# EFFECT OF MILKING FREQUENCY IN COMBINATION WITH RESTRICTED SUCKLING ON MILK YIELD AND CALF PERFORMANCE[1]

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32 Creole and Creole x Friesian cows and their calves were used to compare once or twice daily milking with or without calf suckling in a 2 x 2 factorial arrangements with 8 replications. The suckling calves were allowed to suckle their dams twice daily for the first 30 days and then once daily up to weaning at 90 days. Suckling began 30 minutes after milking and lasted for 30 minutes. Non suckling calves were bucket fed. All calves had free access to a molasses mixture containing 2.5% urea, supplemented with a mixture of 100 g fishmeal and 10 g of mineral mixture daily.

The growth rate of the bucket fed calves was better ($P < .001$) than that of suckled calves, irrespective of milking frequency (0.31 vs 0.22 kg/d). This was attributed to their significantly higher consumption of milk (3.3 vs 2.15 kg/d) and fishmeal (0.106 vs 0.074 kg/d).

Both milking frequencies and suckling had significant effects on the liveweight change of the cow (0.06 vs 0.10 kg/d for once and twice milking respectively; and -0.08 vs 0.04 kg/d for suckling and bucket feeding respectively). There was no interaction between milking frequency and suckling. .

There was no difference in the amount of milk taken out by milking but cows which suckled their calves were significantly more efficient than chose which were conventionally milked in terms of total milk yield (8.55 vs 6.37 kg/d) and saleable milk (6.39 vs 3.06 kg/d).

It is concluded that once daily milking with restricted suckling is the best system of management in terms of net saleable milk production, maintenance of condition in the dam and lowest operating costs.

Key words: Cattle, milk production, milking frequency, calf rearing

It has been shown (Ugarte and Preston 1972,1975; Gaya et al 1977,1978) that restricted suckling can be a more economical system of rearing dairy calves than the artificial rearing system. It reduces the incidence of mastitis in cows and provides an increased stimulus for milk let down.

It was observed by Alvarez (1979 personal communication) that the decrease in milk production in crossbred Bos taurus x Bos indicus cows (Holstein and Brown Swiss x Zebu) when milking frequency was reduced from twice to once daily, was less marked in cows that suckled their calves after milking than when artificial rearing was practised. The trial was set up to test if this benefit due to suckling would be manifested in pure Bos taurus cows (Creole) in Mauritius. The report of Preston and Ugarte (1972) stated that calves from Holstein and Holstein crosses which were suckled twice daily had a better growth rate than those suckled once daily (0.86 vs 0.60 kg/day) and Gaya et al (1978) noted that calves suckled once daily to 90 days old looked stunted at weaning. It was therefore decided to suckle twice daily for the first month and then once daily to 90 days.

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## Materials and Methods

*Treatments, Animals and Design*: Two milking frequencies, once and twice daily, were compared with or without calf suckling, in a 2 x 2 factorial arrangement with 8 replications. Thirty-two Creole and Creole x Friesian cows from Curepipe Livestock Breeding Station were allocated at random to the treatment combination as they calved taking into account their age, average daily production in previous lactations and number of lactations. Cows were confined throughout the experiment in yolk stalls.

*Management and feeding*: Calves were separated from their dams at birth and bucket fed with colostrum for the first 5 days and were subsequently allocated to the treatment combinations. In the suckling treatments the calves had access to their dams twice daily for the first 30 days and then once daily after morning milking up to weaning at 90 days. The, were allowed to suckle for a 30 minute period after milking. An interval of 30 minutes was maintained between the end of milking and suckling. In the once milking treatment, the cows were not milked in the afternoon but were allowed to suckle their calves for 30 minutes starting at 1400 hours.

Non-suckling calves were offered a daily ration of 100 g fishmeal and 10 g of mineral mixture as from the 10 th day after birth and had free access to a molasses mixture containing 2.5% urea (w/w) as from the 15th day after birth. The fishmeal was given separately from the molasses. Fresh cut fodder mostly*Setaria sphaecelata* variety Bua River, was offered on a free choice basis after 3 weeks of age.

Cows were hand milked in the morning between 0730 hr and 0800 hr and in the afternoon between 1400 hr and 1430 hr. Each cow was fed 40 kg cut Setaria grass daily distributed in two feeds at 0930 hr and 1400 hr.

A concentrate mixture was given at the rate of 5 kg/head daily for the first 7 days after calving and subsequently at the rate of 0.375 kg for every kg of milk produced by the cow. The concentrate was fed in two meals daily at 0830 hr and 1330 hr.

*Measurements*: Suckling calves were weighed daily before and after suckling in order to determine their milk consumption and at the same time serve as a check on their growth rate. The non-suckling calves were weighed twice weekly. A record of the intake of molasses and fishmeal was kept throughout the trial. Milk recording was on a daily basis. The cows were weighed individually every two weeks up to the end of the trial.

*Feed analysis*: Feeds were analysed regularly for chemical composition. Nitrogen was determined by the Kjeldahl method. Ether extract and crude fibre were determined by the methods outlined by AOAC (1965). The dry matter percentage (DM) of molasses was calculated after 72 hr in an oven at 70! Statistical analysis of data was done according to the methods outlined by Snedecor and Cochran (1969).

## Results and Discussion

There was little variation in the feeds used (Table 1) except for the forage which was probably not harvested at the same stage of growth every time.

Table 1:
Composition of feed ($\bar{X} \pm SE\ \bar{X}$) on DM Basis

| | DM | N x 6.25 | Crude fibre | Ether extract |
|---|---|---|---|---|
| Cow feed | 80.6 ± 0.71 | 20.7 ± 0.42 | 6.34 ± 0.20 | 1.47 ± 0.09 |
| Fish meal | 89.1 ± 0.13 | 55.6 ± 0.25 | 0.17 ± 0.01 | 3.30 ± 0.27 |
| Setaria forage | 20.5 ± 1.16 | 5.3 ± 0.40 | 37.4 ± 0.50 | 1.89 ± 0.07 |
| Sugar cane tops | 32.1 ± 1.18 | 5.8 ± 0.46 | 31.8 ± 1.43 | - |
| Molasses | 74.1 ± 0.81 | 6.2 ± 0.29 | Brix 84.1 ± 0.68 | |

Sugar cane tops were used as roughage for the lactating cows in order to replace Setaria for a certain period (from August to September) and it had approximately the same composition as Setaria. The noteworthy feature is the low protein and high fibre content of the forage used, which suggests that the Setaria was not harvested at the right stage.

*Animal health:* Eight calves had minor therapy, chiefly for diarrhoea and pneumonia which were not related to the experimental treatments. One calf in the once milking and suckling treatment was so affected, it lost condition rapidly and looked stunted at weaning. It was therefore not included in the analysis. One cow in the twice milking without suckling regime had a difficult calving which resulted in a prolapse of the uterus.

*Suckling and milk let down*: cows in the twice milking treatment tended to retain their milk, especially in the afternoon milking, when the calves were suckled twice daily (for the first month). Subsequently they let down their milk when once daily suckling was performed.

*Performance of calves*: Bucket fed calves grew faster than suckled calves (Tables 2 and 3 and Figure 1), probably because of their significantly higher intake of milk and of fishmeal. Suckled calves tended to have a better conversion of milk into liveweight gain.

*Performance of cows*: The treatment combinations had no significant effect on the amount of milk taken out by milking, which, for twice milking cows, was comparable to those milked once daily, irrespective of whether or not they suckled their calves (Table 3). This lack of effect may have been associated with the short milking interval between morning and afternoon milking (approximately 6h ) and with suckled cows retaining their milk for the calf.

Total and saleable milk production was significantly higher ($P < .01$) for cows which suckled their calves (Table 3). Cows which were milked twice daily lost weight while those milked once daily gained weight. Suckling also led to a reduction in body condition compared with not suckling.

Differences were associated directly with the way the calves were reared. The bucket-fed calves were given milk taken out by milking (3.3 ± 0.03 kg/d) compared with the suckled calves which were estimated to take an additional 2.15 ± 0.14 kg/d of milk from their dams.

*Table 2:*

*Liveweight change of cows and calves over 84 day period with once or twice milking with or without suckling*

| | Once Milking | | Twice Milking | | |
|---|---|---|---|---|---|
| | Bucket fed | Suckling | Bucket fed | Suckling | SE of diff.[2] (P) |
| No of calves | 8 | 7 | 8 | 8 | |
| Initial LW, kg | 30.5 ± 0.85 | 30.4 ± 1.59 | 32.0 ± 1.20 | 30.7 ± 0.81 | |
| Final LW, kg | 54.8 ± 2.93 | 49.4 ± 2.30 | 59.9 ± 2.51 | 51.6 ± 2.72 | |
| Weight gain, kg/d[1] | 0.29 | 0.21 | 0.33 | 0.23 | 0.026 (.01) |
| Feed intake, kg/d | | | | | |
| Milk | 3.3 | 2.1 | 3.3 | 2.2 | 0.136 (.002) |
| Molasses | 0.23 | 0.15 | 0.39 | 0.22 | 0.128 |
| Fish meal | 0.11 | 0.07 | 0.10 | 0.07 | 0.008 (.001) |
| Conversion, kg of milk/kg LW gain | 12.7 | 10.3 | 10.3 | 10.2 | 1.018 |

[1] Determined by linear regression of liveweight time

[2] SE of the difference between any two means

*Table 3:*

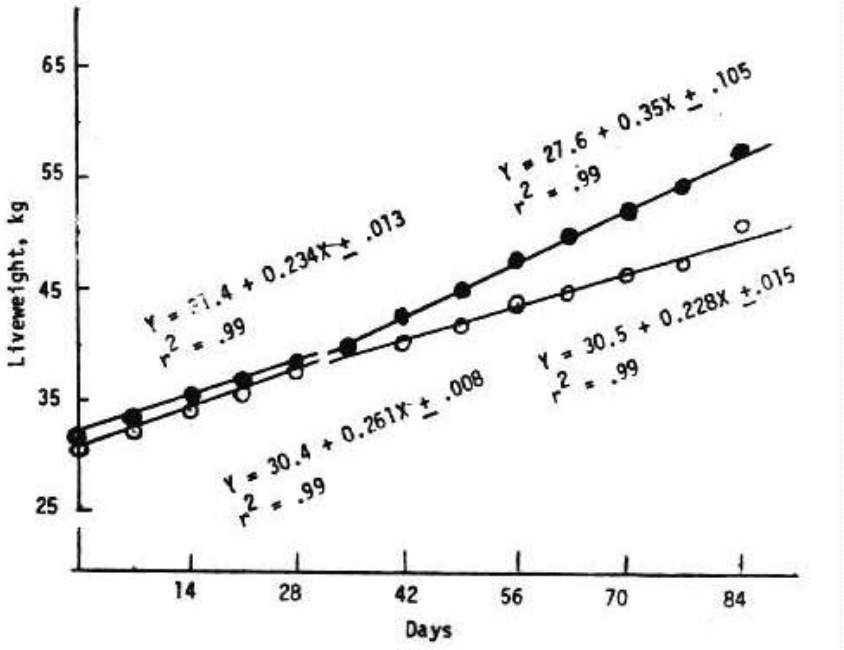
*Effect of milking frequency and suckling on weight gain and milk production (mean values for main treatment effects)*

| | Effect of Milking | | | Effect of Suckling | | | |
|---|---|---|---|---|---|---|---|
| | Once | Twice | P | Without | With | P | SE[2] |
| Liveweight gain, kg/d | | | | | | | |
| Calf | 0.25 | 0.28 | 0.25 | 0.31 | 0.22 | 0.001 | 0.018 |
| Cow | 0.065 | -0.102 | 0.001 | 0.04 | -0.08 | 0.01 | 0.041 |
| Milk production, kg/d | | | | | | | |
| By milking | 6.00 | 6.76 | 0.25 | 6.37 | 6.39 | - | 0.578 |
| Total | 7.06 | 7.86 | 0.25 | 6.37 | 8.55 | 0.01 | 0.61 |
| Saleable | 4.35 | 5.10 | 0.25 | 3.06 | 6.39 | 0.001 | 0.58 |

[1] kg of milk per kg LW gained

[2] Standard error of a difference between any two pairs of means

*Figure 1:*
*Growth curves for calves reareded artificially (**!**) or by restricted suckling (**"**)*




There was a highly significant difference (P< 0.001) in calf growth rate between the suckling and non-suckling treatments. The non-suckling calves grew faster than the suckling ones (0.310 and 0.224 kg daily respectively, Table 3). This difference in liveweight gain was associated with the different level of feed intake. There was a significant difference in the amount of milk consumed (P <0.002) and fishmeal intake (P <0.001) in favour of the non-suckling calves. It is worth pointing out that the fishmeal intake in the non-suckling treatments had a confounding effect as it was given mixed in their milk. This resulted with the non-suckling calves consuming their daily fishmeal ration of 0.106 kg daily compared with only 0.074 kg daily for suckling calves. There was no significant difference between molasses intakes of suckling and non-suckling calves.

The present findings have shown that calves raised by restricted suckling (twice daily for the first 30 days and once for the remaining days to weaning at 90 days) had a significantly lower milk intake, and a lower weaning weight, irrespective of milking frequency, than those which were bucket fed, Daily growth rate of calves which were raised with or without out suckling were 0.21 and 0.29 kg respectively for once milking and 0.23 and 0.33 kg respectively for twice milking with an average weaning weight of 49.4 and 54.8 kg (once milking) and 51.6 and 59.9 kg (twice milking) respectively.

The liveweight change of both suckling and artificially reared calves for the first 30 days and for the subsequent two months up to weaning is a noteworthy feature. The suckling calves on a twice daily suckling regime performed similarly to those reared artificially with an average daily live weight gain of 0.261 and 0.234 kg respectively, but subsequently those reared artificially performed significantly better up to weaning than the suckling calves which were allowed to suckle only once a day - daily LWG of

0.35 and 0.23 kg/d respectively (Figure 1).

This modified twice suckling system permits the calves to have a better start in the first critical month, but they were unable to perform any better later on as they were not consuming enough supplement and molasses mixture. The low milk intake on the once suckling daily regime was not compensated for by a higher intake of molasses and supplement.

The significant difference ($P < 0.001$) in fishmeal intake between the non-suckling and suckling calves is associated directly to the fact that that non-suckling calves received their daily fishmeal ration mixed in their milk. It is believed that the strong fishy odour of the fishmeal resulted in the low intake in the suckling calves. Had the suckling calves consumed their ration of supplement they may have performed as well as the artificially reared calves.

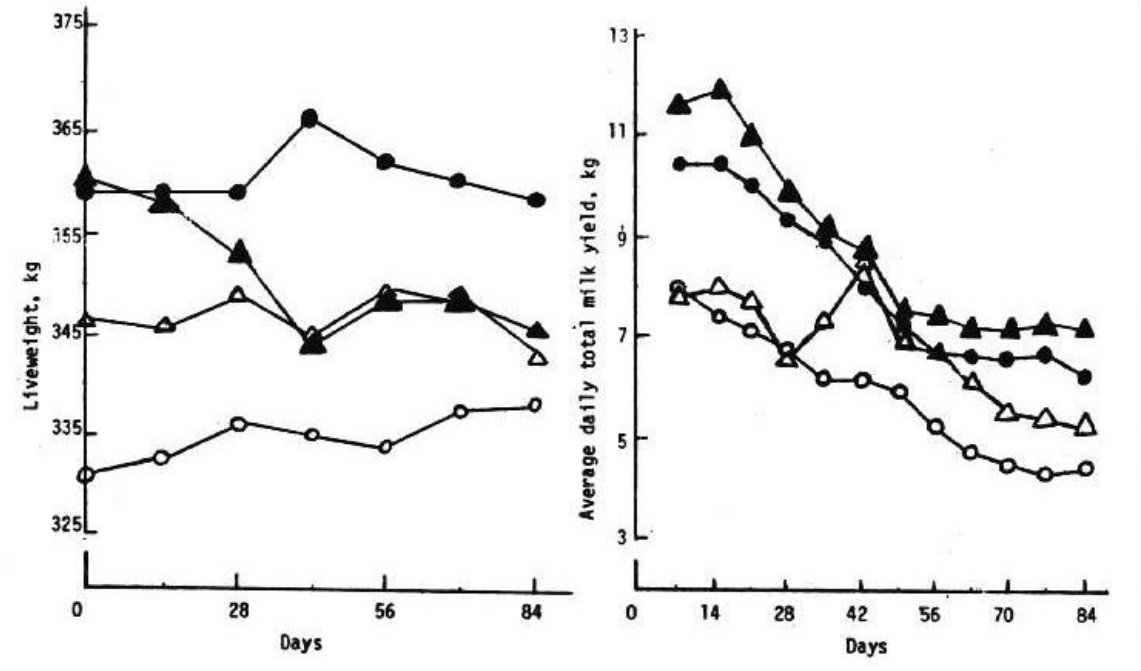
The low milk intake of suckling calves (2.15 kg/day) is less than is required for maintenance as calculated by Roy (1970) to be an average of of 3.0 kg/day for a calf with a birth weight of 30 kg and a weaning weight of 50 kg. The non-suckling calf with its daily ration of 3.3 kg of milk had more than enough to maintain body weight.

On a molasses based diet, the main limiting factors are availability of by-pass protein and glucose precursors (Leng and Preston 1976) and it is known that milk consumed by suckling passes directly into the abomasum via the oesophageal groove, thus representing an efficient source of both protein and energy. This suggests, therefore, that with suckling calves the supplementary diet of molasses/urea and low fishmeal intake must have contributed to a significant degree to the overall nutrition and body maintenance and performance of the animal. This is reflected in the efficiency with which the milk consumed has been utilised (Table 2). There was no significant difference on the milk conversion ratio (kg of milk per Kg LW gained) between the suckling and the non-suckling calves, 10.32 and 11.35 respectively.

Both milking and suckling frequency influence the daily liveweight change and daily milk production. Variance analysis shows that milking and suckling act independently of each other as there exists no interaction between them. This means that suckling is an additional milking stress on the cow which has to synthesize and secrete milk over and above its normal production at the expense of its bodyweight (Figure 2). Results indicate that suckling cows were losing about 0.118 kg daily more than the nonsuckling cows irrespective of milking frequency.

This trial shows that lactating cows which are on a milking and suckling regime are more efficient milk producers than those managed conventionally ie milking only. It appears that cows that were milked either once or twice daily with the calf suckling are equally effective in terms of total daily milk yield - 8.24 and 8.86 kg respectively, but differ significantly ($P< 0.01$) from those whose calves were reared artificially -8.55 vs 6.37 kg/d respectively, as the suckling calf is being fed after the cow has been completely milked, ie over and above its normal milk production. Though the milk yield at milking between once milking with suckling and twice milking only is comparable, it is suggested that the former is a better system of management with the cow not losing condition and more milk being available for sale because of the requirement of the non-suckled calf.

*Figure 2:*
*Change in liveweight and daily total milk yield of cows milked once (!) or twice (▲) daily with calf sucking or once (") or twice (△) without sucking*




The importance of these results relate to the general development of a calf rearing system based on restricted suckling and use of molasses/urea. It offers the possibility of achieving moderate calf performance and increasing both total milk yield and daily saleable milk yield on a system of once daily milking with the calf raised on a modified twice daily suckling system.

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