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SOME FACTORS AFFECTING MILK YIELD AND LACTATION LENGTH IN NILI RAVI BUFFALOES

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ABSTRACT

Effects of parity, lactation length, calving season, calf sex and service period on milk yield for 426 records in 134 Nili Ravi buffaloes maintained at the National Agricultural Research Center, Islamabad Pakistan during 1988-2004 were evaluted. The effects of parity, calving season, calf sex and service period were also recorded on lactation length of these buffaloes. The overall average milk yield was 1831.6 ± 530.9 litres per lactation and the average lactation length was 273.3 ± 52.8 days. Milk production was lower in first lactation than that in 2nd, 3rd and 4th lactations (P<0.05). Milk yield per lactation increased with increasing lactation length (P<0.05). The season of calving had significant effect on milk yield. Buffaloes calving in spring showed the highest and those calving in summer showed the lowest milk yield. Sex of calf did not affect milk yield. Milk yield of the animals conceiving within 31–100, 101–200 and 201–300 days after calving did not differ from one another. However, milk yield of the animals conceiving >300 days after calving (2045.6 ± 588.5 litres per lactation) was significantly higher than that of the animals conceiving within 31–100 days after calving (1846.1 ± 527.5 liters per lactation). The lactation length was not affected by parity, calving season, calf sex and service period. It is concluded that parity and lactation length significantly affected milk production in Nili Ravi buffalo, however, a service period of <300 days and calf sex did not affect the yield.

Key words: Buffalo, milk yield, lactation length, parity, service period.

INTRODUCTION

Buffalo is the major dairy animal in Pakistan, contributing approcimately 67% of the total milk produced in the country (GOP, 2005). High capacity to face adverse environmental conditions and a remarkable longevity (up to 10 years production period) of buffalo have also been appreciated in Italy, where the buffalo population increased from 0.106 million in 1989 to 0.2 million in 2000 (Catillo *et al*., 2002). Among the two established breeds of buffalo in Pakistan, the Nili-Ravi breed originated in the valleys of Sutlej and Ravi rivers is dominant in the Punjab province. This breed has now spread over all parts of Pakistan including NWFP, Sindh, Baluchistan and Kashmir. Nili-Ravi buffaloes performed far better than local and crossbred cattle in Muzaffarabad, Azad Jammu and Kashmir (Kuthu, 2007), indicating its adaptation to various environmental conditions.

In order to enhance productivity of a dairy animal, it is necessary to develop an understanding of the factors affecting its milk production. Milk yield and lactation length, two important parameters in dairy animals, depend on both genetic and non-genetic factors. Genetic improvement may be brought about by selection. The non-genetic factors such as management, amount and quality of feed, season etc. also influence milk yield and lactation length, and need to be assessed in a production set up. Analysis of long term data of Nili-Ravi buffaloes maintained at experimental stations in the home tract of the breed has shown that factors affecting milk yield in buffaloes are almost similar to those of cattle including: year, season, herd, parity, days in milk, days open, age and sire (Cady *et al*., 1983). The objective of the present study was to evaluate the effects of parity, season of calving, sex of calf and service period on milk yield and lactation length in Nili-Ravi buffaloes maintained at the Livestock Research Station, National Agricultural Research Centre, Islamabad, Pakistan.

MATERIALS AND METHODS

Data recorded on milk production of a herd of Nili-Ravi buffaloes maintained at the Livestock Research Station, National Agricultural Research Center, Islamabad, Pakistan. were used for this study. The research station has been maintaining a herd of around 80 adult buffaloes for the last 25 years. The replacement of the buffaloes has been coming from the female calves born at the station. Introduction of animals through purchase has been occasional only.

Feeding and management

At this experiment station, seasonal green fodder i.e. oats (November to April), maize (May, June), millet and sorghum (July, August) and Mott grass (September, October) are fed to buffaloes *ad libitum* during the year. A concentrate mixture is offered to milking herd only once a day @ 2 kg per buffalo round the year. The mixture comprises of sunflower meal, cottonseed cakes, wheat bran, rice polish, DCP and rock salt. In addition, animals are grazed for 4 hours daily on natural grasses. The feeding remained uniform over the last many years, so the feeding practices were not taken as a variable in the present analysis. The herd is de-wormed thrice a year with a broad spectrum anthelmintic. Animals are vaccinated against Foot and Mouth disease, Haemorrhagic Septicemia and Black Quarter disease every year and are given bath against ecto-parasites on monthly basis. Buffaloes have been bred by natural service for the last many years. Breeding dates, calving dates and sex of calf born are recorded precisely. Animals are hand milked twice daily at 12 hour interval. Individual milk production is recorded fortnightly. Calves are weaned at the age of 4 months.

Data recording and statistical analysis

Records of buffaloes which calved normally during 1988-2004 were used in the analysis. The records with less than 181 days of lactation were not included in the study. These short records were due to calf mortality, disease or culling of animals. Data on 508 lactation-records were available for 141 buffaloes over a period of 16 years (1988-2004). Out of these, 82 (16.14%) lactations were less than 181 days, so they were not included in the analysis. A total of 426 lactation records were used for analysis from 134 buffaloes.

Information on date of birth, calving dates and calf sex, lactation number, milk yield per lactation and lactation length for each animal was taken. Effect of lactation number, lactation length, season of calving, calf sex and service period was studied on milk yield per lactation. Similarly, effect of lactation number, season of calving, calf sex and service period on lactation length was also studied. The lactation length of buffaloes was classified into 7 groups viz. 182 – 210 days (group 1), 211 – 240 days (group 2), 241 – 270 days (group 3), 271 – 300 days (group 4), 301 – 330 days (group 5), 331 – 360 days (group 6) and 361 – 450 days (group 7). The service period of buffaloes was split into four categories i.e. 30 – 100 days (group 1), 101 – 200 days (group 2), 201 – 300 days (group 3), and > 300 days (group 4). The year was divided into four seasons i.e. autumn (August, September, October), winter (November, December, January), spring (February, March, April) and summer (May, June, July).

Analysis was done by general linear model (GLM) technique, using Minitab statistical computer package (Release 12.22, 1998). Tukey's test was used to find out difference between means. Correlation coefficient was also calculated between lactation length and milk yield.

RESULTS

The overall average milk yield was 1831.6 ± 530.9 liters per lactation (range, 798–3962 liters) with an average lactation length of 273.3 ± 52.8 days (range, 182–447 days). Average age at first conception calculated from 106 records was 1092.3 ± 196.8 days (range, 646–1588 days). The service period computed from 311 records was 166.4 ± 119.0 days (range, 31–676 days).

Effect of parity on milk yield

The data of milk yield during different lactations are presented in Table 1. The milk production was significantly lower in the first lactation than the yield in the 2nd, 3rd and 4th lactation (P<0.05). However, the yield of first lactation was not different from that of 5th, 6th and 7th lactation. Similarly, the milk yield did not differ among second to seventh lactations.

Table 1: Milk yield and lactation length of Nili-Ravi buffaloes in different lactations

Lactation number	Number of cases	Lactation length (days)	Milk yield per lactation (litres)	
			Mean ± SD	Range
1	112	278.2 ± 57.2	1624.0 ± 471.0[a]	832 – 2877
2	109	270.3 ± 55.9	1921.5 ± 567.9[b]	798 – 3962
3	83	274.0 ± 51.4	1891.7 ± 533.0[b]	1058 – 3155
4	51	273.8 ± 51.5	1998.8 ± 585.6[b]	877 – 3841
5	35	265.5 ± 40.2	1868.3 ± 414.0[ab]	1205 – 2617
6	21	274.6 ± 50.5	1894.9 ± 434.5[ab]	1200 – 3142
7 +	15	266.9 ± 41.3	1654.0 ± 395.0[ab]	964 – 2555
Total	426	273.3 ± 52.8	1831.6 ± 530.9	798 – 3962

Means with different superscripts in the same column differ significantly (P<0.05).

Effect of lactation length on milk yield

The data of milk yield for different lactation lengths are presented in Table 2. The milk production increased with increasing lactation length. It was the lowest in the lactations of less than 240 days and the highest in lactation lengths of >361 days (P<0.05). A significant positive correlation was recorded between lactation length and milk yield (r=0.623, P<0.05).

Table 2: Effect of lactation length on milk yield of Nili-Ravi buffaloes

Lactation length (days)	Number of cases	Milk yield per lactation (litres)	
		Mean ± SD	Range
182 – 210	46	1325.0 ± 301.2[a]	798 – 2065
211 – 240	76	1528.6 ± 306.2[a]	877 – 2455
241 – 270	106	1745.0 ± 393.2[b]	893 – 2671
271 – 300	83	1910.3 ± 404.6[bc]	964 – 2785
301 – 330	60	2162.0 ± 513.1[d]	1078 – 3577
331 – 360	26	2093.3 ± 506.3[cd]	1308 – 2899
361 – 447	29	2581.0 ± 596.0[e]	1267 – 3962

Means with different superscripts in the same column differ significantly (P<0.05).

Effect of calving season on milk yield

The season of calving had a significant effect (P<0.05) on milk yield of buffaloes (Table 3). Animals calving in spring showed the highest and those calving in summer showed the lowest milk yield. The milk yield did not differ between the autumn, winter and summer calvers.

Effect of calf sex on milk yield

Out of 417 calvings, 48% buffaloes gave birth to female calves and 52% animals gave birth to male calves. The milk yield of buffaloes giving birth to male (1816.8 ± 526.7 liters per lactation) or female (1847.7 ± 533.5 liters per lactation) calves did not differ significantly.

Effect of service period on milk yield

The milk yield and lactation length of animals conceiving after different time intervals post-partum is given in Table 4. Milk yield of the animals conceiving within 300 days after calving did not differ from each other. However, milk yield of the animals conceiving >300 days after calving was significantly higher than the animals conceiving within 31–100 days after calving. The milk yield did not differ among animals conceiving 101–200, 201-300 and >300 days after calving. Lactation length of these four groups did not differ from each other.

Lactation length

The overall lactation length of 426 records of buffaloes analyzed was 273.3 ± 52.8 days with a range of 182 to 447 days. The lactation length was not affected by parity (Table 1), calving season (Table 3), service period (Table 4) and calf sex.

DISCUSSION

The average milk yield per lactation in Nili-Ravi buffaloes during the period from 1988 to 2004 was recorded as 1831.6 ± 530.9 liters per lactation for an average lactation length of 273.3 ± 52.8 days. This value is in close agreement to the finding of Cady *et al*. (1983; 1811 kg) and Khan and Chaudhry (2000; 1984 kg) for Nili-Ravi buffaloes. Higher yield than that noted in the present study has been reported by Chaudhry (1992). Better feeding and longer lactation might be possible reasons for this difference. Chaudhry (1992)

Table 3: Effect of calving season on lactation length and milk yiled of Nili-Ravi buffaloes

Calving season	Number of calvings	Lactation length (days)	Milk yield per lactation (litres)	
			Mean ± SD	Range
Autumn	183	274.4 ± 53.6	1831.6 ± 538.6a	798 – 3962
Winter	85	282.8 ± 47.7	1912.6 ± 472.1ab	893 – 3114
Spring	29	282.0 ± 55.7	2191.0 ± 630.0b	1161 – 3841
Summer	129	263.7 ± 53.2	1697.5 ± 486.9a	832 – 3577

Means with different superscripts in the same column differ significantly (P<0.05).

Table 4: Effect of service period on milk yield and lactation length of Nili-Ravi buffaloes

Service period (days)	Number of cases	Lactation length (days)	Milk yield per lactation (litres)	
			Mean ± SD	Range
31 – 100	125	269.5 ± 49.0	1846.1 ± 527.5[a]	1005 – 3962
101 – 200	99	269.2 ± 46.0	1858.7 ± 485.0[ab]	798 – 3155
201 – 300	33	280.5 ± 56.4	2017.5 ± 546.6[ab]	993 – 3127
301 – 676	54	273.9 ± 56.3	2045.6 ± 588.5[b]	877 – 3466

Means with different superscripts in the same column differ significantly (P<0.05).

reported an average milk yield of 2031 kg per lactation with an average lactation length of 302 days in Nili-Ravi buffaloes maintained at Bahadurnagar, district Okara, Pakistan.

Milk yield was lower in buffaloes in the first lactation than the yield in the 2nd, 3rd and 4th lactations. It did not differ between second to seventh lactations. According to Cady *et al*. (1983), in Nili-Ravi buffaloes, the milk yield was lowest in the 1st lactation and was not different between 2nd to 5th lactation. According to the present study, the average age at first conception in buffaloes was 1092.3 ± 196.8 days. The animals, however, continued to grow and at the time of first lactation the full production potential was not depicted.

The decline in milk yield has been reported after 4th lactation in buffaloes (Ahmad and Shafiq, 2002). However, in the present study, milk yield did not differ between 2nd to 7th lactation. The reason may be that only high milk yielders were retained for 5 plus lactations. Thirty one per cent animals were retained by 5th lactation in the present study. Almost a similar percentage of buffaloes (35%) reached 5th lactation in a study at Bahadurnagar, Okara (Chaudhry, 1992). Parity has also been shown to affect milk yield per lactation in Sahiwal cattle (Tahir *et al*., 1989; Bajwa *et al*., 2004)

The lactation milk yield increased with increasing lactation length in the present study. A strong correlation has been noted between lactation length and milk yield in buffalo and cattle (Khan, 1997; Dahlin *et al*., 1998). The longer the lactation length, higher the lactation yield. However, total life time yield in such animals will be substantially less comparing with animals with normal lactation length and calving interval. Khan and Chaudhry (2000) observed that the overall relationship between lactation length and milk yield was quite linear in Nili-Ravi buffaloes except for animals with shorter lactation length. Ahmad and Shafiq (2002) also observed that the regression coefficient of lactation length on milk yield was highly significant. A lactation length of 305 days is considered a standard or ideal one. Improved management, feeding and selection can play important role in achieving this goal (305-day lactation length) in buffaloes.

The animals calving in spring showed the highest and those calving in summer showed the lowest milk yield. The reason may be that abundant maize fodder is available to spring calvers during summer in the rain-fed area of Islamabad. However, the summer calvers face stressful hot and humid rainy weather shortly after calving. Chaudhry (1992) also recorded highest milk yield in spring calving (2151 kg) and lowest in autumn calving buffaloes (1960 kg). Ahmad and Shafiq (2002) noted that the maximum and minimum milk production was in winter (2400 kg) and dry hot season (2237 kg). However Raheja *et al.* (1983), Dutt and Yadav (1986) and Ghaffar *et al.* (1991) reported a non-significant effect of season of calving on milk production in Nili-Ravi and Murrah buffaloes. Season can affect milk production in two ways. First, a deficiency of fodder in a particular season, and secondly, seasonal stress due to extreme temperatures and humidity may suppress production at the peak of lactation curve. Conflicting reports on effect of season on milk production indicate that these stress factors may be overcome through better feeding and management.

The milk yield of buffaloes giving birth to male or female calves did not differ in the present study. Basu and Tomar (1981) also observed no influence of calf sex on lactation length and lactation yield in Murrah buffaloes. The male calves are heavier than female calves in Nili-Ravi buffaloes (37 vs 35 kg; Anonymous, 1994) but this factor did not affect milk production. However, Chaudhry (1992) reported that the Nili-Ravi buffaloes giving birth to male calves yielded higher milk per lactation compared to animals giving birth to female calves ((2078 vs 1985 liters per lactation) due to a longer post partum oestrous interval in buffaloes giving birth to male calves.

The milk yield did not differ among animals conceiving within 300 days post partum in the present study. So it may be presumed that early conception did not affect milk production in Nili-Ravi buffaloes. The milk yield was higher in buffaloes conceiving >300 days after calving than animals conceiving with in 100 days after calving but a longer service period is not considered economical (Din and Ahmad 1987). Studies in cows show that although pregnancy related reduction in yields of milk occurred after mid gestation, overall effects of pregnancy on milk production were small (Roche, 2003). The buffalo farmers are usually reluctant to get their buffaloes conceived during first six months of lactation. They believe that it reduces milk production of the animal. A thorough investigation is recommended using data sets from other experimental farms and/or planned studies to clarify the point.

The lactation length did not differ among buffaloes of different parities in the present study. Most of the studies in buffalo have shown a significant effect of parity on lactation length. The difference may be due to a different production set up and different managemental conditions. Cady *et al*. (1983) reported that lactation length decreased with increase in parity in Nili-Ravi buffaloes. Chaudhry (1992) observed the maximum and minimum lactation lengths of 310 and 284 days in the first and sixth lactations, respectively. Khan and Chaudhry (2000) noted that the lactation length was highest (280 days) for the first parity in Nili-Ravi buffaloes. The present study showed no effect of

season of calving on lactation length which supports the observations of Ghaffar *et al*. (1991), Chaudhry (1992) and Khan and Chaudhry (2000).

It is concluded that parity, lactation length and calving season significantly affected milk production in Nili-Ravi buffalo. However, service period and calf sex did not affect the yield. Lactation length was not affected by parity, calving season, calf sex and service period.

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