EFFECTS OF MOLASSES AT DIFFERENT LEVELS IN CONCENTRATE SUPPLEMENT ON MILK CONSTITUENTS AND BLOOD METABOLITES OF DAIRY COWS GRAZING SETARIA GRASS (*SETARIA SPHACELATA*) PASTURE IN FIJI

E. V. Tamani[1], E. M. Aregheore[2], P. Manueli[3]

[1]*Pasture Research and Development Unit, Animal Health and Production Division, Ministry of Agriculture, Sugar and Land Resettlement, Koronivia Research Station, Nasouri, Fiji*
[2]*The University of the South Pacific, School of Agriculture, Animal Science Department, Alafua Campus, Apia, Samoa*
[3]*Secretariat of the Pacific Community (SPC), Animal Health and Production Division, Private Mail Bag, Suva, Fiji*

The effect of molasses at different levels in concentrate supplement on voluntary dry matter intake, milk yield; milk constituents and blood metabolites of cows grazing *Setaria* grass pastures was investigated using thirty Friesian cows, 6–7 years old, mean pre-experimental body weight of 428 ± 6.5 kg, allotted to five dietary treatments in a completely randomized design experiment that lasted for 126 days. Experimental treatments were forage alone; and forage + concentrate mixtures with molasses included at 0, 5, 10 or 15% levels and they were designated as T_1, T_2, T_3, T_4 and T_5, respectively. Forage intake of cows in T_1 (forage alone) was higher than those of cows on T_2, T_3, T_4 and T_5, however the differences observed were not statistically significant ($P > 0.05$). Concentrate dry matter intake increased with increase in the level of molasses in diets, but concentrates intakes were also not statistically significant ($P > 0.05$). Total dry matter (DM) intakes (forage + concentrate) were significantly higher ($P < 0.001$) for cows on concentrate mixtures than those on forage only. Average milk yield among the treatments were significantly different ($P < 0.05$) from each other. Pre-experimental milk protein and milk fats for all cows were 2.2 and 1.8 mg/100 ml, respectively. There were no significant differences due to dietary treatments among the cows in the concentration of milk protein and milk fats. However the period had significant ($P < 0.05$) effects on milk protein and milk fats and these values are higher than pre-experimental period values indicating the influence of dietary treatment over time. Pre-experimental blood glucose and blood urea-N for the cows were 1.1 and 3.1 mg/100ml, respectively. Dietary treatments and period had significant effects on blood glucose concentrations of the cows and the values were higher than the pre-experimental period. Blood urea-N was not affected by dietary treatments. Results of this trial show that the dietary treatments were sufficient to meet the protein and energy requirements of the cows for milk production. Data on voluntary DMI, milk yield and milk constituents, seems to suggest that milk yield of cows could be modulated by level of molasses in the concentrate mixtures and therefore molasses levels that ranges between 5–10% are most suitable. In conclusion the 10% level seems the best and therefore it is recommended for inclusion in the concentrate mixtures of lactating dairy cows on a basal diet of *Setaria sphacelata* in Fiji.

molasses; *Setaria* grass; dairy cow; blood urea-N, blood glucose; milk protein and fat; Fiji

INTRODUCTION

Dairy cow nutrition is mostly affected by the inappropriate use of available energy supplements in Fiji (e.g. molasses). Fiji is the only small island in the South Pacific that has an established dairy industry, however, the efficiency of milk production from existing lactating cows is not optimized due to many associated factors, especially nutrition. The existing forage resources have nutritional limitations and therefore, this call for the use of supplementary feeds to complement the low quality diets of lactating dairy cows. The potential of local forages is limited by long dry periods and overgrazing that leads to permanent weed ingression and loss of productive pastures composition.

Mineral deficiencies, such as sodium, copper and sulfur, reduce the forage quality and result in low digestibility and nutritive value of *Setaria* and other native pastures. Also low legume content of most pastures and inadequate use of protein and energy supplements during the May–November dry season are some of the factors that affect milk yield, milk constituents and blood metabolites of dairy cows in Fiji.

Inadequate nutrition has always been highlighted as the prominent drawback and a major reason why milking cows in Fiji produce well below average compared to cows in New Zealand and Australia. Australia and New Zealand dairy farmers use other sources of supplement to complement the basal diet of forage of lactating cows on a daily basis. The important role of protein-energy interactions in the rumen has been stressed (Oldham, Alderman, 1981; Tamani, 2004). This research aims at increasing milk production by ensuring that the nutritional needs for maintenance is fully met first, so that further physiological activities of producing cows are maximized. Therefore, the aim of this study was to investigate

the effect of inclusion of molasses at different levels in concentrate mixture on voluntary dry matter intake, milk yield and constituents; blood glucose and urea concentrations of cows grazing a basal diet of Setaria grass pastures in the Central Division of Fiji.

MATERIAL AND METHODS

Location

The experiment was carried out at the Koronivia Research Station – Livestock Research Unit, Nausori (18° S, 178° 30′ E), which is situated 19 km north of Suva at an altitude of about 15-m above sea level. The annual rainfall is 3050 mm while mean annual temperature is 24.4 °C.

Animals, diets and experimental design

Thirty milking Friesian cows, 6–7 years old, mean pre-experimental body weight of 428 ± 6.5 kg and in their early stage of lactation were allotted randomly to five dietary treatments in a completely randomized design with six replications. Each cow was ear tagged for individual identification purposes and represented an experimental unit. The dietary treatments were forage alone, and forage/concentrate mixtures with molasses included at 0, 5, 10 or 15% levels. The dietary treatments were designated as T_1 – forage alone (*Sateria sphacelata*); T_2 – forage/concentrate without molasses (0%); T_3 – forage/concentrate with 5% molasses; T_4 – forage/concentrate with 10% molasses; and T_5 – forage/concentrate with 15% molasses

The feedstuffs and ingredients used for the concentrate mixtures were dried brewer's grains, mill mix (bran and pollard), copra meal, salt, micro-ingredients and molasses. Table 1 presents the percentage composition of the concentrate mixtures. The concentrate mixtures were formulated to contain 18% CP on DM basis, the level considered optimal for dairy cows raised under the tropical conditions of Fiji (Crest Feed, 2002).

Grazing

The experiment started in August 19, 2002 and ended in December 22, 2002 (126 days). An adaptation period of 15 days allowed the animal to get used to the treatments before data collection. The cows were grazed in 16 night paddocks composed of Setaria (*Setaria sphacelata*) as the main grass. The paddocks were stripped depending on their size and the cows grazed the paddocks on rotational basis for 25–28 days. During the day, the cows were grazed on three stripped paddocks located near the milking shed on a 15–18-day rotation. The cows have access to fresh clean drinking water and mineral lick blocks.

Representative herbage samples, of what the cows ate, were collected at the beginning, middle and end of the experiment. The samples were dried, processed and stored until required for chemical analysis. Voluntary herbage intake of cows in the paddocks was estimated as:

Table 1. Percentage composition of concentrate mixtures

Feedstuff / Ingredients	Diets			
	0	5	10	15
Mill mix	53.0	43.0	34.0	25.0
Molasses	–	5.0	10.0	15.0
Dried brewer's grains	5.0	10.0	14.0	18.0
Coconut meal	40.0	40.0	40.0	40.0
Salt (NaCl)	0.5	0.5	0.5	0.5
Premix*	1.5	1.5	1.5	1.5
Total	100.0	100.0	100.0	100.0

*ALROC Livestock mineral supplement (ALROC Companies, Australia) contains: phosphorus 3252 mg/kg, potassium 3787 mg/kg, sulphur 1.32%, calcium 5.30%, magnesium 2.6%, iron 1.81 mg/kg, manganese 344 mg/kg, copper 20.4 mg/kg, zinc 52.2 mg/kg, sodium 3.19%

$$\text{Forage intake (kg/d)} = \frac{\text{Faecal output (kg/d)}}{1 - \text{herbage digestibility}}$$

Concentrate feeding and management

The concentrate mixtures were prepared on a weekly basis from the same batch of feedstuffs and ingredients. During each milking time at 06.00 and 15.00 h, 300 g of the concentrate was given to avoid spillage, however the rest of the concentrate portion (7.4 kg) for each cow was given after the morning and evening milking in individual feeding stalls before they were returned to paddocks for grazing. The amounts of concentrate offered in the feeding stalls were estimated at the ratio of 2 litres of milk to 1 kg of concentrate (S a m s o n , 1993). Concentrate mixtures offered to the cows were reduced or increased depending on intake and refusals recorded on a daily basis to determine actual intake. Total feed intake for each cow was the sum of voluntary forage intake and concentrate mixture offered and consumed.

Milk yield and composition

Milk yield was recorded daily during the morning (06.00 h) and evening (15.00 h) milking sessions to determine actual daily milk yield using the Waikato Milk Meters, (Waikato, NZ). Milk samples were collected from cows in each treatment at the pre-experimental period and at 32, 60, 90, and 120 days into 200 ml cylindrical sampling bottles (Becton Dickson, NZ). Milk samples collected each period were analyzed for milk fat and protein.

Blood composition

Blood samples were collected at 0 day (pre-experimental period as reference point), and at 18 and 92 days. Blood was collected through the jugular vein and 5–10 ml of blood was taken. Blood sample was collected before the morning feeding into bijou bottles. The blood was allowed to clot at room temperature for approximately 15 minutes

and then placed on ice and later centrifuged (Quantum Scientific PTY Ltd, Queensland, Australia) for 10 minutes at 1500 g to separate the serum and plasma, and stored at –80 °C until required for analysis. The processed blood samples were analyzed for blood glucose and blood urea-N (BUN).

Proximate analysis

The AOAC (1990) procedure was used for proximate chemical analyses of available nutrients in the forage, concentrate mixtures and faecal samples. Dry matter (DM) was by drying at constant weight at 70 °C for 24 h in a forced-air oven, ash by incineration at 600 °C for 2 h, protein by the micro-Kjeldahl procedure (N x 6.25) (Procedure ID Number 954.02). Fibre fractions, neutral detergent fibre (NDF), acid detergent fibre (ADF), acid detergent lignin, cellulose and hemicellulose were determined by the procedures of Van Soest et al. (1991). The NDF was assayed with sodium sulfite, without alpha amylase and was expressed with residual ash. All analyses were completed in triplicate. The gross energy (MJ/kg) values of feedstuffs, concentrate mixtures, forage and faecal samples were determined using a bomb calorimeter (Adiabatic bomb, Parr Instrument Co. Molin, IL, USA) with thermochemical benzoic acid as the standard. Gross energy values of the respective dietary treatments were converted to metabolizable energy (ME MJ/kg DM).

Milk fat and protein analyses were carried out according to the procedures outlined by Kirk, Sawher (1991) and AOAC (1990), respectively. Blood glucose was estimated by a colorimetric assay based on the use of hexokinase and glucose-6-phosphate dehydogenase (G-6PD), Kunst et al. (1983), while blood urea-N (BUN) concentration was estimated by the method of Talke and Schubert (1965).

Statistical analysis

The experiment was a completely randomized design with five dietary treatments and data on voluntary dry matter intake (DMI), milk yield, milk fat and protein; and blood glucose and urea-N were analyzed using standard analysis of variance (ANOVA) using MINITAB (2000) statistical software. The LSD procedure was used to separate means in the presence of a significant ($P < 0.05$; $P < 0.001$), F-test for treatment.

RESULTS

Proximate chemical composition of diets

Chemical composition of the forage (*Setaria sphacelata*) and concentrate mixtures is presented in Table 2. Crude protein (CP) content of the concentrate diets was within the range of 18.0–18.2% compared to 11.1% for forage. Ash content of the forage was however higher than that of the concentrate mixtures. Fibre fractions (NDF, ADF, ADL, hemicellulose and cellulose) were higher in T_2, T_3, T_4 and T_5 than in T_1. However, among the concentrate mixtures T_2 (0% molasses) had higher NDF than T_3, T_4 and T_5. Metabolizable energy (MJ/kg DM) of the dietary treatments was 8.3, 9.9, 10.3, 11.0, and 10.0 MJ/kg DM) for T_1, T_2, T_3, T_4 and T_5, respectively.

Table 2. Proximate chemical composition of forage and experimental diets

Components	Diets[a]				
	T_1	T_2	T_3	T_4	T_5
Dry matter – DM (%)	15.8	89.5	88.9	88.7	88.6
On dry matter basis					
Crude protein	11.1	18.1	18.0	18.0	18.2
Ether extract	2.7	5.3	6.3	6.3	6.4
Ash	12.2	6.4	6.6	6.8	7.1
Neutral detergent fibre	27.1	38.2	36.5	34.6	33.9
Acid detergent fibre	12.5	20.2	20.4	20.5	20.8
Acid detergent lignin	6.8	10.7	10.8	10.8	10.9
Hemicellulose	14.6	18.0	16.1	14.1	13.1
Cellulose	5.7	9.5	9.6	9.7	9.9
Organic matter	87.8	93.6	93.4	93.2	92.9
Metabolizable energy (MJ/kg DM)	8.3	9.9	10.3	11.0	11.0

[a] T_1 – forage alone (*Sateria sphacelata*), T_2 – forage/concentrate without molasses (0%), T_3 – forage/concentrate with 5% molasses, T_4 – forage/concentrate with 10% molasses, T_5 – forage/concentrate with 15% molasses

Feed intake and milk yield

Table 3 presents data on voluntary DMI and milk yield. Forage DMI of cows in T_1 (forage alone) was higher than that of cows that had T_2, T_3, T_4 and T_5, however the differences observed were not statistically significant ($P > 0.05$). Concentrate DMI increased with an increase in the level of molasses, but these were also not statistically significant ($P > 0.05$).

Total DMI (forage + concentrate) was significantly higher ($P < 0.001$) for cows on concentrate mixtures than those on forage only. The percentage intake of forage DM was higher than that of concentrate DM intake for cows on forage/concentrate mixtures with or without molasses.

Average milk yield of cows was 914.8, 924.5, 1221.4, 1418.4 and 1017.9 l for T_1, T_2, T_3, T_4 and T_5, respectively. Milk yield of cows in T_1 (forage alone) was the lowest. Among cows in the concentrate mixtures, milk yield was higher in the cows that received T_4, followed by those cows on T_3, T_5 then T_2 (forage/concentrate mixtures with molasses at 10, 5, 15 and 0%, respectively). Average milk yield among the treatments was significantly different ($P < 0.05$) from each other. Milk yield of cows in T_4 was 503.6, 493.9, 197 and 400.5 l higher than that of cows on T_1, T_2, T_3, and T_5, respectively.

Table 3. Effects of molasses levels on total dry matter intake and milk yield of cows

Parameters	Diets[a]							
	T_1	T_2	T_3	T_4	T_5	s.e.m.	l.s.d.	Sign.
Forage intake (kg/d)	10.5	9.2	8.7	8.6	8.1	0.43	3.31	ns
Concentrate (kg/d)	–	5.9	5.9	6.1	6.5	0.43	0.78	ns
Total dry matter intake (kg/d) (forage + concentrate)	10.5	14.9	14.6	14.6	14.6	0.49	3.16	*
Percentage of forage intake	100	60.9	59.6	58.2	55.8	–	–	–
Percentage of concentrate intake	0	39.1	40.4	41.8	44.2	–	–	–
Average milk yield (litres)	914.8	924.5	1221.4	1418.4	1017.9	56.2	371.6	*
Average daily milk yield (litres)	7.3	7.3	9.7	11.3	8.1	0.45	2.95	*

[a] T_1 – forage alone (*Sateria sphacelata*), T_2 – forage/concentrate without molasses (0%), T_3 – forage/concentrate with 5% molasses, T_4 – forage/concentrate with 10% molasses, T_5 – forage/concentrate with 15% molasses
s.e.m. = standard error of mean, l.s.d. – least significance difference, Sign.– significance
ns = not significant, * $P < 0.05$

Table 4. Milk protein (mg/100 ml) and milk fat (mg/100 ml) concentration of cows fed forage alone or forage supplemented with concentrate with varying levels of molasses

Milk protein	Diets[a]					
Period (days)	T_1	T_2	T_3	T_4	T_5	Mean
0	2.1	1.9	2.4	2.2	2.4	2.2
30	3.3	3.4	3.5	3.3	3.4	3.4a
60	3.0	3.1	3.1	3.0	3.0	3.1b
90	3.0	2.9	3.0	2.9	2.9	2.9bc
120	2.8	2.8	3.0	2.5	3.0	2.8c
Mean	3.0a	3.2a	3.2a	3.1a	2.9a	–
Milk fat						
0	1.5	2.0	2.2	1.7	1.5	1.8
30	3.6	2.9	3.0	2.9	3.4	3.2ab
60	2.9	3.0	3.0	2.7	2.7	2.9b
90	3.1	3.4	3.3	2.9	3.0	3.2ab
120	3.5	3.6	3.3	3.4	3.2	3.4a
Mean	3.3a	3.2a	3.0a	2.9a	3.1a	–

[a] T_1 – forage alone (*Sateria sphacelata*), T_2 – forage/concentrate without molasses (0%), T_3 – forage/concentrate with 5% molasses, T_4 – forage/concentrate with 10% molasses, T_5 – forage/concentrate with 15% molasses
Means followed by the same letter are not different at $P = 0.05$ using LSD

Milk protein and fat

Table 4 presents the data on milk protein and milk fat. Mean milk protein concentration of cows was 3.0, 3.2, 3.2, 3.1 and 2.9 mg/100ml for T_1, T_2, T_3, T_4, and T_5, respectively. The above values did not differ significantly from the mean value of 2.2 mg/100ml for all cows at the pre-experimental period. The concentration of milk protein between the dietary treatments did not differ significantly ($P > 0.05$), however, between the periods at 30, 60, 90 and 120 days, there was a significant increase in milk protein over time (Fig. 1). Milk protein increased with time up to the 60 day period for all dietary treatments. The data between 41% (15% molasses) and 75% (10% molasses) of variability in milk protein were explained by differences in period of milking. A highly significant ($P < 0.001$) correlation coefficient was established between milk protein concentration and period (days) with $r^2 = 0.70$, $r^2 = 0.67$, $r^2 = 0.49$ and $r^2 = 0.41$ for forage alone and forage plus concentrate diets with 0%, 5% and 15% molasses inclusion, respectively. Similarly, there was a significant ($P < 0.05$) correlation coefficient between milk protein and period for cows on forage + 10% molasses concentrate, $r^2 = 0.75$. The degree of closeness between the relationships of milk protein concentration over time can be explained by the quadratic equations as follows:

$T_1 = -0.0002\,x^2 + 0.0275\,x + 2.2629$

$T_2 = -0.0002\,x^2 + 0.0339\,x + 2.1171$

$T_3 = -0.0002\,x^2 + 0.0204\,x + 2.5886$

$T_4 = -0.0002\,x^2 + 0.0273\,x + 2.34$

$T_5 = -0.0002\,x^2 + 0.0166\,x + 2.5857$

Milk fat

Milk fat concentration of cows in all treatments followed the same trend as milk protein ($P > 0.05$). An effect

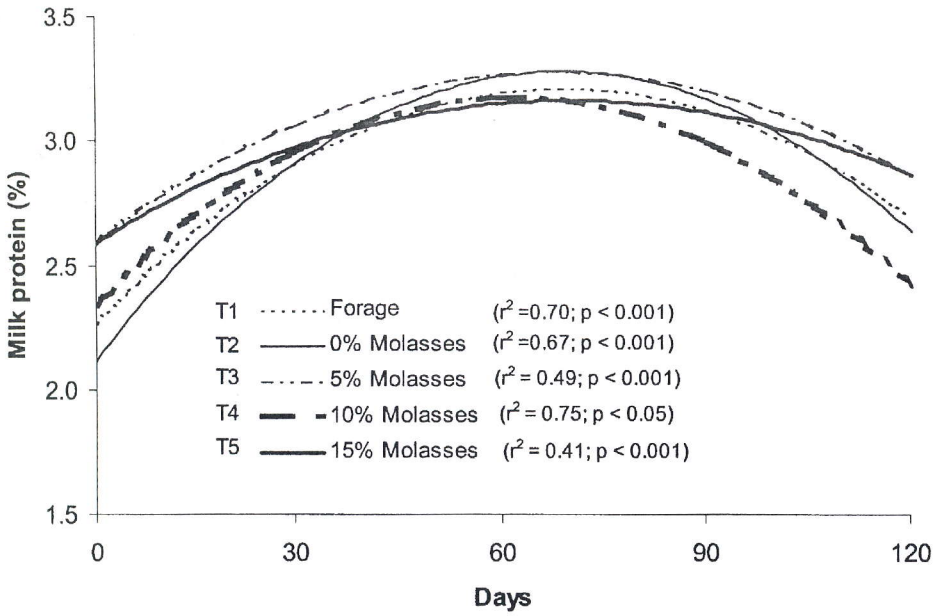

Fig. 1. Trend of milk protein concentration of cows fed forage alone or forage supplemented with concentrate with varying levels of molasses on monthly intervals during the experimental period

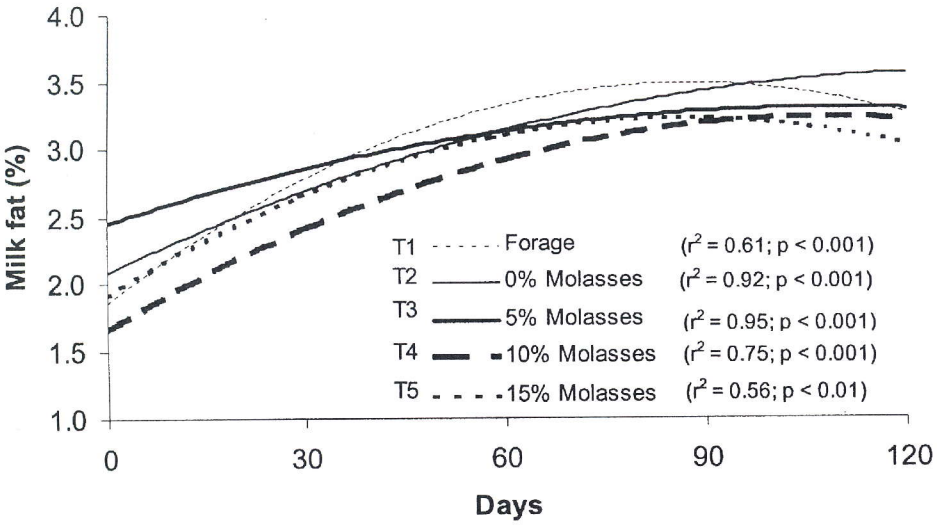

Fig. 2. Trend of milk fat concentration of cows fed forage alone or forage supplemented with concentrate with varying levels of molasses on monthly intervals during the experimental period

of periods on milk fat production of cows in the different dietary treatments is represented graphically in Fig. 2. Mean milk fat concentration of cows was 3.3, 3.2, 3.0, 2.9 and 3.1 mg/100ml for T_1, T_2, T_3, T_4, and T_5, respectively and periods had significant influence ($P < 0.05$) on milk fat concentration of cows in all treatments (Table 4).

Milk fat increased with time and reached the highest levels at 120 days for cows in all dietary treatments. Coefficient determination (r^2) between milk fat and period (days) was 0.61, 0.92, 0.95 and 0.75 for cows on forage alone and forage/concentrate mixtures with molasses at 0%, 5%, 10%, and 15%.

$T_1 = -0.0002\,x^2 + 0.0355\,x + 1.8629$

$T_2 = -0.0009\,x^2 + 0.0228\,x + 2.0829$

$T_3 = -0.0001\,x + 0.0204\,x + 2.2743$

$T_4 = -0.0002\,x^2 + 0.0209\,x + 1.8971$

$T_5 = -0.0002\,x^2 + 0.0329\,x + 1.8171$

Blood glucose and blood Urea-N

Table 5 presents the data on the effects of dietary treatments on blood glucose and blood urea-N concentration of cows. Blood glucose concentration of cows prior to the experiment (pre-experimental period) was comparatively low with a mean value of 1.1 mg/100 ml. However, when the cows had fully adjusted to dietary treatments, periods had significant ($P < 0.05$) effects on blood glucose concentration. Periods and treatments had effects on blood glucose of cows ($P < 0.05$) and mean blood glucose concentrations were 3.1, 3.5, 3.6, 3.7 and 3.9 mg/100 ml for T_1, T_2, T_3, T_4, and T_5, respectively and these values were higher than mean value obtained at the pre-experimental period.

At the pre-experimental period cows had mean blood urea-N concentration of 3.1 mg/100 ml. However, after adjustment, dietary treatments had a significant effect ($P < 0.05$), on blood urea-N of cows on T_1, T_2, T_3, T_4, and T_5.

Table 5. Blood glucose (mg/100 ml) and blood urea-N (BUN) (mg/100 ml) concentrations at pre-, mid- and post-experimental period of lactating cows fed forage alone or forage supplemented with concentrate with varying levels of molasses

Blood glucose	Diets [a]					
Period (days)	T_1	T_2	T_3	T_4	T_5	Mean
0	1.0	0.9	1.3	1.0	1.2	1.1
18	2.8	3.4	3.5	3.5	3.7	3.4
92	3.3	3.6	3.6	3.9	4.1	3.7
Mean	3.1c	3.5b	3.6ab	3.7ab	3.9a	–
Blood urea						
0	3.5	3.2	2.7	3.3	2.9	3.1
18	3.2	5.3	5.3	5.1	4.9	4.7a
92	3.0	4.4	3.7	3.9	3.9	3.8b
Mean	3.1b	4.8a	4.5a	4.5a	4.3a	–

[a] T_1 – forage alone (*Sateria sphacelata*), T_2 – forage/concentrate without molasses (0%), T_3 – forage/concentrate with 5% molasses, T_4 – forage/concentrate with 10% molasses, T_5 – forage/concentrate with 15% molasses
Means followed by the same letter are not different at $P = 0.05$ using LSD

Except for cows on T_2, and T_3 period had no significant effects on the blood urea-N concentration of the cows ($P > 0.05$). Mean blood urea-N concentration was 3.1, 4.8, 4.5, 4.5 and 4.3 mg/100 ml for T_1, T_2, T_3, T_4, and T_5, respectively.

DISCUSSION

Compared to other grass species in Fiji, *Setaria sphacelata* has high dry matter yield, nutritive value and persistence. These qualities have over the years attracted dairy farmers in Fiji to its usage (Ranacou, 1985). The average CP content of 18.1% for the concentrate mixture is the same as the value recommended to meet milk production requirements of lactating dairy cows in the tropical environment of Fiji (Crest Feed, 2002). Also the CP content of the forage and concentrate mixtures are within recommended levels suggested by NRC (2001) as adequate to meet the requirements of the live-weight of cows used in this trial.

NDF indicates an index of bulk and it was observed to decrease with increasing levels of molasses in the concentrate mixtures and this could be due to the diluting effects of molasses. NDF content of the concentrate mixtures was, however, below concentrations of 55–60% above which may limit feed intake and affect an efficient rumen environment (NRC, 2001). ADF content ranged from 20.2 to 20.8% and this was similar in value to minimum range of 19 to 21% recommended as ideal in ruminant diets (NRC, 2001). All the concentrate mixtures had similar contents of organic matter and metabolizable energy. The metabolizable energy of the dietary treatments was within the range reported for lactating cows on forage alone (ARC, 1990); and forage and concentrate mixtures (ARC, 1990).

Estimation of voluntary dry matter intake (DMI) is important in nutritional studies because it establishes the amount of nutrients available to an animal for health and production (NRC, 2001) and is influenced primarily by dietary and animal factors. DM content of the concentrates was observed to influence total dry matter intake (DMI) of cows. The high DMI of cows on the forage/concentrate mixtures compared to those on forage alone supported Laird and Leaver (1981) who reported that DMI of cows increased linearly as the percentage of DM in concentrate mixtures increased.

DMI of the concentrate mixtures increased with the addition of molasses. The inclusion of molasses increased the efficiency of digestion and hence the improved DMI of cows. Molasses is a concentrated plant juice, and as such contains a wide range of trace minerals, vitamins, sugars (sucrose, glucose and fructose, usually about 2 : 1 : 1) and is particularly rich in potassium and sulphur (Sudan, Leng, 1986). In this experiment molasses might have acted mainly to increase efficiency of utilization of the diets. Improved DMI of cows in forage/concentrate mixtures is in agreement with Berry, Pena (1981), Gill et al. (1981), and Yan et al. (1997), who reported higher total feed intake in diets of dairy cows supplemented with molasses. The level of molasses used in the concentrates was within the range reported by Hatch and Beeson (1972).

Voluntary DMI is related to basal metabolism and is affected by balance of nutrients in the absorbed products of digestion (Aregheore, 2001) and the composition of a diet determines an animal voluntary feed intake (Van Soest, 1965). The voluntary DMI of the different dietary treatments therefore indicated that the composition of the concentrate mixtures was acceptable to the cows and their acceptability reflected on daily milk yield observed.

The increase in milk protein concentration is in line with Keady and Murphy (1998) who reported increase in milk protein concentration when molasses was included in forage silage diets. They attributed this to the increase in microbial protein synthesis and amino acid production. Increase milk protein concentration could be the consequence of increased energy intake associated with increasing proportion of molasses in the diets (Yan et al., 1997).

Robinson et al. (1996) stated that typical milk protein would decrease as the stage of lactation progressed in the range of 3.6 to 3.8%, however, in this trial milk protein concentration was observed to increase with period. Milk protein values in this study are within the reference range of 2.80–4.00 for dairy cows (Eckles et al., 1951). Furthermore, the data s eem to indicate that the cows accumulated nitrogen in the blood that was transformed to nitrogen during milk synthesis, an indication of dietary protein and carbohydrate fermentation, rumen efficiency and protein/energy balance Oldham and Alderman (1981).

Dietary sources and amount of energy, CP and fat are associated with milk protein production and the distribution of N fractions of milk. In this trial, milk protein concentration followed very closely to pattern of blood urea-N, although milk protein tended to be less than blood urea-N. This observation is in agreement with Rosler et al. (1993) who reported that milk protein tended to be less than blood urea-N in cows fed diets varying in rumen degradable protein. It has been postulated that a surplus of N intake increases blood urea-N, and there is a close relationship between blood urea-N and milk protein because milk protein is affected as the ratio between protein and energy intake increases. Blood urea-N and milk protein concentration were in the same range, probably because the concentrate mixtures were iso-nitrogenous and close in metabolizable energy (Table 2).

Forage to concentrate ratio generally causes variable response in milk fat concentration. The level of molasses did not influence milk fat concentration of cows in the different dietary treatments. In this trial, forage to concentrate ratio of total DM intake was in the range of 55–61 forage and 39–44 concentrate and this ratio is consistent with the report of Atkinson (1998) that diets containing 50 or more roughage and at least, 21% ADF and 28% NDF facilitates rumen condition would produce acceptable level of fat. The effect of molasses on milk fat concentration observed in this trial concurs with Mayne (1989) and Woods (1990) who did not find significant differences in milk fat when molasses replaced concentrate or silage in the rations of dairy cows. However, Yan et al. (1997) in Australian observed drop in milk fat concentration with the feeding of molasses diets to grazing cows. The concentration of milk fat obtained in this trial is consistent with milk fat concentration of Holstein Friesian cows raised in the tropics (Olaloku, 1976).

Blood glucose concentration increased minimally with levels of molasses in the concentrate mixtures. Molasses is usually used as an intake stimulant and energy source for cattle. Blood glucose obtained in this trial seems to suggest that (i) the cows responded positively to available energy in the concentrate mixtures, and (ii) there was a stable level of volatile fatty acids (VFA) and increase in the proportion of propionic acid in the rumen that might have resulted in faster and complete fermentation of the less fibrous carbohydrate in the molasses based concentrate mixtures.

Marty et al. (1970) reported that increase in blood glucose could be attributed to an increase in the proportion of propionic acid at the expense of acetic acid as molasses content of diet increases. Maglad et al. (1983) reported higher blood glucose levels when sheep were fed diets that contained 15 and 20% molasses.

Glucose must be oxidized for milk fat synthesis, therefore all fat (lactose) in milk arises from blood glucose and *in toto* the need for glucose greatly increased in the lactating ruminant. The need for glucose for fat synthesis in milk production is influenced markedly by the level of energy in the diet and depending on the quantity of dietary energy glucose availability may be a primary factor influencing the efficiency of utilization of a feed for production (Preston, Leng, 1984). The concentrate mixtures fed to the cows were similar in metabolizable energy (Table 2), and all the cows had close blood glucose concentration (Dhimann et al., 1991). The concentration of blood glucose obtained is within the normal range for cattle in different diets (Thorpe et al., 1988).

The effect of period on blood urea-N concentration of cows on forage/concentrate without and with molasses inclusions at 5, 10, and 15 suggest that microbial protein fermentation and fixation were better in the concentrate mixture than in the cows fed forage alone. BUN concentration of cows on all concentrate mixtures seems to suggest that ruminal ammonia was well utilized for optimal microbial growth and there was no protein shortage. An increase in blood urea-N has long been associated with an increase in N intake (Torrell et al., 1974) and with the ratio of N and energy intakes (Huntington, 1980). The range of values generated in this trial are close to that observed in normal production systems, which are between 1.67 and 4.16 mM in sheep (Torrell et al., 1974), dairy cows (Morbeck et al., 1991; Hayes et al., 1996).

Blood-N is used as a supplementary indicator of nitrogen utilization and feeding adequacy in dairy cows and the main theory behind this concept is that urea concentration in blood can provide information on nitrogen losses following absorption of ammonia from the gut (particularly the rumen) (Oltner et al., 1985). When rumen microbes utilized ammonia (converted to microbial protein), this is absorbed across the rumen wall into the blood (McLlmoyle, 2003). Overall, BUN concentrations of cows in this trial are below the 10 mg/100 ml level reported by Preston et al. (1965) as indicative of efficient blood urea-N utilization.

Blood glucose and not blood urea-N was affected by molasses levels. The results of this trial show that dietary treatments were sufficient to meet the protein and energy requirements of the cows for milk production. Data on voluntary DMI, milk yield and milk constituents, seem to suggest that milk yield of cows could be modulated by level of molasses in the concentrate mixtures and therefore molasses levels that ranges between 5–10% are most suitable. In conclusion the 10% level seems the best and therefore recommended for inclusion in the concentrate mixtures of lactating dairy cows on a basal diet of *Setaria sphacelata* in Fiji.

Acknowledgements

TEV is grateful to Dr. Peter Saville (formerly of SPC, Livestock Section) for approving fund for the analyses of samples, staff of the Chemistry Laboratory, Agricultural Research Institute, Boroko, NCD, Papua New Guinea; also staff of Fiji Agricultural Chemistry Laboratory, Nasouri, Fiji for chemical analyses of samples and Dr. K. Ofori, Crop Science Department, School of Agriculture, The University of the South Pacific, Alafua Campus Apia, Samoa for statistical analysis of data.

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Received for publication on November 9, 2005
Accepted for publication on March 15, 2006

TAMANI, E. V. – AREGHEORE, E. M. – MANUELI, P. (Pasture Research and Development Unit, Animal Health and Production Division, Ministry of Agriculture, Sugar and Land Resettlement, Koronivia Research Station, Nasouri, Fiji; The University of the South Pacific, School of Agriculture, Animal Science Department, Alafua Campus, Apia, Samoa; Secretariat of the Pacific Community, Animal Health and Production Division, Private Mail Bag, Suva, Fiji):

Vliv přídavků melasy do doplňkových jadrných krmiv na složení mléka a krevní metabolity u dojnic spásajících pastviny zaplevelené bérem (*Setaria sphacelata*) na Fidži.

Scientia Agric. Bohem., *38*, 2007: 34–42.

Byl sledován vliv přídavků melasy k doplňkovým jadrným krmivům na příjem sušiny krmné dávky, dojivost, složky mléka a krevní metabolity u dojnic spásajících pastvu zaplevelenou bérem (*Setaria sphacelata*). Do pokusu bylo zařazeno 30 dojnic fríského plemene ve věku 6–7 let, s průměrnou hmotností 428 ± 6,5 kg. Před zahájením pokusu byly dojnice rozděleny do pěti skupin podle krmných dávek aplikovaných v pokusu, který trval 126 dní. Pokusné skupiny podle zkrmovaného krmiva tvořily : T_1 – jenom pastva, T_2 – pastva + jadrné krmivo, T_3 – pastva + jadrné krmivo s přídavkem 5 % melasy, T4 – pastva + jadrné krmivo s přídavkem 10 % melasy, T_5 – pastva + jadrné krmivo s přídavkem 15 % melasy. Příjem sušiny pastvy byl u skupiny T_1 statisticky nevýznamně vyšší než u ostatních pokusných skupin ($P > 0,05$). Celkový příjem sušiny krmné dávky byl u skupin dostávajících přídavek jádra statisticky významně vyšší než u skupiny T_1. Dojivost mezi skupinami se statisticky významně lišila ($P < 0,05$). V obsahu bílkovin a tuku v mléce nebyly zjištěny významné rozdíly mezi skupinami, ale u dojnic v pokusu byl zaznamenán významný rozdíl proti hodnotám před zahájením pokusu. Hodnoty glukózy v krvi byly před zahájením pokusu 1,1 mg/100 ml, pokusnou krmnou dávkou byly významně ovlivněny – byly vyšší. Hodnota močoviny v krvi byla před zahájením pokusu 3,1 mg/100 ml a nebyla pokusnou krmnou dávkou ovlivněna. Výsledky pokusu ukázaly, že krmné dávky byly dostatečné pro plnění požadavků dojnic jak v dusíkatých látkách, tak i v energii. Údaje o příjmu sušiny, dojivosti a složkách mléka naznačují, že dojivost byla ovlivněna úrovní přídavku melasy. Jako nejvýhodnější se ukázaly přídavky melasy 10 %, proto je lze doporučit pro zařazení do jadrných směsí pro dojnice v laktaci pro zaplevelenou pastvu na Fidži.

pastva dojnic; plevel *Setaria sphacelata*; melasa; metabolity v krvi; mléčné složky

Contact Address:

Eroarome Martin A r e g h e o r e , The University of the South Pacific, School of Agriculture, Department of Animal Science, Alafua Campus, Apia, Samoa, tel.: +685 21 671, fax: +685 22 933, e-mail: aregheore_m@samoa.usp.ac.fj