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STUDY OF SOME PERFORMANCE TRAITS IN SAHIWAL COWS DURING DIFFERENT PERIODS

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ABSTRACT

Data on some production performance traits of Sahiwal cows maintained at the Livestock Experiment Station, Bahadurnagar, Okara, Pakistan during three different periods i.e. period-1 (1973-1982), period-2 (1983-1992) and period-3 (1993-2002) were compared. Each period was spread over 10 years duration. The data set included 1895, 2123 and 1679 lactation records for the three periods, respectively. Five performance traits viz lactation milk yield, lactation length, dry period, service period and calving interval were included in the analysis. The least squares means for lactation milk yield for the periods 1, 2 and 3 were 1429 ± 21.27, 1632 ± 17.95 and 1527 ± 19.34 kg, respectively. The corresponding values for lactation length were 258 ± 2.51, 256 ± 2.13 and 267 ± 2.29 days, respectively. The means for dry period, service period and calving interval were 172 ± 3.70, 156 ± 4.03 and 437 ± 3.74 days, respectively in the period-1, 161 ± 3.19, 139 ± 3.45 and 420 ± 3.23 days, respectively for period-2. and 158 ± 3.55, 152 ± 3.86 and 429 ± 3.60 days, respectively for period-3. The analysis of variance showed that period of calving showed significant variation ($P<0.01$) for all the productive and reproductive traits, while season of calving had significant effect on lactation milk yield and lactation length. The lactation number (parity) had significant effect on all traits except lactation length, which showed non-significant variation among parities.

Key words: Sahiwal cows, lactation milk yield, dry period, service period, calving interval.

INTRODUCTION

Lactation milk yield is the most important trait of a dairy animal. Higher milk yield increases the profitability and decreases the rearing cost of dairy animals. The Sahiwal breed is well known among Zebu cattle for its superior dairy qualities. It has been exported to many countries (Maule, 1990) for both cross and pure breeding purposes. There is also a dire need to conserve Sahiwal breed due to a decreasing trend of purebred population in Pakistan (Dahlin, 1998).

Present investigation was made to study some performance traits of Sahiwal cows kept at the Livestock Experiment Station (LES) Bahadurnagar, Okara, Pakistan during three different periods (period-1: 1973-1982, period-2: 1983-1992 and period-3: 1993-2002).

MATERIALS AND METHODS

Data of 5697 lactation records on 1565 Sahiwal cows maintained at the Livestock Experiment Station (LES), Bahadurnagar (Okara), Pakistan during 1973 to 2002 were used in this study. Data were analyzed by least square analysis of variance techniques, using the Statistical Analysis System computer programme. The performance traits included lactation milk yield and lactation length records (5697), dry period (4435), calving interval (4461) and service period (4411). The lactations affected by disease or resulting from pre-mature death were excluded from the study. The lactations of 60 days or longer duration were included in the analysis. Edits were also made for any out lier values ± 3 phenotypic standard deviations. A total number of 175 records (<3%) were dropped from the analysis. The data were grouped into three periods with each period spread over 10 years duration; Period-1 consisted of 1973-82, period-2 consisted of 1983-92 and period-3 comprised of 1993-2002. The year was divided into five seasons (Rehman *et el*., 2006) depending on the climatic condition i.e. winter (December to February), spring (March to April), hot dry (May to June), hot humid (July to September) and autumn (October to November). The mathematical model assumed was as follow:

$Y_{ijkl} = \mu + Y_i + S_j + P_k + e_{ijkl}$ where,

Y_{ijkl} = Observation of any trait

μ = Population mean

Y_i = Effect of i^{th} period of calving (where i = 1, 2, 3).

S_j = Effect of j^{th} season of calving (where j = 1, 2, 3, 4, 5).

P_k = Effect of k^{th} lactation number (where k = 1, 2, 3……..10).

e_{ijkl} = Remainder

RESULTS AND DISCUSSION

Lactation milk yield

The population least squares mean for lactation milk yield over the period of 30 years was 1537 ± 9.03 kg for 5697 records of Sahiwal cows kept at LES Bahadurnagar (Table1). Higher estimates (1617 ± 35.09 kg) were reported by Rehman *et al*. (2006) for the data on Sahiwal cattle from LES Bahadunagar, Okara. The least squares mean for lactation milk yield was highest during 1983-92 and lowest during 1973-82. The difference was significant (P<0.01). The variation in lactation milk yield observed in different periods indicates the level of management as well as environmental effects. The level of management varies according to the ability of the Farm Manager, his efficiency in the supervision of the staff, system of crop husbandry, method and intensity of culling. The high milk yield during the period 1983-92 in the herd may be due to good nutrition and other managemental practices during this period.

Season of calving and lactation number (parity) also showed significant variation for the said trait. Shafiq *et al*. (1995) also made similar observations in Sahiwal cows. The cows calved in winter season had the highest milk yield (1661 ± 19.20 kg) and those calved in hot humid season had the lowest milk yield (1418 ± 23.87). These results are partially in agreement with the study reported by Javed *et al.* (2000) and Rehman *et el*. (2006). The observed variation in lactation milk yield in cows calving during different seasons could be due to the seasonal influences as well as the type of feed, temperature, humidity and management which varies greatly during different seasons.

Milk yield was lowest for the first lactation and highest for the sixth lactation, the difference was significant (Table 1). Many studies have found significant effect of parity (lactation number) on production, especially difference between first and later parities. This indicates that cows starting lactation at early age are not fully mature and their mammary glands are not fully functional and give less lactation yield compared to the cows which are in the 3rd , 4th, 5th or 6th lactation and are fully mature. The reduction in the lactation milk yield in later lactations (parities) can also be due to some other biological reasons.

The average milk yield in this study was lower than some earlier studies on Sahiwal cattle in Pakistan. Ahmad (1993) used data from Livestock Experiment Station, Bahadurnagar Okara from 1966 to 1991 and reported the average milk yield of 1692 ± 484 kg. In his study, lactations of 180-308 days durations were used. Iqbal (1996) reported a higher average of 1971 ± 473 kg for this station when lactations were of 308 days in length. However, Dahlin *et al*. (1998) published lower average yield of 1477 kg for an average lactation length of 256 days for 11 institutional herds in Pakistan including the LES, Bahadurnagar. Only first three lactations were used in their study and there was no minimum for the lactation length to be indicated. The variation in these estimates may be due to size of data set, location, method of analysis used and difference in managemental practices at different farms and time periods.

Lactation length

The population least squares mean for lactation length was 262 ± 1.04 days for 5697 records of Sahiwal cows (Table 1). Higher lactation length was observed in the cows calved during period 3 compared to those calved during period 1 and period 2, the difference in lactation length between the latter two periods was non significant (Table 1). The cows calved in hot dry season had the longest lactation (268 ± 3.12 days), while the cows calved in hot humid season had the shortest lactation length (254 ± 2.83 days). Further analysis showed that the lactation length did not differ among cows calving in winter, spring, hot humid and autumn seasons (Table 1). Lactation number (parity) showed non-significant variation for the said trait, although the value was maximum in the 5th lactation and minimum in 10th lactation. These results are partially in agreement with the results reported by Rehman *et al*. (2006).

Dahlin *et al.* (1998) reported average lactation length of 256 days for large data set on Sahiwal cattle in Pakistan, while Ahmad (1999) indicated an average lactation length of 281 ± 55 days in Sahiwal cattle for the data set of 1968-94. The study also showed that year/period and season of calving had significant effect on lactation length. A report of Javed (1999) for Sahiwal cattle at LES Jehangirabad indicated an average lactation length of 267± 63 days. Furthermore, the year/period, season of calving and parity had significant effects on the trait. So keeping in view the cattle standard, lactation length is much lower than breeds like Friesian. Syrstad (1993) has reported that generally the lactation length is much smaller in Zebu cattle than Taurines.

Although the milk yield increased with the increase of lactation length, yet it did not seem advantageous to have lactation length, exceeding 10 months. The daily milk yield in the later stages of lactation becomes low and hence affects the life time productivity. Moreover, longer lactation length prolongs the calving interval and decreases the number of calves that could be obtained during the life span of a cow. Thus, attempts should be made to select cows on the basis of regularity in breeding so that they drop calves every year with a lactation period of about 10 months.

Dry period

The population least squares mean for dry period was 172 ± 1.44 days for 4435 records of Sahiwal cows (Table1). The dry period was longer during the first period of study compared to 2nd and 3rd periods, the

difference between latter two periods was non-significant (Table 1). Higher mean value of dry period (221.68 ± 5.20 days) was reported by Javed *et al*. (2000) for the 1st lactation in Sahiwal cattle. The least squares mean for dry period was 273 ± 17.84 days for the Sahiwal cows kept by Patadars, while it was 155 ± 16.41 days for the cows kept at Livestock Experiment Station Bahadurnagar, Okara (Rehman *et al*., 2006). The cows calved in spring season had the longest dry period (167 ± 3.96 days), while the cows calved in hot humid season had the shortest dry period (161 ± 4.17 days). Similarly the longest mean dry period was observed in the first lactation (199 ± 2.76 days), while the shortest (150 ± 15.25 days) was noted in the 9th lactation. Analysis of variance (Table 2) showed that period of calving and lactation number (parity) had highly significant (P<0.01) effect on the dry period, while season of calving showed non-significant variation for this trait.

It is generally believed that milk yield is affected by the preceding dry period. Considering the biological limits and economics of the operation involved, many workers in tropical and sub-tropical regions have set a range of 40-60 days as an optimum dry period for the perspective of cow's health and farmers profit. Dry periods of Sahiwal cattle were above this optimum level. A considerable reduction was achieved (Mahadevan, 1955) in the dry periods of Zebu cattle through improved management practices in Sri Lanka. This also indicates that length of dry period is largely influenced by environment. Khan (1985) pointed out that some managers of the farm are inclined to dry off their animals earlier to improve the herd average, while other managers go on milking the cows as long as it is affordable. Emphasis should be given to select the animals on the basis of their production level and higher persistency of lactation, which should automatically lead to a decrease in dry period. It should be pointed out that increase of true production in a fixed lactation period (e.g 305 days) is needed, rather than of 305 days corrected records of actually short lactations.

Service period

The service period is the interval from calving to the next conception. It has obvious economic importance because a longer service period increases the calving interval, resulting in a reduced life time production. The over all mean service period in this study was 159 ± 1.56 days for 4411 records of Sahiwal cows (Table 1). The least squares means for service period were 156 ± 4.03, 139 ± 3.45 and 152 ± 3.86 days in the period-1, 2 and 3, respectively. The service period was longer during period-1 and period-3 than the period-2, the difference between the former two periods was non significant. The cows calved in hot dry season had the longest service period (155 ± 4.86 days), while the cows calved in hot humid season had the shortest service period (144 ± 4.53 days), the difference was non significant. Similarly, the longest mean service period was observed in the first lactation (186 ± 2.98 days), while the shortest (130 ± 16.27 days) service period was noted in the 9th lactation number. The analysis of variance (Table 2) showed that the period and lactation number (parity) had highly significant (P<0.01) effect on the service period. These results are in agreement with the results reported by Ahmad (1999).

The ideal service period for Zebu cattle is not apparent from the literature. General guidelines are available such as delaying service period until mobilization of body reserves ceases (Bourchier, 1981). As a rule of thumb a cow is preferably bred during third oestrus after calving in most dairy herds. With a lactation length of 300 days, this allows a rest of about 60-65 days prior to carrying another pregnancy. From a practical management point of view, a range of 60-90 days service period should be feasible. Brahmstaedt and Schonmuth (1983) suggested that service period in cattle should not be less than 40 days. Kale *et al*. (1982) showed that Red Sindhi cows conceiving after 106 days of calving had longer lactations versus those conceiving earlier.

Calving interval

The calving interval is defined as the period between two consecutive calvings. The over all mean calving interval in this study was 437 ± 1.46 days for 4461 records of Sahiwal cows (Table1). The least squares means for calving interval were 437 ± 3.74, 420 ± 3.23 and 429 ± 3.60 days in the period-1, 2 and 3, respectively. The longest (437± 3.74 days) calving interval was observed in the cows calved during period 1, while the shortest (420 ± 3.23 days) calving interval was found in period 2. The cows calved in hot dry season showed the longest calving interval (432 ± 4.51 days), while the cows calved in hot humid season had the shortest calving interval (423 ± 4.22 days).

Similarly, the longest mean calving interval was observed in the first lactation (462 ± 2.80 days), while the shortest (420 ± 9.90 days) calving interval was noted in the 8th lactation number. Analysis of variance (Table 2) showed that calving period and lactation number (parity) had highly significant (P<0.01) effect on the calving interval, while season of calving showed non-significant variation for the said trait. Ahmad (1999) reported that period/year, season of calving and lactation number (Parity) had significant effect on calving interval.

A calving interval of 365 days is usually considered ideal (Khan *et al.,* 1992). Therefore, the calving intervals, as seen in this study, suggest a large need for future improvement. The length of gestation and service period are the two main constituents of calving interval out of which the former can not be

Table 1: Least square means (±SE) for various productive and reproductive traits in Sahiwal cows

Particulars	No. of Obs.	Lactation milk yield (Kg)	Lactation length (days	No. of Obs.	Dry period (days)	No. of Obs.	Sevice period (days)	No. of Obs.	Calving interval (days)
Population mean	5697	1537 ± 9.03	262 ± 1.04	4435	172 ± 1.44	4411	159 ± 1.56	4461	437 ± 1.46
Period-1	1895	1429 ± 21.27^{c}	258 ± 2.51^{b}	1500	172 ± 3.70^{a}	1485	156 ± 4.03^{a}	1518	437 ± 3.74^{a}
Period-2	2123	1632 ± 17.95^{a}	256 ± 2.13^{b}	1686	161 ± 3.19^{b}	1690	139 ± 3.45^{b}	1687	420 ± 3.23^{b}
Period-3	1679	1527 ± 19.34^{b}	267 ± 2.29^{a}	1249	158 ± 3.55^{b}	1236	152 ± 3.86^{a}	1256	429 ± 3.60^{a}
Season of calving									
Winter	2075	1661 ± 19.20^{a}	261 ± 2.28^{b}	1644	165 ± 3.45	1635	147 ± 3.74	1640	428 ± 3.50
Spring	1178	1505 ± 22.83^{c}	261 ± 2.70^{b}	919	167 ± 3.96	918	153 ± 4.29	930	432 ± 3.99
Hot dry	964	1483 ± 26.37^{c}	268 ± 3.12^{a}	597	162 ± 4.46	590	155 ± 4.86	603	432 ± 4.51
Hot humid	955	1418 ± 23.87^{d}	254 ± 283^{b}	717	161 ± 4.17	708	144 ± 4.53	721	423 ± 4.22
Autumn	725	1579 ± 27.22^{b}	258 ± 3.22^{b}	558	164 ± 4.63	560	146 ± 5.01	567	429 ± 4.69
Parity (Lactation number)									
1	1641	1372 ± 17.38^{f}	261 ± 2.06	1318	199 ± 2.76^{a}	1318	186 ± 2.98^{a}	1327	462 ± 2.80^{a}
2	1200	1529 ± 19.59^{de}	265 ± 2.31	956	161 ± 3.10^{cd}	944	150 ± 3.37^{b}	963	428 ± 3.14^{bc}
3	851	1557 ± 23.08^{cde}	262 ± 2.73	678	160 ± 3.65^{cd}	669	147 ± 3.98^{b}	683	427 ± 3.71^{bc}
4	631	1570 ± 26.73^{bcd}	262 ± 3.17	508	158 ± 4.20^{de}	505	149 ± 4.56^{b}	506	426 ± 4.28^{bc}
5	471	1618 ± 30.81^{ab}	268 ± 3.65	370	156 ± 4.91^{de}	368	150 ± 5.32^{b}	368	427 ± 5.01^{bc}
6	342	1649 ± 36.14^{a}	263 ± 4.28	260	160 ± 5.85^{cd}	267	150 ± 6.24^{b}	267	424 ± 5.88^{bc}
7	248	1608 ± 42.49^{abc}	264 ± 5.04	180	169 ± 7.03^{bc}	177	146 ± 7.66^{b}	182	431 ± 7.11^{c}
8	161	1563 ± 52.75^{bcde}	263 ± 6.24	96	153 ± 9.62^{de}	94	148 ± 10.51^{b}	94	420 ± 9.90^{c}
9	86	1505 ± 71.96^{e}	253 ± 8.54	38	150 ± 15.25^{e}	39	130 ± 16.27^{c}	40	421 ± 15.13^{bc}
10	66	1323 ± 82.06^{f}	244 ± 9.74	31	171 ± 16.88^{b}	30	134 ± 1854^{c}	31	421 ± 17.18^{bc}

Values with different superscripts within a column differ significantly from each other ($p<0.01$).

expected to change much for physiological reasons. Kumar (1982) reported 97 and 98% variation in calving interval due to service period in Hariana and Tharparkar cattle, respectively. Since service period constitutes nearly all of the variation in calving interval, the only way to reduce the calving interval in Zebu cattle would be through an early conception within biological limits. Selection for calving interval is practically equivalent to selecting for service period. Variation in this trait showed that a further improvement in calving interval is possible in Sahiwal cows through selection but probably more importantly with better management.

Conclusions

The significant effects of period, season of calving and lactation number (parity) on the performance traits suggested that improvement in feeding and management of the said herd is needed for obtaining better results in Sahiwal cows.

Table 2: Analysis of variance (f-ratio) for various productive and reproductive traits in Sahiwal cows

Trait	DF	Milk yield	Lactation length	DF	Dry period	DF	Services period	DF	Calving interval
Period of calving	2	43.74**	9.15**	2	7.54**	2	11.91**	2	11.72**
Season of calving	4	26.63**	3.58**	4	0.60^{NS}	4	1.42^{NS}	4	1.11^{NS}
Lactation number	9	12.74**	0.95^{NS}	9	17.08**	9	13.34**	9	13.63**
Remainder	5681			4419		4395		4445	

** = highly significant (P<0.01); NS = Non-significant, DF = Degree of freedom.

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