1968; Balaine and Aggarwal, 1973) concluded that there was a strong positive relationship between DO and DP. Schaeffer and Henderson (1972), Bar-Anan and Soller (1979) and Basu and Ghai (1980) found that as the length of open period increased, M305 and TMY increased considerably.

The partial linear and quadratic regression coefficients of M305, TMY, LP and DP on days open (Tables 22&23&24) were significant ($P < 0.01$) in the three lactations. This agrees well with findings of Smith and Legates (1962), Willton et al. (1967), Olds et al. (1979), Basu and Ghai (1980) and Khattab and Ashmawy (1988) who showed that DO exerted significant ($P < 0.05$ or $P < 0.01$) effects on M305 and/or TMY. Similar to what obtained in the present study, days open was found to be an important ($P < 0.05$ or $P < 0.01$) source of variation in length of LP (Kavitkar et al., 1968; Balaine and Aggarwal, 1973; Ashmawy, 1975; Basu and Ghai, 1980).

The high relative sizes of F-values and R^2 of days open shown in Tables 22&23&24 indicate that length of days open constituted a considerable contribution in the variance of productive traits

under study.

4.1.2 Reproductive Traits

Means and variation of uncorrected records:

Means, standard deviation (SD) and coefficients of variation (CV) of gestation length (GL), calving interval (CI) and days open (DO) in the first, second and third lactations are given in Table 25.

Averages of GL in the present work (278.3, 277.8 and 272.6 days for the first, second and third pregnancies, respectively) are longer than 267.7 days reported by Gianola and Tyler (1974). At the same time, they are lower than 280.4, 282.0 and 282.0 days shown by Alexander (1950), Fisheer and Williams (1978) and McElhenney et al. (1985), respectively. Calving interval of the different lactations of this study (459.3, 433.6 and 413.9 days) are within the range of estimates (411 to 462 days) obtained by El-Sheikh (1960), Ragab and Asker (1960), El-Sheikh and El-Fouly (1962), Fahmy et al. (1963), Abd El-Ghany and Fahmy (1966), Ashmawy (1975), Ortiz Martinez (1979), Basu and Ghai (1980), Madalena et al. (1983), Arafa (1987), Mohamed (1987) and El-Sedafy (1989). Days open averages of this work are more than those estimated by some Egyptian investigators (El-Sheikh, 1960; Sourour, 1962; and Mohamed, 1987) and other investigators (Kragelund et al., 1979; Pogacar, 1980) all working on Friesian cattle. However, these averages are lower than those estimated for Friesian cattle raised in Egypt by El-Sheikh and El-Fouly (1964), Abd El-Ghani and Fahmy (1966) and Ashmawy (1975). However, the relatively long DO and CI in dairy cows (Table 25) may be caused by

Table 25. Means, standard deviation (SD) and coefficients of variability (CV %) of uncorrected records for different reproductive traits in Friesian cattle.

Lactation	GL (days)	CI (days)	DO (Days)
First lactation:			
Mean	278.3	459.3	190.1
SD	12.7	145.8	126.8
V %	4.5	28.9	65.9
Second lactation:			
Mean	277.8	277.8	170.7
SD	15.0	142.7	119.9
V %	5.3	30.5	70.0
Third lactation:			
Mean	277.6	413.9	149.7
SD	15.0	131.5	106.7
V %	6.4	13.7	69.4

several factors, e.g. level of milk production, housing, silent heat, missed oestrus due to weak symptoms, frequency and timing of oestrus detection, and feeding season (Morrow et al., 1966; De Kruik, 1975; Hale, 1975; Bulman and Wood, 1980; Aboul-Ela, 1980; El-Keraby and Aboul-Ela, 1982).

Coefficients of variation (CV) in the first three lactations of the study (Table 25) were low for GL (4.5, 5.3 and 6.4 %), within the normal range for CI (28.9, 30.5 and 13.7 %) and considerably high for DO (65.9, 70.0 and 69.4%). Poor management of cow herds in Egypt lead to such high phenotypic variation in DO and CI. Findings of the present study may lead to state that phenotypic selection may be effective in improving length of CI and DO.

Year of calving:

Values of R^2 for the effect of year of calving on GL, CI and DO in each of the first 3 lactations (Tables 29&30&31) were of small magnitudes indicating that the contribution of year of calving in the variance of these traits was small although it proved significance ($P < 0.05$ or $P < 0.01$) for DO of the first lactation, GL of the second lactation and for both CI and DO of the third lactation.

Year-of-calving effects were found to constitute a significant ($P < 0.05$ or $P < 0.01$) source of variation in GL by Nodot et al. (1980); in CI by Madsen and Vinther (1975), Badran (1978), Gill and Balaine (1979), Nodot et al. (1980), Madalena et al. (1983), Guerra and Menendez (1984) and Mohamed (1987) and in DO by Acharya et al. (1971), Kumar (1982), Sharma (1982) and Butte and

Table 26. Least-squares means and standard errors (SE) for factors affecting reproductive traits in 1st lactation.

Independent Variable	No.	GL (days)	CI (days)	DO (days)
		Mean $\pm$ SE	Mean $\pm$ SE	Mean $\pm$ SE
<u>General mean</u>	1653	277.6 $\pm$ 0.4	471.8 $\pm$ 5.9	193.4 $\pm$ 4.96
<u>Year of calving</u>				
1962	18	283.1 $\pm$ 7.2	393.9 $\pm$ 76.0	255.9 $\pm$ 71.6
1963	76	284.1 $\pm$ 5.7	380.1 $\pm$ 60.9	196.9 $\pm$ 57.4
1964	143	281.6 $\pm$ 5.5	323.9 $\pm$ 58.2	257.2 $\pm$ 54.8
1965	90	278.0 $\pm$ 5.5	337.9 $\pm$ 58.6	176.8 $\pm$ 55.2
1966	116	277.7 $\pm$ 5.4	382.4 $\pm$ 57.2	153.5 $\pm$ 53.9
1968	85	276.9 $\pm$ 4.5	429.5 $\pm$ 48.1	154.3 $\pm$ 45.2
1969	92	277.2 $\pm$ 4.5	446.8 $\pm$ 47.7	205.9 $\pm$ 44.9
1970	92	278.6 $\pm$ 4.2	433.7 $\pm$ 45.2	183.0 $\pm$ 42.5
1971	19	280.4 $\pm$ 4.8	438.3 $\pm$ 50.9	100.6 $\pm$ 47.9
1972	54	282.4 $\pm$ 4.1	504.0 $\pm$ 43.2	133.3 $\pm$ 40.6
1973	74	274.8 $\pm$ 3.5	477.8 $\pm$ 37.7	117.3 $\pm$ 35.4
1974	98	278.8 $\pm$ 3.4	483.9 $\pm$ 35.9	172.0 $\pm$ 33.7
1975	56	278.8 $\pm$ 3.6	491.9 $\pm$ 38.1	176.8 $\pm$ 35.8
1976	88	274.9 $\pm$ 3.3	504.5 $\pm$ 35.6	139.6 $\pm$ 33.4
1977	77	280.3 $\pm$ 3.5	498.8 $\pm$ 37.2	152.8 $\pm$ 35.0
1978	88	276.1 $\pm$ 3.5	503.8 $\pm$ 37.1	187.1 $\pm$ 34.9
1979	72	276.0 $\pm$ 3.9	537.6 $\pm$ 42.2	203.3 $\pm$ 39.7
1980	70	278.7 $\pm$ 3.9	549.2 $\pm$ 42.1	216.3 $\pm$ 39.6
1981	48	275.9 $\pm$ 4.4	578.1 $\pm$ 46.5	246.9 $\pm$ 43.7
1982	59	272.4 $\pm$ 4.2	548.7 $\pm$ 44.8	235.2 $\pm$ 42.1
1983	61	273.8 $\pm$ 4.5	554.7 $\pm$ 48.4	250.9 $\pm$ 45.6
1984	53	274.4 $\pm$ 4.7	552.2 $\pm$ 50.5	251.4 $\pm$ 47.5
1985	19	276.3 $\pm$ 5.3	473.8 $\pm$ 56.8	216.6 $\pm$ 53.5
1986	5	274.7 $\pm$ 7.2	497.0 $\pm$ 76.6	258.4 $\pm$ 72.1
<u>Season of calving</u>				
Autumn	300	274.0 $\pm$ 0.8	470.1 $\pm$ 9.8	188.5 $\pm$ 8.9
Winter	385	277.9 $\pm$ 0.7	472.6 $\pm$ 8.8	193.8 $\pm$ 7.8
Spring	602	279.9 $\pm$ 0.6	470.1 $\pm$ 7.9	194.5 $\pm$ 6.9
Summer	366	279.1 $\pm$ 0.8	474.2 $\pm$ 9.0	196.9 $\pm$ 8.1
<u>Reg. on age at calving in month</u>				
Linear	1653	0.058 $\pm$ 0.09	-0.092 $\pm$ 0.984	-0.857 $\pm$ 0.93
Quadratic	1653	-0.003 $\pm$ 0.01	0.055 $\pm$ 0.089	0.010 $\pm$ 0.08
<u>Reg. on days open</u>				
Linear	1653	0.003 $\pm$ 0.002	0.475 $\pm$ 0.029	
Quadratic	1653	0.000 $\pm$ 0.000	-0.000 $\pm$ 0.000	

Table 27. Least-squares means and standard errors (SE) for factors affecting reproductive traits in 2nd lactation.

Independent Variable	No.	GL (days)	CI (days)	DO (days)
		Mean $\pm$ SE	Mean $\pm$ SE	Mean $\pm$ SE
<u>General mean</u>	1075	278.3 $\pm$ 0.65	432.1 $\pm$ 6.1	160.5 $\pm$ 4.6
<u>Year of calving</u>				
1964	50	271.4 $\pm$ 8.0	474.4 $\pm$ 77.9	328.4 $\pm$ 65.0
1965	55	275.8 $\pm$ 7.5	493.5 $\pm$ 73.7	276.1 $\pm$ 61.5
1966	99	271.8 $\pm$ 7.2	472.5 $\pm$ 70.2	239.3 $\pm$ 58.7
1967	97	271.5 $\pm$ 7.1	459.2 $\pm$ 69.2	260.8 $\pm$ 57.8
1968	5	273.9 $\pm$ 9.9	505.2 $\pm$ 96.9	146.5 $\pm$ 80.9
1969	49	270.8 $\pm$ 5.7	482.1 $\pm$ 55.4	243.0 $\pm$ 46.3
1970	50	265.1 $\pm$ 5.6	462.2 $\pm$ 54.5	201.4 $\pm$ 45.5
1971	96	274.3 $\pm$ 5.1	426.7 $\pm$ 49.8	161.8 $\pm$ 41.6
1972	24	277.1 $\pm$ 5.4	405.6 $\pm$ 52.4	131.7 $\pm$ 43.7
1973	29	280.5 $\pm$ 5.4	393.5 $\pm$ 52.8	184.9 $\pm$ 44.1
1974	35	279.8 $\pm$ 5.1	462.6 $\pm$ 49.3	104.1 $\pm$ 41.2
1975	53	284.3 $\pm$ 5.1	459.3 $\pm$ 49.9	128.2 $\pm$ 41.6
1976	53	285.4 $\pm$ 5.3	469.0 $\pm$ 51.0	128.7 $\pm$ 42.6
1977	50	287.2 $\pm$ 5.1	422.1 $\pm$ 49.8	93.1 $\pm$ 41.6
1978	49	280.7 $\pm$ 5.3	427.4 $\pm$ 52.3	147.4 $\pm$ 43.6
1979	51	284.8 $\pm$ 5.4	397.7 $\pm$ 52.7	120.3 $\pm$ 43.9
1980	50	281.4 $\pm$ 5.8	335.7 $\pm$ 56.8	88.8 $\pm$ 47.4
1981	54	283.4 $\pm$ 5.9	387.9 $\pm$ 57.5	105.7 $\pm$ 47.9
1982	33	283.1 $\pm$ 6.6	367.9 $\pm$ 64.5	93.4 $\pm$ 53.8
1983	41	279.0 $\pm$ 6.7	399.9 $\pm$ 64.8	112.3 $\pm$ 54.1
1984	52	282.7 $\pm$ 7.2	369.7 $\pm$ 70.3	74.7 $\pm$ 58.7
<u>Season of calving</u>				
Autumn	232	278.5 $\pm$ 1.2	441.9 $\pm$ 11.2	164.8 $\pm$ 9.1
Winter	307	276.5 $\pm$ 1.0	416.6 $\pm$ 9.7	156.2 $\pm$ 7.8
Spring	311	280.0 $\pm$ 1.0	447.1 $\pm$ 9.8	155.2 $\pm$ 7.9
Summer	225	278.1 $\pm$ 1.2	422.7 $\pm$ 11.1	165.7 $\pm$ 9.0
<u>Req. on age at calving in month</u>				
Linear	1075	-0.038 $\pm$ 0.09	1.182 $\pm$ 0.92	1.05 $\pm$ 0.77
Quadratic	1075	0.001 $\pm$ 0.000	-0.006 $\pm$ 0.004	-0.000 $\pm$ 0.003
<u>Req. on days open</u>				
Linear	1075	0.000 $\pm$ 0.005	0.437 $\pm$ 0.042	
Quadratic	1075	0.000 $\pm$ 0.000	-0.000 $\pm$ 0.000	

Table 28. Least-squares means and standard errors (SE) for factors affecting reproductive traits in 3rd lactation.

Independent Variable	No.	GL (days)	CI (days)	DO (days)
		Mean $\pm$ SE	Mean $\pm$ SE	Mean $\pm$ SE
<u>General mean</u>	683	277.9 $\pm$ 0.67	414.6 $\pm$ 2.45	152.4 $\pm$ 5.4
<u>Year of calving</u>				
1965	13	263.4 $\pm$ 10.9	449.9 $\pm$ 42.4	98.4 $\pm$ 77.7
1966	25	278.4 $\pm$ 9.1	478.7 $\pm$ 35.2	196.5 $\pm$ 66.7
1967	61	269.3 $\pm$ 8.7	468.3 $\pm$ 33.4	174.0 $\pm$ 61.3
1968	77	273.4 $\pm$ 8.5	484.2 $\pm$ 32.8	155.4 $\pm$ 60.2
1969	13	286.3 $\pm$ 8.9	490.5 $\pm$ 34.2	165.0 $\pm$ 62.7
1970	21	279.9 $\pm$ 7.5	462.7 $\pm$ 28.9	168.2 $\pm$ 53.1
1971	31	273.5 $\pm$ 6.8	483.1 $\pm$ 26.2	127.7 $\pm$ 48.1
1972	36	272.6 $\pm$ 6.5	480.7 $\pm$ 25.2	161.8 $\pm$ 46.2
1973	15	273.3 $\pm$ 6.8	480.4 $\pm$ 26.1	259.2 $\pm$ 47.7
1974	15	276.2 $\pm$ 6.9	419.3 $\pm$ 26.7	209.7 $\pm$ 48.9
1975	29	275.1 $\pm$ 5.4	299.1 $\pm$ 20.9	79.2 $\pm$ 38.4
1976	40	273.5 $\pm$ 5.7	376.2 $\pm$ 21.9	127.0 $\pm$ 40.3
1977	45	278.4 $\pm$ 5.7	368.5 $\pm$ 22.0	126.6 $\pm$ 40.4
1978	40	279.1 $\pm$ 5.8	365.5 $\pm$ 22.3	208.5 $\pm$ 40.9
1979	20	280.4 $\pm$ 6.7	366.3 $\pm$ 25.7	184.6 $\pm$ 47.2
1980	40	282.0 $\pm$ 6.2	377.0 $\pm$ 23.9	156.4 $\pm$ 44.0
1981	32	281.3 $\pm$ 6.9	353.5 $\pm$ 26.8	107.9 $\pm$ 49.2
1982	34	284.8 $\pm$ 7.3	374.1 $\pm$ 28.3	80.1 $\pm$ 51.9
1983	25	280.7 $\pm$ 7.7	378.8 $\pm$ 29.7	175.5 $\pm$ 54.5
1984	29	287.7 $\pm$ 7.7	381.9 $\pm$ 29.7	109.4 $\pm$ 54.4
1985	42	287.6 $\pm$ 7.9	367.7 $\pm$ 30.3	129.7 $\pm$ 55.7
<u>Season of calving</u>				
Autumn	174	276.8 $\pm$ 1.3	412.9 $\pm$ 4.9	151.9 $\pm$ 9.4
Winter	192	277.9 $\pm$ 1.2	414.4 $\pm$ 4.6	149.7 $\pm$ 8.9
Spring	187	278.8 $\pm$ 1.3	412.5 $\pm$ 4.9	163.4 $\pm$ 9.4
Summer	130	278.4 $\pm$ 1.5	418.4 $\pm$ 5.6	144.7 $\pm$ 10.6
<u>Req. on age at calving in month</u>				
Linear	683	0.080 $\pm$ 0.178	-0.045 $\pm$ 0.689	-1.610 $\pm$ 1.261
Quadratic	683	0.012 $\pm$ 0.017	0.073 $\pm$ 0.068	0.083 $\pm$ 0.123
<u>Req. on days open</u>				
Linear	683	0.012 $\pm$ 0.007	0.927 $\pm$ 0.028	
Quadratic	683	-0.000 $\pm$ 0.000	-0.001 $\pm$ 0.000	

Table 29. F-ratios and coefficients of determination (R^2) for factors affecting reproductive traits of the 1st lactation in Friesian cattle.

Source of variation	d.f	GL		CI		DO	
		F	R^2	F	R^2	F	R^2
Sire	193	0.96	0.11	1.33**	0.13	1.16**	0.13
Year of calving	23	1.16	0.02	1.24	0.01	2.68**	0.04
Season of calving	3	11.80**	0.02	0.08	0.00	0.21	0.00
Reg. on age at calving							
Linear	1	0.40	0.00	0.01	0.00	0.85	0.00
Quadratic	1	0.12	0.00	0.37	0.00	0.02	0.00
Reg. on days open							
Linear	1	1.34	0.00	259.54**	0.13		
Quadratic	1	0.79	0.00	0.40	0.00		
Remainder	1429						0.83
Remainder mean squares		156.5	0.85	17633.1	0.72	15688.5	0.83

* Significant at ($P < 0.05$)

** Significant at ($P < 0.01$)

Table 30. F-ratios and coefficients of determination (R^2) for factors affecting reproductive traits of the 2nd lactation in Friesian cattle.

Source of variation	d.f	GL		CI		DO	
		F	R^2	F	R^2	F	R^2
Sire	160	1.16**	0.17	1.17**	0.16	0.99**	0.15
Year of calving	20	1.08**	0.02	0.74	0.01	1.40	0.03
Season of calving	3	2.35	0.01	3.00*	0.01	0.45	0.00
Reg. on age at calving							
Linear	1	0.11	0.00	0.62	0.00	1.86	0.00
Quadratic	1	6.26*	0.01	3.39	0.00	0.00	0.00
Reg. on days open							
Linear	1	1.61	0.00	86.64**	0.07		
Quadratic	1	1.27	0.00	0.9	0.00		
Remainder	887						
Remainder mean squares		216.5	0.80	17434.5	0.75	14284.2	0.82

* Significant at ($P < 0.05$)

** Significant at ($P < 0.01$)

Table 31. F-ratios and coefficients of determination (R^2) for factors affecting reproductive traits of the 3rd lactation in Friesian cattle.

Source of variation	d.f	GL		CI		DO	
		F	R^2	F	R^2	F	R^2
Sire	115	1.06	0.18	0.85	0.05	1.22**	0.19
Year of calving	20	1.28	0.04	2.90**	0.03	2.56**	0.07
Season of calving	3	0.42	0.00	0.25	0.00	0.73	0.00
Reg. on age at calving							
Linear	1	0.20	0.00	0.004	0.00	1.63	0.00
Quadratic	1	0.44	0.00	1.18	0.00	0.46	0.00
Reg. on days open							
Linear	1	2.59	0.00	1129.4**	0.60		
Quadratic	1	0.02	0.00	48.0**	0.03		
Remainder	540						
Remainder mean squares		215.2	0.78	3210.8	0.29	10796.7	0.73

* Significant at ($P < 0.05$)

** Significant at ($P < 0.01$)

Deshpande (1987). However, those effects were found to be non-significant on GL (Jafar et al. 1950; Everett and Magee, 1965; Gianola and Tyler, 1974; Rajan et al. 1979; Roy et al. 1985; Silerio and Assefaw, 1985), on CI (Slama et al. 1976; Basu et al. 1979; Basu and Ghai, 1980; Nagarcenkar and Roa, 1982) and on DO (El-Sheikh and El-Fouly, 1963; Nigm, 1976; Rashad, 1986).

Season of calving:

Reproductive traits in this work varied with season of calving, but without any consistent trend in the three lactations studied (Tables 26&27&28). Season of calving showed significant effects only on GL of the first lactation ($P < 0.01$), CI of the second lactation ($P < 0.05$). These findings, when combined with their low R^2 values (Tables 29&30&31) indicate that effects of season of calving on GL, CI and DO were negligible. In this respect, Kohli and Suri (1957), Vyas et al. (1971), Fisher and Williams (1978) and Rashad (1986) found significant season-effects on GL and Madasen and Vinther (1975), Basu et al. (1979), Basu et al. (1982), Hermas et al. (1985), Arafa (1987) and EL-Sedafy (1989) found that season-effects on CI were significant ($P < 0.05$). On the other hand, Danasoury (1962), Basu and Ghai (1980), Morsy et al. (1984), Roy et al. (1985) and Mohamed (1987) obtained significant effects for season of calving on DO.

Age at calving:

Constants of partial linear and quadratic regression coefficients given in Tables 26&27&28, indicate that age at calving was negatively associated with CI and DO, while it showed positive

association with GL and that all associations were weak and non-significant except in the second lactation which proved significant. In this respect, age-of-calving effects were found to be non-significant on GL (Vyas et al., 1971; Kirella, 1977; Reynolds, 1980); CI (Slama et al. 1976; Badran, 1978; Basu and Ghai, 1980 ; Sharma, 1982) and on DO (Abdel-Ghany and Fahmy, 1966; Schaeffer and Henderson, 1972; Basu and Ghai, 1978; Sharma, 1982; Mohamed, 1987). However, age-of-calving effects were observed to be significant on GL (Chaudhuri and Sinha, 1951; Brackel et al. 1952; Lasley et al., 1961), CI (Abdel-Ghani and Fahmy, 1966) and DO (Martinez et al., 1980; Fonseca et al., 1983).

Days open:

Partial linear regression coefficients of GL and CI on days open showed positive association between days open and each of GL and CI (Tables 26&27&28). Days-open effects on CI were found to be significant ($P<0.01$) in the first three lactations, but its contribution in the total variance of CI was high (60 %) only in the first lactation (Tables 29&30&31). These observations indicate that DO is an important element that determine CI and this is expected since DO relative to CI is a part of a whole. Days-open effects on CI were shown to be highly significant and in concordant with the present results by Olds (1969), Kalinka (1979) and Williamson et al. (1980).