PRODUCTIVE 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 productive performance of Red Sindhi cows kept at the Government Red Sindhi Cattle Farm, Hub Chowki, District Lasbela (Balochistan). The least squares means (LSM) for first lactation milk yield (FLMY), lactation milk yield (LY), milk yield per day of lactation length (MYLL), lactation length (LL), dry period (DP) and life time milk yield (LTMY) were 1488.4 ± 23.2 kg, 1531.0 ± 34.8 kg, 6.6 ± 0.1 kg; 277.3 ± 5.6 days, 245.2 ± 11.9 days and 5203.4 ± 178.4 kg, respectively. The variation in effects of different factors on these traits may be due to different environmental conditions, managemental practices, feeding planes, housing systems and personal skill of labour engaged in farm operations. The little difference of season and year of calving on the traits revealed that there is a narrow range between minimum and maximum temperature throughout the year and within the year and the managemental operations on the farm remained same over the years with little efforts towards improvement.

Key Words: Productive traits, hot humid environment Red Sindhi cattle

INTRODUCTION

The Red Sindhi cattle are considered one of the few distinct dairy breeds of cattle in the whole Indo-Pak 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 all over the world. Although the animals of this breed are good producer, yet their production is considerably lower than the well-defined breeds of the temperate region. This low productivity is due to low average daily yield coupled with reduced reproductive efficiency. There are many other factors which affect the production. The major ones include: age at calving, number of days in lactation and the dry period (Chaudhry *et al*., 1983). The age at first calving and calving interval 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 (Khan *et al*., 1992).

There is a lack of information in the current state of knowledge regarding evaluation of the performance of the Red Sindhi cattle kept at Government Red Sindhi Cattle Farm Hub Chowki District Lasbela (Balochistan). The productive performance of these animals is reported in this study.

MATERIALS AND METHODS

Data for the present study were collected from Government Red Sindhi Cattle Farm, Hub Chowki, District Lasbela of Balochistan Province. Data comprised of 179 animals with 485 lactation records covering 19 years period from 1978 to 1997. Their performance parameters were taken up-to 8 lactations.

The productive parameters of Red Sindhi cows either obtained directly from the records or calculated from the data to study the overall performance included the followings :

1. First lactation milk yield (FLMY)
2. Lactation milk yield (LY)
3. Milk yield per day of lactation length (MYLL)
4. Lactation length (LL)
5. Dry period (DP)
6. Life time milk yield (LTMY)

The effects of different known factors like year of birth/calving and season of birth/calving 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 or chronic illness were excluded from the study. The lactations with less than 5 months (150 days) duration were considered to be abnormal. All the records for lactation length and dry period, more than three standard deviations from the mean of the population were considered abnormal and excluded.

The mathematical model assumed, for example, for first lactation milk yield is as under :

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

Where

Xijk = First lactation milk yield of k_{th} cow calved in j_{th} season of i_{th} year.
μ = Over all population mean
Y_i = Effect of i_{th} year of calving (1 to 19)
S_j = Effect of j_{th} season of calving (1 to 4)
e_{ijk} = Random residual error associated with the first lactation milk yield of k_{th} cow calved in j_{th} season of i_{th} year.

The Software Quattro Pro® 4 (1992) was used for the entry, editing and processing of the data. The statistical software mixed model least squares and maximum likelihood LSMLMW (Harvey, 1990) was used to evaluate the influence of various environmental factors on productive traits.

RESULTS AND DISCUSSION

First lactation milk yield (FLMY)

The least squares mean for first lactation milk yield (FLMY) in present study was 1488.4 ± 23.2 kg. The least squares analysis of variance revealed that the effect of year and season of calving was not significant for FLMY, as shown in Table 1. The cows which calved in 1985 produced maximum quantity of milk (1801.2 ± 143.5 kg) while those which calved in 1988 produced minimum (1321.8 ± 68.6 kg). The effect of year of birth and season of birth was not significant for FLMY (Table 3).

The least squares means are in close agreement with the findings of Jat *et al.* (1996). The FLMY reported by Gupta and Tripathi (1994) and Nanavati and Khan (1997) was considerably lower than the estimates of the present study. However, some other workers like Shah and Zafar (1986) and Mohiuddin *et al.* (1990) reported higher estimates for FLMY.

The effect of both year and season of calving on FLMY was not significant. However, the least squares means revealed that the cows calved during the year 1985 produced maximum and cows calved during 1988 produced minimum FLMY. As far as the effect of season of calving on FLMY is ,concerned, there was no remarkable difference in mean values for various seasons. These findings on FLMY are in line with those of Das *et al.* (1990), who also found non significant effect of season of calving on FLMY. However, the finding are not in line with those of Vij *et al.* (1992) and Nanavati and Khan (1997), who reported that the effect of year and season of calving on FLMY was significant.

Lactation milk yield (LY)

The least squares mean for lactation yield (LY) in the present study was 1531.0 ± 34.8 kg. The effect of season and year of calving on LY in present study was not significant, while the effect of lactation number and lactation length (LL) on LY was significant ($P<0.01$) (Table 1). The maximum (1536.2 ± 40.0 kg) LY was produced by the cows calved in spring (Mar-May) and minimum (1526.9 ± 38.7 kg) LY produced by the cows calved in summer (June-Aug). The maximum LY (1795.5 ± 222.3 kg) was produced by the cows calved during 1982 and minimum LY (1314.5 ± 149.4 kg) by the cows calved during 1996. The lactation number showed a definite trend for LY. It increased gradually from one to third lactation and remained almost constant in fourth lactation and after that there was a declining trend from fifth to eighth lactation. The maximum LY (1672.9 ± 53.9 kg) was produced in third lactation and minimum LY (1359.4 ± 131.5 kg) was produced in eighth lactation (Table 3).

The least squares mean for LY found in the present study are close to the finding of Chaudhry *et al.* (1983) and Yadav *et al.* (1995). Some workers like Yadav *et al.* (1994) and Jat *et al.* (1996) reported lower LY than that found in present study. However, Nanavati and Khan (1997) reported higher LY than that found in present study. These differences in LY may be due to the producing capability of cows, as animals vary in producing capability from herd to herd. An other probable reason for these differences in mean values may be the differential managemental practices and nutritional plans because poor managemental practices and unbalanced feeding both quantitatively and qualitatively do not allow the cows to show their potential to the maximum.

The non-significant effects of year of calving on LY are not in line with findings of Jat *et al.* (1996) and Nanavati and Khan (1997), who reported significant effect of year of calving on LY. The non-significant effect of season of calving in present study are in line with the findings of Mathur and Khosla (1994). These findings are not in line with the findings of Jat *et al.* (1996), who reported significant effects of season of calving on LY. The significant effects of lactation number on LY in the present study are in line with the findings of Jat *et al.*

(1996) and Nanavati and Khan (1997). The significant effect of LL on LY is in line with the findings of Kimenye (1981), who reported that the LL accounted for upto 35% of the total variation in LY.

The variation in the effects of different factors on LY may be due to different environmental conditions, managemental practices, feeding plans, housing systems and personal skill of labour engaged in farm operations. The little difference of season and year of calving on LY revealed that the there is a narrow range between minimum and maximum temperature throughout the year and within the year and the managemental operations on the farm remained same over the years with no efforts towards improvement. The gradual increase in productivity over the lactations was expected because cow normally goes on maturing till 8-9 years of age (till 5th lactation). An other possible reason for the increase in milk yield could be ascribed to the increased functional activity of the secretary tissues of mammary glands till maturity and declining trend thereafter.

Milk yield per day of lactation length (MYLL)

The least squares mean for MYLL in the present study was 6.6 ± 0.1 kg. The least squares analysis of variance revealed that the effects of environmental factors i.e. month and year of calving and parity were significant ($P<0.01$) on MYLL. However, the effect of season of calving was not significant for this trait as given in Table 1. The maximum values (8.6 ± 1.2 kg) were found for cows calved during the year of 1982 whereas minimum values (4.9 ± 0.8 kg) were found for those calved during 1996. The cow calved during the autumn (Sep-Nov) had maximum (6.6 ± 0.1 kg) MYLL and those calved during summer (June-Aug) had minimum (6.5 ± 0.1 kg) MYLL, as given in Table 3.

The parity had a significant effect ($P<0.01$) on MYLL with a specific trend that it increased gradually from one to fourth lactation and declined thereafter from fifth to eighth lactation. The maximum value (7.1 ± 0.1 kg) for MYLL was recorded in fourth lactation and minimum value (5.3 ± 0.5 kg) was found in first lactation. It showed that the cows physiologically mature by fourth lactation and afterwards there is a declining trend in the production (Jat *et al*., 1996).

The LSM observed in the present study for MYLL are in close agreement with the findings of Singh (1992) and Ali *et al*. (1993). However, some other workers like Yadav *et al*. (1995) and Jat *et al*. (1996) reported lower values for MYLL than the present findings. Similarly, Rao and Rao (1996) reported higher value for MYLL than that found in the present study.

The least squares analysis of variance in present study are in line with the findings of Yadav *et al*. (1995), who reported significant effect of lactation number and year of calving and non significant effect of season of calving on MYLL. However, Singh (1992) and Jat *et al*. (1996) reported significant effect of season of calving on MYLL. The difference in the influence of season of calving on MYLL in the studies of other workers may be attributed to the difference in availability and quality of feed and extremes of climatic conditions during different seasons of the year compared to present study, where the weather remains moderate throughout the year.

Lactation length (LL)

The least squares means for LL in the present study was 277.3 ± 5.6 days. The effect of year of calving on LL was highly significant ($P<0.01$), whereas the effect of month was significant ($P<0.05$) for LL (Table 2). The LL of the cows calved during 1987 was maximum (321.3 ± 12.7 days), whereas the LL of the cows calved during 1996 was minimum (232.9 ± 14.9 days), as given in Table 4. However, no consistent trend for LL in different years was found. The effect of season of calving on LL was not significant.

The mean values for LL in the present study are close to the findings of Yadav *et al*. (1995) and Jat *et al*. (1996). Das *et al*. (1990) and Vij *et al*. (1992) reported higher LL than found in present study. However, Sivarajasingam and Mukherjee (1975) reported lower values for LL than that found in present study. The wide variation in mean LL may be due to breed difference and different feeding and management practices. The effects of year of calving on LL are in line with the findings of Yadav *et al*. (1995), who reported significant effect of year of calving on LL.

The non-significant effect of season of calving on LL reported by Yadav *et al*. (1995) are in line with the present study. In contrast to this, Jat *et al*. (1996) reported significant effect of season of calving on LL. The variation in these findings is caused by seasonal fluctuation and might be influenced by the quality of feed and fodder available at the time of flushing and the stage of lactation of the cows. The non-significant effect of season of calving on LL revealed that the various metabolic changes in mammary tissue were not affected by changes in environmental temperature.

Dry period (DP)

The least squares means for DP in the present study was 245.2 ± 11.9 days. The effect of season and year of calving was not significant for DP as given in Table 2. The maximum value (531.9 ± 151.1 days) for DP was found in cows calved in 1982 and minimum value (120.6 ± 74.7 days) was found in cows calved in 1996. Similarly maximum value (259.0 ± 21.3 days) for DP was found in

Table 1. **ANOVA for first lactation milk yield (FLMY), lactation milk yield (LMY) and milk yield per day of lactation length (MYLL)**

Source of variation	First lactation milk yield (FLMY) Kg			Lactation milk yield (LMY) Kg			Milk yield per day of lactation length (MYLL) Kg		
	d.f	Mean squares	F-value	d.f	Mean squares	F-value	d.f	Mean squares	F-value
Cows				154	67356.2	2.68**	154	0.9	1.01 N.S
Year of calving	14	68595.0	1.68 NS	14	35411.0	1.41 N.S	14	2.3	2.63*
Season of calving	3	15950.6	0.39 N.S	3	902.2	0.03 N.S	3	0.4	0.49 N.S
Lactation number				7	418842.8	16.68**	7	8.0	9.07**
Lactation length				1	177361.2	70.65**			
Remainder	139	40604.0		304	25097.4		311	0.8	

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

Table 2. **Least Squares analysis of variance for first lactation milk yield (FLMY), lactation milk yield (LMY) and milk yield per day of lactation length (MYLL)**

Source of variation	Lactation length (LL) days			Dry period (DP) days			Life time milk yield (LTMY) Kg		
	d.f	Mean squares	F-value	d.f	Mean squares	F-value	d.f	Mean squares	F-value
Cows	154	4351.5	1.10 N.S	122	16376.8	1.08 N.S			
Year of calving	14	11708.8	2.96**	14	193203.3	1.28 N.S			
Season of calving	3	615.0	0.15 N.S	3	28186.8	1.86 N.S			
Year of calving							12	117994171.9	20.49**
Season of calving							3	46729170.3	8.11**
Age at first calving							1	182969410.6	31.77**
Remainder	313	3948.8		224	15093.4		322	5758543.8	

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

cows calved in spring (Mar-May) and minimum value (209.9 ± 18.5 days) was found in cows calved in autumn (Sep-Nov) (Table 4).

The least squares means for DP in the present study are in close agreement with the findings of Panneersalvam *et al.* (1990). However, Ulmek (1988) reported higher values for different groups depending upon their age at first calving. Vij *et al.* (1992) reported lower DP as compared to the mean values obtained in present study. The variation observed in mean values could be environmental factors (feeding, management, climatic and herd structure). The wide variation in mean values for DP in Red Sindhi cattle indicated that there is a scope for reducing this parameter to an optimum level through efficient breeding management, balanced feeding and proper housing to prevent exposure to adverse climatic conditions. The fact that there is a wide variation in mean values of DP in present study but effect of year of calving was not significant statistically; which is not in line with the findings of Vij *et al.* (1992) and Jat *et al.* (1996), who reported significant effect of year of calving on DP.

The variation in the effects of season and year of calving may be due to differential climatic condition and managemental operations. The fact is that there is a narrow range in environmental temperature during these years which causes minor effect on overall performance of the cows regarding DP.

Life time milk yield (LTMY)

Life time milk yield is a parameter of prime importance for economic evaluation of the dairy animals and managerial efficiency of persons directly involved in the managemental operations. The least squares mean for LTMY in present study was 5203.4 ± 178.4 kg. It was found that this parameter showed a declining trend gradually from 1978-1992. The effect of month, season and year of birth and age at first calving were significant (P<0.01) as shown in Table 2. The highest value (11367.7 ± 710.0 kg) was found in cows born in 1978 and lowest value (985.7 ± 1406.7 kg) for LTMY was found in cows born in 1992. The highest values (5886.5 ± 359.7 kg) for LTMY found in cows born in spring (Mar-May) and lowest values (4180.0 ± 314.9 kg) for LTMY found in cows born in autumn (Sep-Nov), as given in Table 4.

The LTMY reported by Ulmek (1988) for cows calved first at an age of less than 30 months are close to LTMY found in the present study. However, Gandhi and Gurnani (1990) and Rao and Rao (1996) reported higher values for LTMY than those found in the present study. The most probable reason for the variation in LTMY may

Table 3. Least squares means (LSM) and standard error for first lactation milk yield (FLMY), lactation milk yield (LMY), milk yield per day of lactation length (MYLL)

Classification	First lactation milk yield (FLMY) Kg		Lactation milk yield (LMY) Kg		Milk yield per day of lactation length (MYLL) Kg	
	N	LSM ± SE	N	LSM ± SE	N	LSM ± SE
Overall Mean	157	1488.45 ± 23.23	484	1531.02 ± 34.89	490	6.60 ± 0.11
Year of calving						
1982	1	1511.7 ± 203.5	1	1795.5 ± 222.3	1	8.6 ± 1.2
1983	7	1485.0 ± 76.3	7	1580.3 ± 138.1	7	8.1 ± 0.7
1984	10	1569.0 ± 64.8	15	1695.7 ± 116.4	15	8.1 ± 0.6
1985	2	1801.2 ± 143.5	15	1613.3 ± 94.3	15	7.2 ± 0.5
1986	3	1468.7 ± 116.7	51	1639.9 ± 79.3	15	7.6 ± 0.4
1987	17	1416.2 ± 49.1	31	1623.2 ± 62.6	31	6.8 ± 0.3
1988	9	1321.8 ± 68.6	33	1620.6 ± 50.9	33	6.9 ± 0.2
1989	12	1369.0 ± 58.5	39	1547.6 ± 44.5	39	6.2 ± 0.2
1990	15	1373.2 ± 52.8	46	1472.0 ± 44.9	48	5.7 ± 0.1
1991	8	1535.3 ± 71.4	36	1420.6 ± 57.6	37	5.9 ± 0.2
1992	19	1443.7 ± 46.2	47	1490.1 ± 69.7	48	5.9 ± 0.3
1993	22	1448.6 ± 44.7	52	1415.2 ± 88.3	53	6.0 ± 0.4
1994	13	1501.4 ± 56.8	60	1384.7 ± 109.3	60	5.3 ± 0.5
1995	11	1507.5 ± 61.2	47	1351.7 ± 132.3	48	5.1 ± 0.7
1996	8	1573.9 ± 71.9	40	1314.5 ± 149.4	40	4.9 ± 0.8
Season of calving						
Winter	51	1511.4 ± 35.7	129	1531.3 ± 38.5	133	6.54 ± 0.15
Spring	37	1472.9 ± 38.2	110	1536.2 ± 40.0	110	6.64 ± 0.16
Summer	27	1467.7 ± 42.3	113	1526.9 ± 38.7	116	6.52 ± 0.15
Autumn	42	1501.7 ± 34.4	132	1529.5 ± 37.6	131	6.69 ± 0.14
Lactation No.						
1			154	1463.2 ± 102.2	155	5.34 ± 0.5
2			113	1628.2 ± 75.1	113	6.28 ± 0.3
3			89	1672.9 ± 53.9	89	6.77 ± 0.2
4			54	1646.5 ± 40.7	56	7.16 ± 0.1
5			36	1597.3 ± 44.6	38	6.89 ± 0.1
6			26	1447.3 ± 61.6	27	6.72 ± 0.3
7			8	1433.0 ± 91.6	8	6.67 ± 0.5
8			4	1359.4 ± 131.5	4	6.95 ± 0.7

Table 4. Least squares means (LSM) and standard error for lactation length (LL), dry period (DP), life time milk yield (LTMY)

Classification	Lactation Length (LL) N	LSM ± SE	Dry Period (DP) N	LSM ± SE	Life Time Milk Yield (LTMY) N	LSM ± SE
Overall Mean	485	277.3 ± 5.6	364	245.2 ± 11.9	339	5203.4 ± 178.4
1978					15	11367.7 ± 710.0
1979					21	10220.0 ± 549.8
1980					24	7262.0 ± 526.5
1981						
1982	1	295.8 ± 70.0	1	531.9 ± 151.1		
1983	7	270.8 ± 26.5	7	226.8 ± 54.7	21	6857.2 ± 528.9
1984	14	278.9 ± 18.9	15	245.5 ± 38.6	72	5800.7 ± 300.2
1985	15	302.2 ± 18.4	13	250.0 ± 41.2	24	6500.4 ± 509.2
1986	15	279.7 ± 18.5	13	227.9 ± 40.4	24	4809.8 ± 499.7
1987	31	321.3 ± 12.7	30	214.2 ± 27.8	33	4275.3 ± 428.2
1988	33	286.5 ± 12.9	34	270.5 ± 27.0	18	3323.4 ± 585.5
1989	40	307.0 ± 11.9	30	258.0 ± 28.3	45	3005.5 ± 380.3
1990	46	314.8 ± 11.4	26	240.8 ± 31.2	30	1786.5 ± 456.5
1991	36	281.6 ± 12.9	28	228.7 ± 30.2	9	1449.9 ± 821.9
1992	48	263.7 ± 11.7	43	182.6 ± 25.9	3	985.7 ± 1406.7
1993	52	235.8 ± 12.1	46	192.5 ± 26.6		
1994	60	249.7 ± 11.4	48	232.6 ± 27.1		
1995	48	239.2 ± 13.6	26	255.7 ± 35.2		
1996	39	232.9 ± 14.9	4	120.6 ± 74.7		
Season of calving						
Winter	130	279.9 ± 8.3	107	255.0 ± 18.4	90	5866.9 ± 304.9
Spring	110	279.8 ± 9.0	75	259.0 ± 21.3	57	5886.5 ± 359.7
Summer	113	276.6 ± 8.7	86	257.0 ± 19.2	120	4880.1 ± 263.2
Autumn	132	273.5 ± 8.2	96	209.9 ± 18.5	72	4180.0 ± 314.9

be the difference in breed, age at first calving and productive life. The later two factors are directly influenced by management and feeding regimes. Because an efficient management plan and balanced feeding help in minimising the losses of animals/production, reducing age at first calving and increasing productive life of the cow, thus increasing LTMY, would be important.

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