REPRODUCTIVE PERFORMANCE OF RED SINDHI CATTLE UNDER HOT AND HUMID ENVIRONMENT OF BALOCHISTAN PROVINCE OF PAKISTAN

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ABSTRACT

The present study was conducted to investigate the reproductive performance of 179 Red Sindhi cows with 485 lactation records covering 19 years period from 1978 to 1997, kept at the Government Red Sindhi Cattle Farm, Hub Chowki, District Lasbela (Balochistan). The effects of different known factors like year of birth/calving, season of birth/calving and cow were studied. The least squares mean (LSM) for age at first service (AFS), age at first conception (AFCO) and age at first calving (AFC) were 1024.86 ± 27.54, 1043.02 ± 31.46 and 1346.55 ± 27.34 days, respectively, whereas the service period (SP), gestation period (GP), calving interval (CI) and number of services per conception (SPC) were 235.87 ± 14.05 days, 283.15 ± 0.64 days, 515.28 ± 13.84 days and 1.63 ± 0.07, respectively. Year of birth/calving significantly affected ($P<0.01$) all the traits studied, whereas the season of birth/calving significantly ($P<0.01$) affected the service period and calving interval. Service period, gestation period and calving interval differed significantly between cows. The effect of lactation number on gestation period and services per conception was investigated, which significantly ($P<0.01$) affected the services per conception but not the gestation period. The variation in the effects of different factors on the traits may be due to different environmental conditions, managemental practices, feeding planes, housing systems and personal skill of labour engaged in farm operations.

Key Words: Reproductive traits, hot humid environment, Red Sindhi cattle.

INTRODUCTION

Most of the cattle in Pakistan are non-descript and have low milk producing ability. However, Sahiwal and Red Sindhi are famous dairy breeds reputed for good production potentials. The Red Sindhi cattle are considered one of the few distinct dairy breeds of cattle in the whole Indo-Pakistan sub-continent. This breed is well adopted to climatic conditions of the country with the potential for high milk production, and has been exported to various countries of the world. Although the animals of this breed are good producers, yet their production is considerably lower than the well-defined breeds of the temperate region. The low productivity is due to low average daily yield coupled with reduced reproductive efficiency. The age at first calving and calving intervals are the most important factors in determining the reproductive efficiency. These parameters depend greatly on age at first oestrus and service period and vary widely between breeds, herds and years (Javed, 1999).

There is a lack of information in the current state of knowledge regarding evaluation of the reproductive performance of the Red Sindhi cattle. The present study was conducted to investigate the reproductive performance of these animals kept at the Government Red Sindhi Cattle Farm Hub Chowki, District Lasbela (Balochistan).

MATERIALS AND METHODS

Data for the present study were collected from Government Red Sindhi Cattle Farm, Hub Chowki, District Lasbela of Balochistan Province near the costal area. Data comprised of 179 animals with 485 lactation records covering the period from 1978 to 1997. Lasbela is a District of Kalat Division, Baluchistan Province, Pakistan. It is bounded in the north by Khuzdar District, east by the Kirthan Range (Separating it from Sindh). south by Arabian sea and west by the Hala range. Las Bela is an agriculturally under developed zone with untapped water resources, in the west is a narrow costal strip dotted with mangrove swamps. Cultivation depends upon flood irrigation, with Jowar (sorghum) and oil seeds being the chief crops (Wahid, 1971). The average rainfall in the area is 8 inch annually with the temperature ranging from 1^0C to $35\ ^0C$.

The composition of food varied according to the fodder crops available during the year. Green Jowar

(*Andropogon sorghum*), guara (*Cyamposis peoraliodes*), and cow peas (*Vigna sinensis*) were fed during the months of May to October. During November to April, green berseem (*Trifolium alexandrium*), shaftal (*Trifolium renpinatum*), lucerne (*Medicago eativa*) and rape mixture (*Brassica napus*) were mainly given to these animals. Dry fodder comprised of wheat bhoosa. Lumps of common salt were provided in mangers for free choice licking. The standard of feeding was reported to have been maintained, although it may have fallen when there was shortage of concentrates and fodder.

The data were processed to evaluate the reproductive performance of the breed kept under farm conditions in its own home tract. The reproductive parameters of Red Sindhi cows were either obtained directly from the records or calculated from the data to study the overall performance in term of the following parameters.

1. Age at first service (AFS)
2. Age at first conception (AFCO)
3. Age at first calving (AFC)
4. Service period (SP)
5. Gestation period (GP)
6. Calving interval (CI)
7. Number of services per conception (SPC)

The effects of different known factors like year of birth/calving, season of birth/calving etc were studied on the above mentioned performance traits. On the basis of ambient temperature, relative humidity and rainfall each calendar year was divided into the following seasons:

1. Winter. December to February
2. Spring. March to May
3. Summer. June to August
4. Autumn. September to November

The abnormal records like those resulting from abortions, premature birth, still birth, incomplete lactations due to death, shifting, culling and chronic illness were excluded from the study. The lactations with less than 5 months (150 days) duration were considered to be abnormal. All the reproductive records more than three standard (±3SD) deviations from the mean of the population were considered abnormal and excluded.

The sets of environmental factors were different for different parameters, and thus the analysis of variance for each trait was carried out assuming different models for analysis. Theoretical description of the model assumed for example, for age at first calving is as under:

$$X_{ijk} = \mu + Y_i + S_j + e_{ijk}$$

where,

X_{ijk} = Age at first calving of kth cow born in jth season of ith year.

μ = Over all population mean

Y_i = Effect of ith year of birth (i = 1 to 19)

S_j = Effect of jth season of birth (j = 1, 2, 3, 4)

e_{ijk} = Random residual error associated with the age at first calving of kth cow born in jth season of ith year.

The Software MS Excel[*] (1997) was used for the entry, editing and processing of data. The data were analysed by using the Mixed model least squares and maximum likelihood (LSMLMW) computer program. (Harvey, 1990).

RESULTS AND DISCUSSION

Age at first service

The least squares mean value for age at first service (AFS) was 1024.8 ± 27.5 days. The least squares analysis of variance indicated that the effect of year of birth of heifers on AFS was significant (P<0.01) whereas the effect of season of birth on AFS was non significant (Table 1). The heifers born in 1978 had maximum AFS (1764.8 ± 137.5 days) while the heifers born in 1995 had minimum AFS (665.0 ± 216.5 days). The heifers born in winter had maximum AFS (1073.3 ± 49.9 days) whereas the heifers born in autumn (Sep-Nov) had minimum AFS (991.3 ± 55.0 days), as shown in Table 3.

The values of AFS obtained in present study are in agreement with the findings of Ali and Farooque (1989). However these are not in agreement with the findings of Vashist and Katiha (1989), who reported higher values (44.0 months) for AFS as compared to the values for Red Sindhi heifers found in present study. Chaudhry and Ahmad (1994) reported lower values (801.7 ± 21.1 days) for AFS in different breeds as compare to the values found in present study. The differences found in the values of AFS might be due to difference in breeds and environment.

The differences found in AFS among various years can be ascribed mainly due to variation in herd management, nutrition regime and climatic differences found in different years. All these factors have a profound effect on the growth rate of the heifers which has a significant affect on the AFS of the heifers. Thus the animals raised under good managemental conditions show first sign of oestrus at an early age (Ahmad, 1998). Thus, better feeding and efficient managemental systems will be helpful in reducing the AFS which ultimately improves the life time productive and reproductive performance of the animal.

Table 1. Least squares analysis of variance for age at first services, age at first conception and age at first calving

Source of variation	Age at first service			Age at first conception			Age at first calving		
	d.f	Mean squares	F-value	d.f	Mean squares	F-value	d.f	Mean squares	F-value
Year of birth	15	403853.4	4.3^{**}	15	372250.9	3.8^{**}	14	367695.4	3.7^{**}
Season of birth	3	47381.0	$0.5^{N.S}$	3	62345.9	$0.6^{N.S}$	3	73866.8	0.7^{NS}
Remainder	161	92555.2		158	95773.2		151	99039.3	

N.S = Non significant ** = Highly significant (P<0.01)

Table 2. Least squares analysis of variance for service period, gestation period, calving interval and services per conception

Source of variation	Service period			Gestation period			Calving interval			Services per conception		
	d.f.	Mean Squares	F-value	d.f.	Mean Squares	F-value	d.f.	Mean Squares	F-value	d.f.	Mean Squares	F-value
Cows	123	21332.1	1.6^{**}	163	30.30	1.27^{*}	124	20758.2	1.57^{**}			
Year of calving/ services	14	44142.5	3.3^{**}	15	60.43	2.54^{**}	14	42556.2	3.23^{**}	15	2.73	5.1^{**}
Season of calving/ services	3	51953.2	3.9^{**}	3	30.02	0.84^{NS}	3	52878.2	4.01^{**}	3	0.22	0.40^{NS}
Lactation number	---	---	---	7	8.68	0.36^{NS}	---	---	---	7	7.91	14.75^{**}
Remainder	234	13228.9		273	23.72		235	13156.2		526	0.54	

N.S = Non significant ** = Highly significant (P<0.01) * = Significant (P<0.05)

Age at first conception

The least squares mean for age at first conception (AFCO) was 1043.02 ± 31.46 days. The analysis of variance indicated that the effect of year of birth was significant (P<0.01). The heifers born in 1978 conceived at age of 1768.32 ± 139.91 days as compared to heifers born in 1995 that conceived at an earlier age of 683.15 ± 312.95 days. However, the season of birth had no effect on this trait (Table 1). The maximum value (1097.86 ± 52.75 days) was found in cows born in winter and minimum value (1002.22 ± 59.79 days) was for cows born in autumn (Table 3). The mean values for AFCO in the present study are in agreement with the finding (1097 ± 11 days) of Ali and Farooque (1989). The AFCO reported by Mirza *et al*. (1985) was higher (1328 days) while Singh *et al*. (1990) reported lower values (901 ± 4.78 days) for this trait as compared to values found in the present study.

This trait can greatly be reduced if the factor like care and management from suckling to breeding stage, balanced feeding particularly at breeding age, keen observation of heat symptoms and timely service are taken into account. Through reducing AFCO by reduced AFS and ultimate reduction in AFC, the increase in life of about two production years can be made which significantly increase the overall milk production of the dairy cows.

Age at first calving

The least squares mean for age at first calving (AFC) in the present study was 1346.55 ± 27.34 days. The least squares analysis of variance revealed that the effect of year of birth of heifers on AFC was highly significant (P<0.01), as given in Table 1. It was maximum (2050.25 ± 142.40 days) in heifers born in 1978 and minimum (1117.77 ± 122.09 days) in heifers born in 1992 (Table 3). However, the effect of season of birth was not significant. The AFC was maximum (1408.61 ± 51.21 days) in heifers born in winter and minimum (1302.68 ± 59.89 days) in heifers born in autumn (Sep-Nov), as shown in Table 2. The values found in the present study are very close to the findings

Table 3. Least squares means (±SE) for age at first services, age at first conception and age at first calving

Classification	Age at first services (Days)		Age at first conception (Days)		Age at first calving (Days)	
	N	LSM ± SE	N	LSM ± SE	N	LSM ± SE
Overall Mean	180	1024.8±27.5	177	1043.02±31.46	169	1346.55± 27.34
Year of Calving						
1978	5	1764.8±137.5	5	1768.32±139.91	5	2050.25±142.40
1979	7	1342.3±116.0	7	1343.27±118.08	7	1623.11±120.17
1980	8	1199.1±111.4	8	1201.70±113.47	8	1486.68±115.74
1981						
1982						
1983	7	1119.3±115.5	7	1118.59±117.53	7	1398.11±119.55
1984	24	1054.6±64.2	24	1056.95± 65.43	24	1340.17± 66.76
1985	9	1211.3±104.1	9	1215.89±105.94	9	1493.65±107.98
1986	9	889.4±101.8	9	890.31±103.62	9	1170.69±105.42
1987	12	953.8±88.7	12	978.25± 90.34	12	1254.50± 90.93
1988	12	930.3±88.0	12	974.52± 89.54	12	1249.83± 91.08
1989	20	925.0±68.5	19	972.15± 71.64	19	1238.80± 72.89
1990	23	1015.9±65.0	23	1061.30± 66.22	23	1335.68± 67.52
1991	9	581.1±104.3	9	898.19±106.62	9	1175.33±108.49
1992	8	824.7±109.7	7	846.91±119.83	7	1117.77±122.09
1993	9	838.0±102.0	9	855.51±103.85	9	1133.51±105.68
1994	16	812.5±77.0	16	823.37± 78.44	9	1130.23±111.29
1995	2	665.0±216.5	1	683.15±312.95		
Season of calving						
Winter	47	1073.34±49.9	47	1097.86±52.7	45	1408.6±51.2
Spring	42	1015.2±52.8	42	1039.87±55.7	39	1339.9±57.9
Summer	58	1019.4±45.3	58	1032.15±48.2	55	1334.9±46.8
Autumn	33	991.3±55.0	33	1002.22±59.7	30	1302.6±59.8

of Patro and Rao (1983). Gupta and Tripathi (1994) reported higher values (1338.66 ± 15.67 and 1498.40 ± 13.75 days), Shah and Zafar (1986) reported relatively lower value for AFC (1168.62 ± 145.53 days) than the present study.

The variation in mean values of AFC and effect of year of birth on this trait indicates that most of the reproductive parameters are greatly influenced by environment rather than genetics. Distinct variation in feeding, breeding management and other environment related factors like year, season, ambient temperature and relative humidity directly influence the body weight and reproductive activities of the animals (Ahmad, 1998). Possibility of improvement by reducing AFC will be enhanced if the factors like proper heat detection, timely service, balanced feeding particularly at breeding ages and managemental parameters are taken care of properly.

Service period

The least squares mean for service period (SP) in the present study was 235.87 ± 14.05 days. The effect of season and year of calving on SP was significant (Table 2). The cows calved during the year 1982 showed longest SP (519 ± 141.50 days) while the cows calved during 1996 showed shortest SP (87.36 ± 58.53 days). However it showed no specific trend for different years. The maximum value for SP (263.29 ± 21.23 days) was found in cows calved in spring while minimum value (189.82 ± 19.16 days) was found in autumn calvers (Table 4).

The LSM for SP in the present study are close to the findings of Ali *et al.* (1993). However, Qureshi *et al.* (1996) reported from moderately low to very low SP, while Panneerselvam *et al.* (1990) reported a higher SP (252.14 ± 13.49 days) than estimated in the present study. The variation in mean values of SP seems to be largely due to environment (management, feeding and breeding). Through efficient managemental practices, proper heat detection, timely insemination and balanced feeding, the value for SP can be reduced to optimum (60-90 days).

The findings of the present study imply that the cows calved during autumn season (September-November) show the symptoms of heat during winter when ambient temperature is favourable. Under the stress of high ambient temperature, the spring calvers may not show the symptoms of heat during summer which may cause an increase in SP. Because the SP is greatly a managemental dilemma, the increased mean values indicates bright chances of the improvement through efficient management, balanced feeding, proper housing, heat detection and timely service.

Gestation period

The least squares mean for gestation period (GP) in the present study was 283.1 ± 0.6 days. The least squares analysis of variance revealed that the effect of year of calving was significant ($P<0.01$) while the effect of season of calving and lactation number was not significant on this trait (Table 2).

The maximum values for GP (289.9 ± 6.3 days) was recorded in cows calved during 1982 and minimum value (276.4 ± 4.1 days) for the cows calved during 1997. Similarly, the maximum value (283.67 ± 0.82 days) was found in cows calved during winter and minimum value (282.6 ± 0.8 days) for the cows calved during autumn (Table 4).

The least squares means for GP found in the present study are close to 284 ± 5 days reported by Fulsounder *et al.* (1984). Vij *et al.* (1993) reported higher values (287.36 ± 1.70 days) for GP while Das *et al.* (1990) reported lower values (272 ± 7.1 days) for GP than those found in present study. The main differences in mean values may be due to the differences in the breed. The adult weight of animals vary in different breeds which can affect the GP.

The differences in the effect of environmental factors may be due to different feeding, management and climatic conditions. In some years the balanced feeding may help to attain proper weight of foetus earlier as compared to other years. The environmental temperature in one locality in some seasons may cause early calving due to heat stress as compared to other areas where there is a little variation in environmental temperature in different seasons. Further, higher birth rate of male calves in some years may cause variation in mean GP as compared to other years when the rate of birth of female calves is higher.

Calving interval

The least squares mean for calving interval (CI) in the present study was 515.2 ± 13.8 days. The least squares analysis of variance revealed that effect of season and year of calving on CI was significant ($P>0.01$) as given in Table 2. The longest CI (785.3 ± 141.1 days) was recorded in cows calved in 1982 and shortest (370.4 ± 58.3 days) was found in cows calved in 1996. Similarly, maximum value for CI (542.3 ± 20.8 days) was found in cows calved in spring season and minimum value (469.1 ± 18.9 days) was found in cows calved in autumn season (Table 4).

The least squares means for CI observed in the present study are close to 518.9 days reported by Kar *et al.* (1987). Sharma and Singh (1994) reported higher values (563 days) while Sethi *et al.* (1997) reported lower values (469.51 ± 5.02 days) for CI compared to the present study. The variation may be due to difference in environmental conditions and level of production. A balanced feeding plan may avoid several problems related to fertility. Because over feeding of cows causes fat deposition around ovaries which results in infertility. Similarly, mineral and vitamins deficiency due to poor feeding also results in infertility. An efficient management which includes proper heat detection, timely service, accurate record keeping and identifying silent heat and problem cases and those showed the symptoms of oestrus 60-90 days post partum will definitely reduce service period and ultimately CI.

Services per conception

The least squares mean for services per conception (SPC) in the present study was 1.63 ± 0.07. The least squares analysis of variance revealed that the effect of year of service and lactation number on SPC was significant ($P<0.01$) while the effect of season of service was non significant (Table 2). In 1997 the cows required maximum (2.11 ± 0.33) SPC compared to 1984 when cows required minimum (1.06 ± 0.20) SPC (Table 4). However it showed no consistent trends in different years.

The mean values for SPC in the present study are in close agreement with the findings of Vij *et al.* (1993), who reported average SPC of 1.71, ranging from 1-11. However, Ali *et al.* (1993) reported higher values (2.13 ranging 1-9) for SPC as compare to present study. The differences may be due to accurate heat detection, timely insemination and to some extent breed characteristics. The significant effects of year and lactation number on SPC are in line with the findings of Vij *et al.* (1993). However, Singh *et al.* (1990) reported no effect of year on this parameter; the non-significant

Table 4. Least squares means (±SE) and standard error for service period, gestation period, calving interval and services per conception

Classification	Service period (Days)		Gestation period (Days)		Calving interval (Days)		Services per conception (No.)	
	N	LSM ± SE	N	LSM ± SE	N	LSM ± SE	N	LSM ± SE
Overall Mean	375	235.8± 14.0	462	283.1±0.65	377	515.28±13.84	552	1.63±0.07
Year of Calving/ Service								
1982	1	519.41±141.5	1	289.91±6.31	1	785.34±141.11	5	1.34±0.34
1983	7	213.59± 50.00	7	286.16±3.84	7	500.55±51.62	14	1.17±0.21
1984	15	227.55± 37.12	12	287.74±3.35	15	507.30±36.85	16	1.06±0.20
1985	14	223.51± 38.41	12	286.36±2.85	14	505.04±38.20	11	1.23±0.23
1986	13	218.40± 38.53	12	286.19±2.43	13	503.97±38.26	27	1.28±0.15
1987	30	248.76± 26.92	30	285.69±1.80	30	533.29±26.71	29	1.62±0.15
1988	33	264.06± 27.06	31	286.55±1.52	33	546.54±26.85	37	1.46±0.13
1989	32	300.61± 27.18	37	284.98±1.16	32	578.69±27.02	54	1.58±0.11
1990	26	312.08± 30.61	42	284.14±1.11	26	589.85±30.47	46	2.08±0.12
1991	29	209.42± 29.02	38	278.84±1.24	29	487.00±28.53	45	1.90±0.12
1992	43	161.06± 25.46	38	278.02±0.54	44	442.54±25.18	61	1.93±0.11
1993	43	146.84± 26.46	49	281.53±2.00	43	422.76±26.34	56	1.58±0.11
1994	48	184.12± 26.48	44	279.79±2.53	48	460.58±26.17	53	1.72±0.11
1995	35	221.24± 31.59	40	279.53±3.15	36	495.27±30.35	50	2.01±0.11
1996	6	87.36± 58.33	40	278.64±3.58	6	370.44±58.34	43	2.01±0.12
1997			29	276.39±4.12			5	2.11±0.33
Season of calving								
Winter	109	245.6±18.9	125	283.68±0.82	110	524.74±18.74	148	1.57±0.08
Spring	7	263.2±21.2	116	283.62±0.88	78	542.36±20.90	144	1.64±0.09
Summer	89	244.76±19.6	98	282.66±0.87	89	524.87±19.45	138	1.64±0.09
Autumn	100	189.8±19.1	123	282.66±0.80	100	469.14±18.95	122	1.67±0.09

effect of season is in line with the findings of Singh *et al.* (1990), who also reported similar results.

The variation in effect of season and year on SPC in the present study and in the literature may be due to the difference in environmental conditions. The difference in managemental practices over years may affect this parameter. A narrow range of environmental temperature in different seasons of year may not influence this parameter. An ideal goal for average SPC would be 1.0. A more realistic goal is 1.5. The range from 1.5-1.7 is acceptable. However, if this figure exceeds 1.75 on an average, it indicates a serious problem and causes should be identified and corrected. The SPC is a useful measure of fertility. It is necessary to minimize SPC through efficient reproductive management to reduces SP and CI and increases life time milk yield by increasing productive life span.

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