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PRODUCTIVE AND REPRODUCTIVE PERFORMANCES OF NILI-RAVI BUFFALOES IN SRI LANKA

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Abstract: The productive and reproductive performances of imported Nili - Ravi buffaloes were evaluated under Sri Lankan condition. The mean calving interval between the 1st and the 2nd calvings was 453.9 ± 56.1 (S.D.) days. The mean interval between a calving and the 1st service was 134.2 ± 93.1 days. The mean birth weight for male and female were 30.5 ± 4.52 kg and 28.6 ± 4.58 kg, respectively. The average daily weight gains for male and female up to 1 year of age were 0.50 kg and 0.43 kg, respectively. The mean lactation milk yield after the 1st parturition was 1698.1 ± 451.3 kg and the mean length of the 1st lactation was 291.4 ± 75.2 days. The findings suggested that the interval between a calving and the 1st service and the birth weight were affected by environmental factors, particularly rainfall.

Key words: Calving, environmental factors, growth, milk production, Nili-Ravi buffalo.

INTRODUCTION

Nili-Ravi buffalo is the major dairy animal in Pakistan and the first herd of these animals was imported to Sri Lanka in 1990. Prior to this, the Indian river buffaloes, particularly Murrah and Surti types were imported to improve the genetic potential of indigenous river-type buffaloes. The productive and reproductive performances of imported Murrah and Surti buffaloes have been investigated by several research workers.[1,2] Although, in general, it is well known that Nili-Ravi buffalo has good reproductive performance,[3] little information is available on this animal under Sri Lankan environmental and managerial conditions. Therefore, it was decided to evaluate the calving interval between the 1st and 2nd calving, the interval between a calving and the 1st service, the birth weight, the growth of calves and the 1st lactation as the productive and reproductive performances of imported Nili-Ravi buffaloes in Sri Lanka.

METHODS AND MATERIALS

A total of 217 Nili-Ravi buffalo heifers and a few bulls *(Bubalus bubalis)* had been imported from Pakistan to the National Livestock Development Board (NLDB) farm in Nikaweratiya, Kurunegala District, North Western Province, Sri Lanka in 1990. This farm is situated at latitude $7^0 44'$N and longitude

80°08' E. The elevation is about 100 ft above the sea level. Environmental data were obtained from the Department of Meteorology in Kurunegala District (latitudes 7°28' N and longitudes 80°22' E). The mean minimum temperature was 22.8°C and the mean maximum temperature was 32.0°C. The mean humidity during daytime was 69% and during night time was 85% through out the year. The mean annual rainfall was 1411.6 mm and the difference in day length was 50 mins.

After birth, calves were weaned at 5d and separated in calf hatches for 2 months. Buffalo cows were hand-milked twice a day at 0300h and 1500h and were housed in a semi-covered shed. Water showers were provided to cool the animals during the hottest part of the day. Each buffalo cow was fed with a mixture of *Brachiaria brizantha, Brachiaria mutica,* and native grasses *ad libitum* and 5 kg/day concentrates (PRIMA COW FEED, Sri Lanka, Composition in g/kg Fresh matter: 951 DM, 742 TDN, 137 DCP, 12.4 Ca and 10.1 P). After 3 months post-partum, buffalo cows were allowed to graze on the range and wallow for over 2h before milking at 1500h. Five stud bulls were maintained in this farm and 3 of 5 bulls were daily used to detect cows in oestrus. Females in oestrus were generally served naturally, but artificial insemination services were sometimes used.

Available records of imported Nili-Ravi buffaloes from April 1991 to April 1993 were used. The records indicating dates of calving were used to determine calving intervals. Data concerned with abortions or still births were excluded from the analysis because they were considered to be abnormal. The calving-to-1st service interval indicated the periods from the 1st or 2nd calving to the day when heat and the 1st service were observed. The calving-to-1st service interval was considered to be the post-partum anoestrus period between a calving and the 1st service. Data of the lactation milk yield and lactation length were collected only from the records of the 1st lactation. The lactation length of over 100 days was considered normal for the analysis of the lactation milk yield. The monthly body weight of calves until 12 months of age were checked. Records of the weight loss due to infectious diseases, parasites and unknown reasons were excluded.

RESULTS

Calving intervals

The data for 29 calving intervals between the 1st and the 2nd calvings showed a mean calving interval of 453.9 ± 56.1 (S.D.) days and 72.4% of all calving intervals were within a range of the mean ± S.D. (398-510 d).

Calving-to-1st service interval

The mean interval of 93 calving-to-1st service was 134.2 ± 93.1 (S.D.) days. Table 1 shows the mean calving-to1st service interval in buffalo cows which had calved in the different month. The longest mean calving-to-1st service interval of 203.8 days was observed in females which had calved in March, while the shortest interval of 39.5 days was found in January.

Table 1: The mean calving-to-1st service interval in Nili-Ravi buffalo cows in different months.

Month	Numbers calving	Mean ±S.D.(days)
January	2	39.5 ± 2.5
February	17	194.2 ± 96.6
March	13	203.8 ± 52.8
April	5	111.4 ± 91.5
May	5	90.4 ± 44.1
June	5	101.8 ± 46.3
July	8	106.1 ± 56.1
August	12	153.9 ± 101.2
September	9	117.3 ± 93.1
October	6	120.5 ± 93.3
November	4	44.0 ± 20.6
December	7	40.6 ± 10.4
Total	93	134.2 ± 93.1

Birth weight

The mean birth weight for 140 calves was 29.6 ± 4.64 (S.D.) kg when both sexes were included. The range was between 20kg and 41 kg. The mean birth weight for 75 male and 65 female calves was 30.5 ± 4.52 (S.D.) kg and 28.6 ± 4.58 (S.D.) kg, respectively. The monthly distribution of the mean birth weight is shown in Table 2. Birth weight was highest in December, and lowest in October.

Growth of calves

Figure 1 shows the changes in mean body weight and daily weight gains of both sexes at different ages. Compared to females, the males were always heavier from birth up to 1 year of age. The mean body weight at 1 year of age for males and females were 211.2 ± 25.4 (S.D.) kg and 187.2 ± 31.9 (S.D.) kg, respectively. The mean weight gains for males and females were 0.50 kg/day and 0.43 kg/day, respectively, up to 1 year of age. The mean daily weight gains of both sexes increased from the birth to the 3rd month, temporarily decreased for subsequent 3 months and increased from the 7th month to 1 year of age again. Calves were classified into 2 groups. One group was less than 29.6 kg (the mean birth weight) and another group was more than 29.6 kg. The changes of body weight at different ages were shown in Figure 2. The heavier group at birth always grew better than the lighter group.

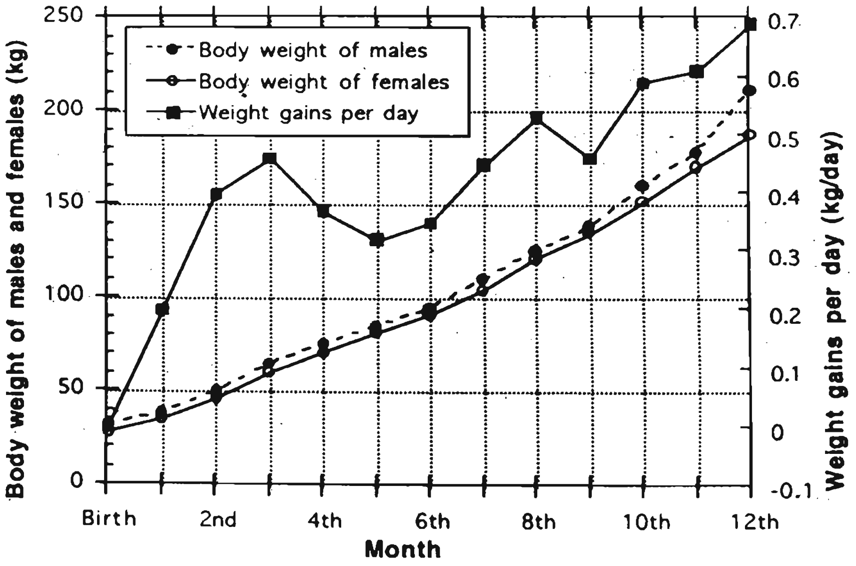

Figure 1: **The comparison of the body weight of male and female (kg) and weight gains per day of both sexes (kg/day) at the different age up to 12th month in Nili-Ravi calves.**

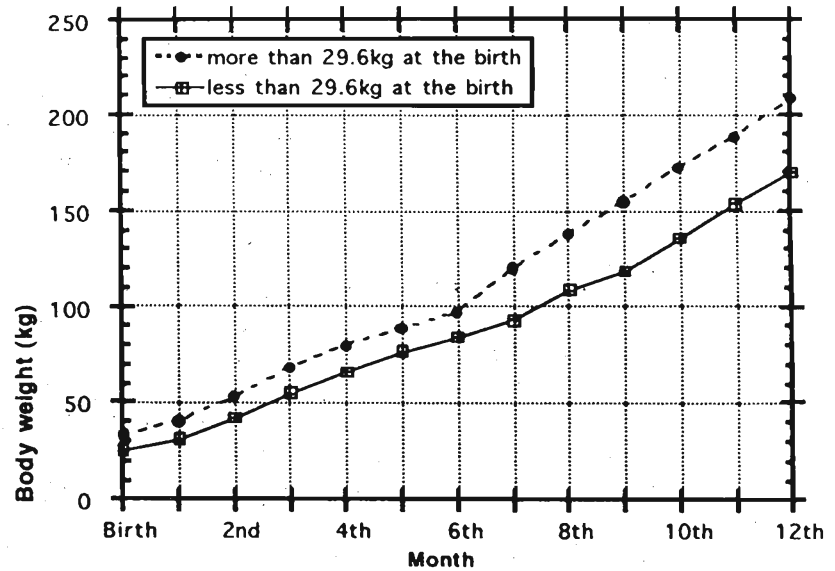

Figure 2: **The comparison of the body weight (kg) of 2 groups classified by the average birth weight (29.6 kg) at the different age up to 12th month in Nili-Ravi calves.**

Table 2: The mean birth weight (kg) of Nili-Ravi buffalo calves born in the different month.

Month	Number of births	Mean weights ± S.D. (kg)
January	10	30.4 ± 3.50
February	22	28.4 ± 4.84
March	23	28.2 ± 3.32
April	5	28.4 ± 5.39
May	5	29.6 ± 3.01
June	7	29.7 ± 4.40
July	13	30.5 ± 5.79
August	19	30.9 ± 5.34
September	9	29.2 ± 4.66
October	8	27.9 ± 4.99
November	5	30.0 ± 3.03
December	14	32.0 ± 3.12
Total	140	29.6 ± 4.64

Lactation

The mean lactation milk yield after the 1st parturition was 1698.1 ± 451.3 (S.D.) kg for 66 lactations and the range was between 634 kg and 2987.5 kg. The mean length of the 1st lactation was 291.4 ± 75.2 (S.D.) days and 5 of 66 buffaloes continued milking until month 14. Figure 3 shows the change of the monthly milk yield. The increase of the lactation yield from the parturition to the 3rd month, a peak milk yield of 230.3 kg in the 3rd month and a subsequent decline were observed.

DISCUSSION

Ahmad *et al.*[4] reported that the calving interval of Nili-Ravi buffaloes which calved in summer and autumn were shorter than the ones which calved in winter and spring in Pakistan. It was suggested that the buffaloes which calved in summer and autumn conceived in the following winter when they became sexually active with the decline of the day length. As Sri Lanka is located near the equator, the change of the day length is less marked through the year than in Pakistan. Sri Lanka is situated in the Indian Ocean and occupies a unique position on account of the very wide range of the rainfall conditions.[5] Sri Lanka can be divided into three major climatological zones, namely, the dry zone, the intermediate zone and the wet zone. The annual rainfall pattern is determined by south-west monsoon called *Yala* and north-east monsoon called *Maha*. Nikaweratiya NLDB farm, where the present study was conducted, is located at the border between the dry zone and the intermediate zone. This farm has two rain seasons during one year. One is the light rain season in April and May during South-West monsoon, another is the heavy rain season in October and November during North-East monsoon

Table 3: Correlation coefficients among the calving-to-1st service interval (CTF), the birth weight (BW), the rainfall (RF), the minimum temperature (MIT), the maximum temperature (MAT), the day humidity (DH) and the night humidity (NH) in Nili-Ravi buffaloes at Nikaweratiya, Sri Lanka.

	NH	DH	MAT	MIT	RF	BW
CTF	-0.47	-0.64*	0.74**	0.12	-0.36	-0.06
BW	0.66*	0.44	0.05	0.45	0.63*	-
RF	0.73**	0.42	-0.21	-0.07	-	-
MIT	0.50	0.56	0.01	-	-	-
MAT	-0.36	-0.75**	-	-	-	-
DH	0.79	-	-	-	-	-

* P< 0.05, ** P< 0.01.

The monthly changes of the mean minimum temperature, the mean maximum temperature, the mean day humidity, the mean night humidity and the rainfall were compared with the calving-to-1st service interval and the birth weight (Fig. 4). Data of the monthly birth weight is moved 2 months forward for analysis. A fetus grows particularly at the end of the pregnant period. The weight of the fetus increases two fold during the last 2 months before the birth. The birth weight is highly influenced in this period. Therefore, the birth weight moved 2 months forward reflects the growth of the fetus in Figure 4. The environmental factors, particularly, the rainfall affected the changes of the calving-to-1st service interval and the birth weight. While a positive relationship is apparently found between the birth weight and the rainfall, the calving-to-1st service interval declined with the onset of rains i.e. during February - April and August - October. Table 3 shows correlation coefficients between the calving-to-1st service interval, birth weight and environmental factors.

The calving-to-1st service interval had a negative correlation with the rainfall, although it was not significant ($r=-0.36$, $p>0.05$). This result means that the post-partum anoestrus period is short after rainfall peaks. Previous reports show that conceptions mainly occurred during the 2-5 months after the North-East monsoon in indigenous[1] and Murrah buffaloes.[2,6] The number of rainfall peaks during one year is different, based on the rainfall pattern of research farms. However, the short post-partum period after the rainfall peak is explained by better pasture growth and the improvement of the pasture quality, so that buffaloes are in good nutritional status and are suitable for conception.[7]

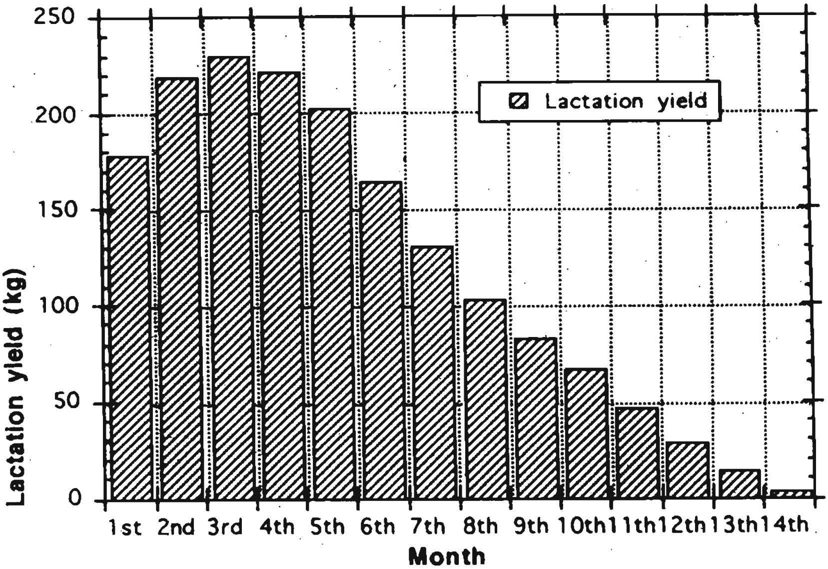

Figure 3: The changes of the 1st lactation yield per month (kg) in Nilli-Ravi buffaloes.

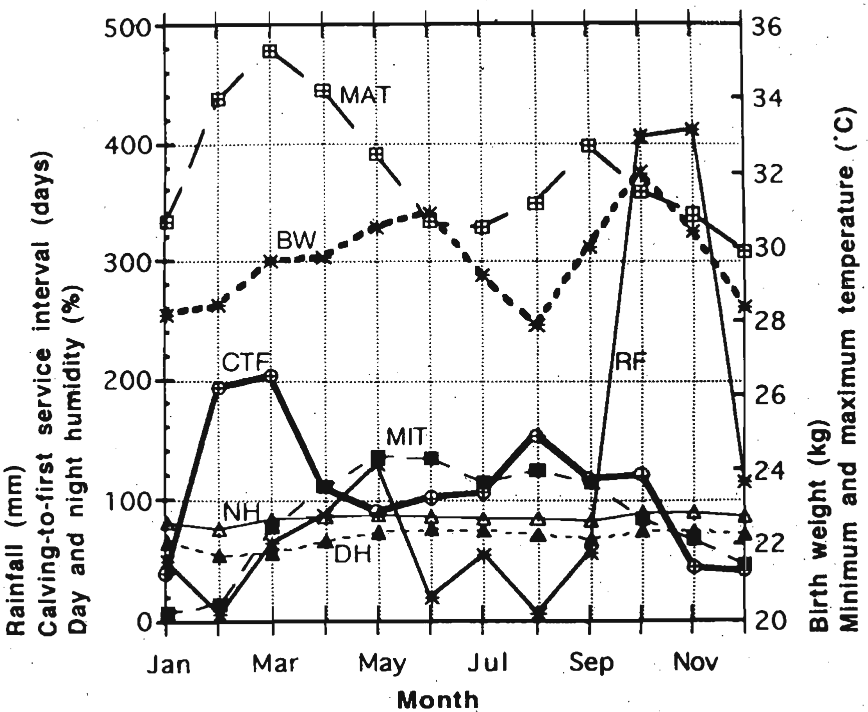

Figure 4: The comparison of the calving-to1st service interval (CTF), and the birth weight (BW), with the changes of the rainfall (RF), the minimum temperature (MIT), the maximum temperature (MAT), the day humidity (DH) and the night humidity (NH) in Nili-Ravi buffaloes at Nikaweratiya, Sri Lanka.

Rajaratne and Ranawana[8] related the difference in pasture quality between the dry and the wet seasons to mineral concentrations in plasma.

The birth weight showed a significant positive correlation with the rainfall ($r=0.63$, $P<0.05$). The improvement of the pasture quality with the increase of the rainfall influenced the growth of the fetus and the birth weight indirectly. Mohamed and Jayaruban[9] reported that supplementary feeding increased body weight gains and decreased the interval from calving to the onset of the first oestrus and to the conception in the indigenous and Murrah buffaloes. Furthermore, they reported that all animals showed a loss in body weight and were not in good nutritional status around the months of September (good pasture for the Nili-Ravi herd was difficult to find before the rains particularly, in March and September). This assumption is supported by the report that lighter buffaloes (less than 400 kg) significantly required longer time for post-partum ovulation than heavier ones (more than 400 kg) in Egyptian buffaloes.[7]

Heat stress reduces the duration and intensity of oestrus. Oestrus is optimal under cool conditions for most livestock.[10,11] The maximum temperature had a highly significant positive correlation with the calving-to-1st service interval ($r=0.74$, $P<0.01$). This means that the high temperature condition causes the long post-partum anoestrus in buffaloes. On the other hand, it is reported that neither high nor low temperature affects the time of oestrus onset or the duration of oestrus, so that climatic factors may not be a major source of variation for the oestrus cycle in swamp buffaloes in the temperate zone.[12,13] However, the high ambient temperature would probably evoke stress and reduce the sexual activity of Nili-Ravi buffaloes in Sri Lanka.

A negative correlation between the day humidity and the calving-to-1st service interval was found to be significant ($r=-0.64$, $p<0.05$). Most research workers have related heat tolerance to various combinations of temperature and humidity. It is clear that high humidity at elevated temperatures acts as a powerful stress factor in the sexual activity of cattle.[14] However, buffalo cows in the present study shortened the post-partum anoestrus period with the rise of the day humidity. This difference may be due to two reasons. First is the highly significant negative correlation ($r=-0.75$, $p<0.01$) between the day humidity and the maximum temperature. The condition might be somewhat humid but the maximum temperature was low in such a condition. In the second place, the change of the humidity relied on the change of the rainfall. The correlation between daytime humidity and rainfall although positive was not significant ($r = 0.42$, $p > 0.05$). Although the condition was humid owing to the rich rainfall, buffalo cows were in good nutritional position during this period. While a hot and humid environmental condition during the last trimester of pregnancy reduced the birth weight of cattle,[15] the correlation between the night humidity and the birth weight was significantly positive ($r=0.66$, $p<0.05$) in the present study. However, it is also possible to explain this correlation by the rainfall pattern as well as the above-mentioned negative correlation between the day humidity and the calving-to-1st service interval.

It is difficult to explain the growth of buffaloes, from only the nutritional status, management, sequence of calving, breeding age, body weight of dam or season of calving. The mean body weight of male at the different age was always heavier than that of female. The temporary decline of the mean body weight gains per day was observed after 3 months of age (Fig. 1). This might be the influence of weaning which had started on that time. As shown in Figure 2, the birth weight appears to be one of the factors related to growth. Heavy calves at birth always grew better than the light ones.

Juma *et al.*[16] reported that the total milking yield was affected by parity in Iraqi buffaloes. The total milking yield increased till the 4th lactation. In the present study, the records of the lactation were collected only from the 1st lactation. The 1st lactation yield was 1698.1 kg. This result is higher than the 1st lactation yield of 1554.0 kg in Murrah buffaloes imported to Sri Lanka and 1592.5 kg in the locally bred Murrahs, which were descendants of the stock imported in 1937.[2] However, the 1st lactation length of 345.7 days in imported Murrahs and 363.9 days in the locally bred Murrahs are longer than that of 291.4 days in imported Nili-Ravi buffaloes.

As this study was conducted in Nili-Ravi buffaloes just after their importation from Pakistan, the results were restricted only to the 1st or 2nd calving. The calving-to-1st service interval and birth weight were already influenced by the environmental factors in Sri Lanka. From now on, not only the 1st calving but also the subsequent calving and lactation should be investigated and compared. The introduction of the new buffalo herds is still continued in order to develop and improve the dairy production and the genetic potential of the indigenous buffaloes. However farm management must take into consideration the effect of seasonal environmental changes in Sri Lanka.

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