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# EFFECT OF LIVEWEIGHT AT CALVING AND OF CONCENTRATE LEVEL ON THE PRODUCTION OF MILK FROM GRAZING COWS

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One hundred and two first lactation Holstein cows were distributed at random to 6 treatments according to a factorial design. The factors under study were: Liveweight at calving and the level of concentrate during the lactation. The treatments within the first factor were high and low calving weight and these were combined with the treatments from the second factor, which were 0.5 kg concentrate/litre after the 10th litre; 0.5 kg of concentrate/litre after the 5th litre and 0.5 kg of concentrate/litre after the 5th litre during the first 10 weeks of the lactation.
The high and low calving weight were 479 and 395 kg after calving, respectively. No interactions were found between the two factors under study. The 305 day milk production differed significantly ($P < 0.001$) between the high and low weight treatments after calving, being 3,611 and 4,232 litres per 305 day lactation respectively. The level of concentrate did not affect the production of milk, 4,095; 4,030 and 4,059 litres being obtained for a 305 day lactation for supplementation after the 10th litre, supplementation after 5th litre and supplementation after 5th for 10 weeks, respectively. The inefficient use of concentrate to realize the milking potential of animals with poor body reserves and ample availability of good quality pasture is discussed.

Key Words: Milk production, body condition, Bermuda cross-1, concentrate, grazing

The importance of body reserves to satisfy the energy need which occurs at the peak of lactation in dairy cows is well known (Bath, et al 1965); Moe et al 1971; Miller et al 1968).

Under tropical conditions the use of body reserves is of particular importance. Milk production is frequently limited by the pastures, particularly in high producers during the peak of lactation. Broster (1971), using results from temperate areas, put forward the relationship that exists between weight gain in the second half of gestation and the requirements for concentrate after calving in order realize the potential of the animal. It is not only the weight gain before calving that is important, but also the overall recuperation obtained during the lactation, especially in the last third of lactation.

The mechanism for the full realization of the cows potential can operate when the cows calving weight is adequate, independant of the weight gain in the second half of the gestation (Martínez et al 1978 and Martínez 1981). Nonetheless, both things (pre-calving weight gain and liveweight after calving) are very closely related in livestock production.

Under our conditions, the use of concentrate should be as a supplement to grazing. Martínez et al (1980) obtained little response to con

centrate supplementation when grass was abundant and of good quality. The partial substitution of grass by concentrate increases as the nutritive value of this increases (Campling and Murdoch 1966). This impedes the animals from attaining a high plane of nutrition, which throws doubt on the possibility that heifers of low calving weight could recover their milk yield potential through the use of concentrates.

The objective of this work is to study the effect of the supplementation by concentrates of grazing animals with high and low live weight at the beginning of the lactation.

## Materials and Methods

*Treatments and design:* One hundred and two Holstein cows in their first lactation were distributed randomly to 6 treatments according to a factorial design. The factors under study were liveweight at calving and levels of concentrate supplementation during the lactation. The treatments for low and high calving weight were as follows: (a) Supplementation after the 10th litre; (b) Supplementation after the 5th litre and (c) Supplementation after the 5th litre during the first 10 weeks.

*Procedure:* The animals were brought to the experimental area 3 to 5 months before calving. During this period feeding and management was similar for all of the animals and consisted of feeding grass, plus 2 kg of concentrate. The differences in weight were produced by different growth rates. The animals were allotted to their treatment, according to liveweight, date of calving and milk production during the first 15 days of the lactation.

All the cows grazed together in 28 paddocks of Bermuda Cross No. 1 (*Cynodon dactylon*) which had been sown three years previously The stocking rate was 3.6 animals/ha.

The grazing system used was one of leaders and followers, with the cows in milk grazing the first day, followed by heifers and dry cows on the second day.

Fertilization of the paddock was at 400, 80 and 60 kg of N, $P_2O_5$ and $K_2O$/ha/year, respectively. Irrigation was used during the dry season at the rate of 50 mm each 15 days. 60% of the N was distributed from November through April and 40% between May and October. Liveweight of the cows was measured at three days after calving and then monthly, always after 14 to 16 hr of fasting. The availability of pasture was calculated using the method of Haydock and Shaw (1975). Fibre and N content of the pasture was determined by the method described by Minson and McLeod (1972).

The concentrate was assigned according to treatment and was distributed on individual basis in each of the milking, and every 15 days the amount was adjusted according to the milk yield. All cows were given 2 kg of concentrate for the first 15 days after calving.

Milking started at 0500 hr and 1530 hr, and at 1030 hr the animals passed into open sheds with shade until the end of the afternoon milking

## Results and Discussion

No interaction was found between liveweight at calving and supplement level. Animals with a low body weight at calving need more concentrate to be able to achieve their milking potential. However, the concentrate supplementation of the pasture did not give the expected response because the plane of nutrition was not sufficiently improved.

That good availability and quality of pasture can affect the efficient utilization of concentrate has been shown by Martínez (1981). Table 1 shows the figures corresponding to the availability and quality of the pasture. In all cases the availability surpasses 28 kg of DM/cow/d. Around the 5th bimonthly period a lowering of the availability was noted which was due to insect attack on the grass.

Measurements for quality of pasture were taken at two levels: 20-30cm and 30-40cm above ground level, this being done because the height residual grass after grazing was 17cm in the 5th bimonthly period.

As can be seen from the results from the third and fourth bimonthly period, protein and DM digestibility were below the requirements of an optimum diet.

However, these were also the months of greater availability most of the grazing was being carried out over 30 cm above ground level.

*Table 1:*

*Availability and quality of the Bermuda cross 1* (Cynodon dactylon) *used in the experiment*

| Measurements | 2 month periods | | | | | |
|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI |
| Grass offered/ha (kg DM) | 4018 | 4610 | 5808 | 6894 | 3196 | 4416 |
| Availability/cow in milk (kg DM/cow/day) | 55 | 62 | 73 | 93 | 51 | 68 |
| Availability/all cows (kg DM/cow/day) | 34 | 39 | 51 | 61 | 28 | 38 |
| Crude protein[1], % | 17.6 | 13.1 | 10.3 | 9.1 | 14.1 | 16.2 |
| Crude fibre[1],% | 24.8 | 29.1 | 29.4 | 30.5 | 30.8 | 29.0 |
| Digestibility of the DM,% | 65.0 | 60.7 | 48.6 | 45.9 | 52.0 | 58.6 |

[1] Data are for grass taller than 20 cm, which was where grazing occurred

No significant differences were obtained between supplementation levels as is shown in Tables 2 and 3.

*Table 2:*
*Effect of concentrate supplementation level on milk production*

| Milk production | Conc.after the 10th lt | Conc,after the 5th lt | Conc.after the 5th lt up to 10 weeks | SE |
|---|---|---|---|---|
| 0 - 100 d | 1566.3 | 1528.6 | 1558.3 | ± 42.6 |
| 0 - 200 d | 2834.6 | 2730.6 | 2736.6 | ± 71.6 |
| 0 - 244 d | 3320.3 | 3258.3 | 3256.5 | ±120.1 |
| 0 - 365 d | 3956.0 | 3925.0 | 3883.0 | ±106.2 |
| Duration of lactation (d) | 316.5 | 318.3 | 327.7 | ± 6.6 |
| Production peak (lt) | 18.5 | 18.5 | 18.9 | ± 0.5 |
| % Production of 0-100 d | 38.7 | 39.1 | 40.52 | ± 0.9 |
| Time from calving to peak production (d) | 27.4 | 30.4 | 30.4 | ± 0.9 |
| Concentrate consumption (kg/cow) | 450 | 1200 | 350 | ± 28.0 |

*Table 3:*
*Effect of level of concentrate supplementation on changes in live weight*

| | Conc. after the 10th lt | Conc. after the 5th lt | Conc.after the 5th lt up to 10 weeks | SE |
|---|---|---|---|---|
| Liveweight at 1st calving, kg | 433.4 | 425.4 | 437.6 | ± 5.8 |
| Liveweight at drying off,kg | 511.9 | 491.5 | 492.3 | |
| | ± 4.0 | ± 5.6 | ± 7.9 | |
| Liveweight at 2nd calving, kg | 523.9 | 546.7 | 521.4 | ±10.0 |
| Age at 1st calving (months) | 35.5 | 35.5 | 36.3 | ± 0.8 |

The liveweight at calving caused significant differences between treatments (high and low weights at calving) for the majority of the parameters under study as is reflected in Table 4.

*Table 4:*
*Effect of liveweight at calving on milk production*

| | Milk production (l) | | |
|---|---|---|---|
| | Low wt group (385.2 kg) | High wt group (479.0kg) | SE Sig level |
| 0 - 100 d | 1421.6 | 1680.5 | ± 34.8*** |
| 0 - 200 d | 2535.2 | 2999.2 | ± 58.5*** |
| 0 - 244 d | 3005.5 | 3551.3 | ± 68.3*** |
| 0 - 305 d | 3611.5 | 4232.5 | ± 86.7*** |
| Total | 3660.7 | 4462.5 | ± 116.3*** |
| Duration of lactation (d) | 312.1 | 330.5 | ± 5.4* |
| Production peak (l) | 17.2 | 20.0 | ± 0.4** |
| % of production 0-100 d | 39.6 | 39.2 | ± 0.6 |
| Time from calving to peak (d) | 29.4 | 29.4 | ± 0.7 |

*** P < 0.001
** P < 0.01
* P < 0.05

Each kg of liveweight at the moment of calving represents an increment of 6 l of milk over a 305 d lactation period, when the high liveweight at calving is compared to the low liveweight at calving.

A high recuperation of liveweight was obtained for cows in the low liveweight at calving group. These gained 82 kg during the whole lactation period and the "high liveweight" group gained only 50 kg (Table 5).

*Table 5:*
*Changes in liveweight during lactation according to calving weight*

| Measurement | Low | High | SE Sign level |
|---|---|---|---|
| LW at 1st calving ,kg | 385.2 | 479.0 | ± 4.8 *** |
| LW at drying off,kg | 467.7 | 529.4 | ± 6.6 *** |
| LW at 2nd calving,kg | 513.6 | 547.6 | ± 8.2 *** |
| Age at 1st calving,months | 33.2 | 38.3 | ± 0.7 *** |

*** P < 0.001

Reproduction results obtained were unsatisfactory (Table 6). The high level of concentrate as well as low liveweight at calving considerably extended the calving intervals.

*Table 6:*

*Effect of supplementation level and weight at calving on selected reproductive parameters*

| | Low | High | Conc.after 10th litre | Conc.after 5th litre | Conc.after 5th litre during 10 weeks |
|---|---|---|---|---|---|
| Time from calving to 1st insemination (d) | 70.2 | 84.3 | 79.8 | 83.4 | 68.5 |
| | ±2.3 | ±5.2 | ±2.6 | ±4.5 | ±6.4 |
| Time from calving to gestation (d) | 231.8 | 204.3 | 201.1 | 252.1 | 201.0 |
| | ±8.6 | ±18.5 | ±10.0 | ±14.0 | ±20.3 |
| Interval between calvings (d) | 518.6 | 488.6 | 481.3 | 551.0 | 473.9 |
| | ± 8.4 | ±16.0 | ±9.8 | ±13.9 | ±19.8 |

In the case of concentrate offered after the 5th litre of milk, it could be postulated that there was an effect on the acid-base balance of the animal, which was unfavourable for the reproduction (García López 1979). On the other hand, the majority of the animals came recently calved into the wet season, whose high temperature and high relative humidity often affect reproductive performance in the Holstein breed (McDowell 1974).

Those cows with "low" calving weight were on average 5 months younger than those in the "high" weight treatment. However, no significant adjustment factor was obtained for the covariance between age and milk production between the treatments.

It is concluded that the preparation of high liveweight heifers at the moment of calving is of particular importance in systems with concentrate supplementation to grass of good availability and quality. This is because of the difficulties in raising the plane of nutrition for animals of lower liveweight at calving, due to the substitution of intake of grass for concentrate and to other factors which affect the response to supplementation.

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