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INTAKE AND MILK PRODUCTION IN COWS FED CHOPPED ELEPHANT GRASS (PENNISETUM PURPUREUM) AND CONCENTRATE

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Two experiments were performed to evaluate the effects of concentrate supplementation on intake and milk production of cows at two levels of production consuming ad libitum a basal ration of Elephant grass (*Pennisetum purpureum*). Twelve cows were used in each experiment with a 3 x 3 Latin square design with three levels of concentrate supplementation of 3, 6 and 9 kg/d. Milk production increased linearly (0.68 and 0.38 kg milk/kg concentrate) and was 13.8 and 9.9 kg/d in Experiments 1 and 2 respectively for the highest level of supplementation. The mean intake of forage was 4.67 and 4.06 kg DM/d and decreased by 0.34 and 0.28 kg DM/kg concentrate DM fed.

Key words: Milk production, intake, Pennisetum purpureum, concentrate supplements.

Milk production by cows of European breeds stallfed a basal diet of chopped forage and high levels of concentrate is a production system utilized in tropical regions to decrease the detrimental influence of the climate on this type of animal. Nevertheless, little is known of the effects of supplementation with concentrates on intake and milk production.

This study was intended to evaluate the intake of Elephant grass forage and milk production in cows of two production levels, receiving three levels of supplementation.

Materials and Methods

Two experiments were carried out with cows in their second to fourth lactation . Experiment 1 commenced on the 23 October 1978 and used 12 Holstein cows initially of 449 ± 34 kg liveweight and 64 ± 19 days after parturition. Experiment 2 commenced on the 22 October 1979 and used 3 Holstein and 9 Brown Swiss cows initially of 459 ± 53 kg liveweight and 71 ± 18 days after parturition.

The experimental design consisted of a 3 x 3 Latin Square with periods of 6 weeks, and measurements were made for the last 4 weeks of each period. Treatments consisted of 3 levels (3, 6 and 9 kg/d) of supplementation with the concentrate described in Table 1.

The cows were fed and tied in individual stalls except during milking. Concentrate (3 - 5 kg depending on the treatment) was given to the cows in the milking-parlour, and the remainder was given in the individual stalls at 08.00 h.

The forage, of approximately 65 days growth, was offered ad libitum in two portions at 10.00 h and 16.00 h with an allowance for refusal of approximately 50% of the forage. Samples of offered and refused forage were taken daily and dried at 80 °C. Bulked samples for each period were analysed for crude protein (AOAC, 1965) in both experiments, and for in vitro digestibility (Alexander, 1969) in Experiment 2. A bulked sample of concentrate for each period was analysed for crude protein, crude fibre, lipid and ash (AOAC 1965). The production of milk was measured daily and samples taken weekly for fat analysis (Milko-Tester), protein (Udy 1956) and solids-non-fat by density.

The cows were weighed twice each week, and liveweight change estimated from the linear regression coefficient of liveweight with time.

Table 1:
Chemical composition and components of concentrates.

	Experiment 1	2
Chemical composition (%)		
Crude protein (N x 6.25)	19.4	19.3
Crude fiber	4.5	5.0
Crude fat	5.5	7.9
Nitrogen-free-extract	65.9	61.3
Ash	4.7	6.5
Components (%)		
Corn meal*	68	68
Cottonseed cake	29	29
Common salt	1	1
Mineral mixture	2	2

* Residue of corn grain after processing to remove corn flour

Table 2:
Consumption, live-weight change, milk yield and composition in Experiments 1 and 2.

	Experiment	Supplementation level 3	6	9	$S\bar{x}$
Milk yield (kg/d)	1	10.1	12.4	13.8	0.32**
	2	7.6	8.8	9.9	0.20**
FCM yield 4% fat (kg/d)	1	9.7	11.0	12.5	0.42**
	2	8.1	8.7	9.1	0.25*
Chemical composition (%)					
Fat	1	3.8	3.4	3.4	0.14*
	2	4.4	3.9	3.5	0.21*
Protein	1	3.0	3.1	3.1	0.05
	2	3.3	3.1	3.1	0.9
Non fat solids	1	7.8	7.7	7.8	0.08
	2	8.5	8.6	8.5	0.08
Live-weight change (kg/d)	1	-0.07	0.17	0.23	0.105+
	2	0.05	-0.02	0.07	0.104
Total consumption(kg DM/d)	1	8.27	10.36	11.92	0.18**
	2	7.51	9.65	11.46	0.14**
Forage consumption (kg DM/d)	1	5.51	4.85	3.65	0.18**
	2	4.77	4.17	3.23	0.14**

\+ $P < 0.10$, * $P < 0.05$, ** $P < 0.01$

Results

Forage refusals constituted 46.1 ± 22.7% and 48.2 ± 24.8% of the consumption of dry matter (DM) in Experiment 1 and 2 respectively. Crude protein content of offered forage was 7.2% and 9.6% on a DM basis respectively, and it was estimated by difference that the consumed forage contained 8.1% and 10.1% crude protein on a DM basis in Experiments 1 and 2 respectively. In Experiment 2 in vitro organic matter digestibility of the forage offered was 49.6%, and assuming additive digestibility, the consumed forage had a digestiblity of 53.0%. With increasing concentrate supplement the intake of forage decreased linearly ($P < 0.01$) at the rate of 0.34 and 0.28 kg DM/kg concentrate DM. Nevertheless there was an increase in the total DM with concentrate supplementation (Table 2).

Milk production increased linearly with supplementation at the rate of 0.68 and 0.38 kg milk/kg concentrate DM in Experiments 1 and 2 respectively. Mean milk production was 12.1 and 8.8 kg/d respectively, while production of 4% fat-corrected milk was 11.1 and 8.6 kg/d respectively. Fat content of milk decreased with supplementation in both experiments, but there was no major effect on the other components determined (Table 2). There was an increase in liveweight with supplementation in Experiment 1, but no differences were observed in Experiment 2.

Discussion

Hardison (1966) has pointed out that Elephant grass pasture of more than 50 days maturity is able to sustain milk production of only 3-4 kg/d with the protein and energy content of the pasture limiting production. Similar results have been obtained in recent experiments in this Institute (Arias and Combellas 1979) where without supplementation milk production (corrected for change in liveweight) was 3.7 kg/d. Therefore it appears that supplements are required for lactating cows to reach their production potential when fed Elephant grass alone. The results of Experiments 1 and 2 indicated that the supplementation had a marked effect on milk production that varied with the level of production of the cows. A better response for cows of higher production has been reported previously (Burt 1957; Broster 1972) and attributed to variations in the level of intake. In the cows in Experiment 1 with a mid-lactation milk production of about 14 kg/d, the response of milk production to supplementation was high and the inclusion of 9 kg/d of concentrate could be justified at present prices with a ratio of price per kg of milk and concentrate of 2.47:1. The cows with a production level of approximately 10 kg/d in Experiment 2 responded to a much lesser extent to the same level of supplementation.

With the high level of concentrate, there was an effect of increasing concentrate supplementation on the fat content of the milk (Table 2). This coincided with an increase in the concentrate: forage ratio in the diet. The change in concentrate: forage ratio in the diet was also accompanied by an increase in food intake, and both factors may have contributed to the depression in the fat content of the milk (Broster et al 1979).

Milk production corrected for fat content showed a lesser response to supplementation, but this was still appreciable in the cows with the best production in Experiment 1.

Forage intake observed in both Experiments 1 and 2 was low and less than that reported by Hardison (1966) where intake varied between 1.25-2.37 kg DM/100 kg liveweight. However, in the latter experiments the forage was the only source of

feed or only small quantities of concentrate were given. Recently Veitia (1971) and Cribeiro et al (1979) observed consumption of 4.7 and 4.9 kg DM/day with the same forage supplemented with 3.7 and 10.8 kg of concentrate respectively, utilizing cows at a similar level of production to those in the present experiments.

The concentrate supplementation decreased slightly the forage consumption within the range studied (Table 2). This decrease was also observed by Hardison (1966) with cut forage of low digestibility, while Holmes and Jones (1964) reported a positive relationship between digestibility and depression of intake due to concentrate supplements.

The low energy content of the elephant grass used in the present experiments cannot be attributed only to maturity since Hardison (1966) observed that when cut at 20-30 d, the energy content of the forage permitted production of less than 5 kg milk/d. Under grazing conditions high milk production has been reported (Lucci et al 1969; Caro-Costas and Vicente-Chandler 1974) suggesting a capacity for selection by animals under these grazing conditions.

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