Journal of Animal and Veterinary Advances 5 (3) : 226-232, 2006

Foliage of *Flemingia macrophylla* for Goats in Samoa

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Abstract: Feed value and voluntary Dry Matter Intake (DMI) of different states (i.e. hay, wilted or fresh) of presentation of *Rottboellia exaltata* fed in combination with foliage of *Flemingia microphylla* was investigated. Three growing Anglo-Nubian x Fiji local goats (2 doelings and 1 buck) with pre-experimental body weight of 19.7±0.3 and 12-15 months old were used in a repeat randomized 3x3 Latin Square design. Three dietary treatments :- (i) *R.. exaltata* (hay) + *F. macrophylla* (ii) *R.. exaltata* (wilted) + *F. macrophylla* and; (iii) *R.. exaltata* (fresh) + *F. macrophylla,* designated as T1, T2 and T3 respectively were tested on goats for 28 days. The state of presentation of *R. exaltata* had effects on a nutrient content. Mean CP content of 14.3 % for all diets was high for goats. Fibre fractions (CF, NDF and ADF) of the diets were moderate and were not above levels that affect Dry Matter Intake (DMI). Voluntary feed intake was 408, 1167 and 1013 g/head/d and when expressed on a metabolic weight basis as g $kg^{-1}W^{0.75}$/DM, DMI was 90.7, 199.6 and 182.5 g kg^{-1} $W^{0.75}$/day. The state of presentation of *R. exaltata* significantly affected ($p<0.05$) DMI. DMI was low in T1 ($p<0.05$), however there was no significant difference ($p>0.05$) between the wilted and fresh in DMI. The goats on T1 had negative body weight change (BWC), while those on T2 and T3 had positive BWC. DM, CP, NDF, ADF, OM and energy digestibilities were significantly lower ($p<0.05$) in the goats in T1, however, there was no significant difference ($p>0.05$) between goats on T2 and T3. *In vitro* DM and OM degradabilities were low in the feeds i.e *R..exaltata* grass and *F. macrophylla*. Also *In vitro* DMD, OMD and ADFD were low in T1, T2 and T3. CP degradability was relatively high in T2 while NDFD was high in both T2 and T3. The state of presentation of *R. exaltata* grass with supplement of foliage of *F. macrophylla* had effect on voluntary DMI, daily protein and energy intakes, BWC, nutrients digestibility and *In vitro* enzymatic degradability. Based on voluntary DMI, nutritive value index, digestible CP and energy intakes, BWC; *In vivo* and *In vitro* digestibility, wilting seems to be the most effective method of processing the grass for goats in confinement. The high *In vitro* CPD observed in the foliage of *F. macrophylla* demonstrates low level of tannins. *R. exaltata* grass hay resulted in low animal performance and nutrient utilization even when supplemented with foliage of *F. macrophylla*. In conclusion it is suggested that the foliage of other legume/browse species be tested with *R. exaltata* grass hay.

Key words: *Rottboellia exaltata* grass, *Flemingia macrophylla*, goats, DMI, BWC, *In vivo, In vitro* digestibility

INTRODUCTION

Rottboellia exaltata also called buffalo bean grass, corn grass, guinea fowl grass or itchgrass is an annual grass with stems up to 3 m high. It is widespread in shady wet places on disturbed soils. It is an excellent fodder grass[1], but unpalatable when tall as its stiff hairs cause irritation. In Samoa, batiki is the predominant pasture grass however others grasses such Guinea (*Panicum maximum*), Signal (*Brachiaria decumbens*), Elaphant (*Pennisetum purpureum*) and Guatamala (*Tripsicum laxum*) are also found but used mostly in cut-and-carry production systems.

Rottboella exaltata is regarded as a weed and therefore it is not used as forage for grazing or in a cut-and-carry production system. It is unnoticed emerging forage in Samoa therefore no scientific attention has been given to it. Proximate chemical composition of its mature forage during early and late dry season indicated that it has crude protein content higher (Aregheore, 1999 unpublished data) than batiki grass, but its stiff hairs that cause irritation are a problem to its utilization in the fresh form. Therefore it was envisaged that processing it into hay might improve its acceptance by ruminant livestock especially the goat.

Flemingia macrophylla is a shrub legume species native to Southeast Asia and it is considered as an excellent plant for soil conservation[2]. It has high crude protein content in the range of 16.2 - 19 % dry matter and therefore could be used to supplement low quality roughages[3,4]. Leaves from trees and shrubs are important component of animal feeding because of their protein quality, minerals and vitamins. They are used to increase the voluntary intake and digestibility of low quality forage such as mature grasses to improve the performance of livestock[5,6].

Knowledge of composition of feedstuff is vital for the animal nutritionist, in order to meet precisely the nutrient requirements of livestock; recommend balanced diets; plan forage production; and to direct strategies that guarantee a competitive, sustainable, environmentally friendly and food-safe agriculture. Variability in feed composition has impact on animal production and animal products. Based on its chemical composition it has been referred to as an excellent fodder grass[7] however information on the feeding value of *Rottboellia exaltata* is scant, while information on the value of the foliage of *Flemingia macrophylla* as a supplement in ruminant nutrition abounds[4,7,8]. The objectives of this study were to investigate the chemical composition of *Rottboellia exaltata* grass and voluntary dry matter intake of different states of presentation (i.e. hay, wilted or fresh) of *Rottboellia exaltata* fed in combination with foliage of *Flemingia microphylla* by goats in confinement.

MATERIALS AND METHODS

Animals, experimental design, management and feeding: Three growing Anglo-Nubian x Fiji local goats (2 doelings and 1 buck) with pre-experimental body weight of 19.7±0.3 and 12-15 months old were allotted in a repeat randomized 3x3 Latin Square design to investigate the feed value of three states of presentation (i.e. hay, wilted or fresh) of *Rottboellia exaltata* supplemented with the foliage of *Flemingia macrophylla*. The dietary treatments were (i) *Rottboellia exaltata* (hay) + *Flemingia macrophylla* (ii) *Rottboellia exaltata* (wilted) + *Flemingia macrophylla* and; (iii) *Rottboellia exaltata* (fresh) + *Flemingia macrophylla* and these were designated as T1, T2 and T3, respectively.

Rottboellia exaltata grass was defined as fresh or wilted, respectively, if harvested within 2-26 hour of feeding. The hay was harvested from the same site, at the same stage of maturity and sun-cured. The foliage of *F. macrophylla* was harvested fresh daily and chopped into smaller pieces of 5-8 cm before being mixed with *R. exaltata* (hay, wilted or fresh). These were thoroughly mixed to prevent selective eating. Diets offered were increased or decreased depending on intake. Total protein in the three dietary treatments was controlled by adjusting the amount of *F. macrophylla* (16.4% CP) added to *R. exaltata* (hay, wilted or fresh). These combinations were thoroughly mixed and offered as a whole diet to reduce selection between *R. exaltata* and the foliage of *F. macrophylla*. These proportionate mixtures were formulated on a DM basis to be isonitrogenous.

The diets were divided into two equal halves and offered at 09.00 h in the morning and 1700h in the evening *ad libitum* to the goats in such a way that daily refusals represent proportionately about 10-20% in excess of the previous day's intake. Before any feed was offered, stale residues were collected and weighed.

The goats were individually housed in pens under a common roof. The pens had concrete floor covered with wood shavings for bedding. Each goat was fed the dietary treatment for 28 day intake and digestion trial, consisting of 15 days adjustment period, 10 days intake and 3 days of faecal collection during which feed offered was adjusted to 90% of voluntary intake. Prior to the start of the experiment the pens were cleaned and the goats drenched with Levicare (Ancare, Auckland, New Zealand). Litter material was changed periodically.

During each period the goats had free access to fresh clean water and mineral/vitamin lick block. The mineral/vitamin lick block contain salt, calcium, magnesium, copper, cobalt, iodine, phosphorus, manganese, iron, zinc, selenium, Vit. A, D and E, with copra meal and molasses added (Summit). Body weight was determined on the first three days of each experimental period and the last day each period. Body weight change (gain/loss) was calculated by difference between mean body weight at the beginning and end of each period. Records of feed intake and body weight changes were kept for each period.

***In vivo* digestibility study:** At the end of each period digestibility study was carried out using the total faecal collection method. The goats received daily 1.50 kg of each dietary treatment fed in two equal amounts at 9.00 h and 16.00 hrs. Prior to the morning feeding, the faeces voided by each goat for the proceeding 24 hrs were carefully collected, weighed and recorded to determine actual faecal output before a sample of 25% was taken for moisture determination. Faeces were dried in a forced-air oven at 70°C for 24 hrs. Daily dried faeces for each goat over the collection period were bulked, sampled and milled in a hammer mill to pass through a 1.66 mm sieve and stored in airtight bottles until required for proximate chemical analysis.

***In vitro* enzymatic degradability:** The *In vitro* enzymatic degradability of Dry Matter (DM), Organic Matter (OM), Crude Protein (CP), Neutral Detergent Fibre (NDF) and Acid Detergent Fibre (ADF) in the samples was determined using the method of Tilley and Terry[8] modified by Aufrere and Michalet-Doreau[9] was followed to measure rumen degradability of DM, N, NDF and ADF in samples over a period of 48 hrs and standard procedures were used for the calculation of DM, N, NDF and ADF degradability.

Analytical procedures: AOAC[10] methods were used to determine nutrient contents of the hay, foliage of *Flemingia macrophylla*, experimental diets and faecal samples. Dry matter was determined by drying at 102°C for 24 h, ash by firing at 600°C for 2 h, crude protein by the micro-Kjeldahl procedure (N x6.25) (Procedure ID Number 954.02). Fibre fractions, Neutral Detergent Fibre (NDF) and Acid Detergent Fibre (ADF) were determined by the procedures of Van Soest *et al*.,[11]. The NDF was assayed with sodium sulfite, without alpha amylase and was expressed with residual ash. Concentrations of hemicellulose were calculated mathematically as the difference between NDF and ADF after nonsequential analysis of NDF and ADF. Gross energy values were determined with a bomb calorimeter (Adiatic bomb calorimeter (Parr Instrument Company, Moline, IL. USA) using thermochemical benzoic acid as standard.

Statistical analysis: The design of the experiment was a randomized repeat 3x3 Latin Square design where each of the three dietary treatments was tested on each goat separately in the following order (T2, T1 and T3; T3, T2 and T1; and T1, T3 and T2). Data on voluntary feed intake, body weight change, in vivo and other calculated parameters were statistically evaluated using analysis of variance (ANOVA) with each goat, period and dietary treatment included as the mean effects[12] and where significant differences occurs, the least significant difference test (LSD) test was used for mean separation[13].

RESULTS AND DISCUSSION

Proximate chemical composition of foliage of *F. macrophylla* and *R. exaltata* (hay, wilted and fresh) is presented in Table 1. Except for Dry Matter (DM) content, other nutrients-Crude Protein (CP), Neutral Detergent Fibre (NDF) and Acid Detergent Fibre (ADF) are similar to values reported for *F. macrophylla* by Mui *et al*.,[7] in Vietnam. The foliage of *F. macrophylla* had CP content higher than 14.5% reported by Asare. However, it was very similar to the value of 16.4% reported by Binh *et al*.,[6]but lower than 17.7% reported by Getachew *et al*.,[14] and 19.0%[3,15]. The fibre (NDF) content of *F.macrophylla* was not higher than values reported for leaves of similar browses such as *C. calothyrsus*, *L. Leucocephala* by Barahona *et al*.,[16].

Table 1: Proximate analysis of feeds used in the trial

	Feeds			
Nutrients (%)	Flemingia	Rottboellia (Hay)	Rottboellia (Wilted)	Rottboellia (Fresh)
Dry matter (DM)	34.8	89.8	64.2	48.6
On DM basis				
Crude protein	16.4	7.4	10.7	11.8
Crude fibre	24.9	36.3	27.5	23.4
NDF	66.5	66.5	66.4	66.7
ADF 55.5	55.5	55.6	55.4	
Hemicellulose	11.0	11.0	10.8	11.3
Ether extract	2.7	1.0	1.2	1.6
Ash	7.3	5.6	10.3	14.3
Organic matter	92.7	94.4	89.9	85.7
G.E (MJ/kg DM)*	14.7	14.6	14.5	12.8

* GE, Gross energy

The state of presentation of *R. exaltata* (i.e. hay, wilted or fresh), had effect on its nutrients content. Except for the low CP content of the hay (7.4%), CP content of wilted and fresh *R. exaltata* was moderate for maintenance/live-weight gain in goats. The CP of fresh and wilted *R. exaltata* grass was similar to values reported by Dougall[17] but extremely higher than the 3.1% CP reported by Bwire *et al*.,[18] for *R. exaltata* in East Africa. The CP content of the hay was higher than value reported by Bodgan[1] and Bwire *et al*.,[18]. Fibre fractions (NDF and ADF) are similar to the values reported for *R. exaltata* in Tanzania[18]. Gross energy values of the foliage of *F. macrophylla* and *R.exaltata* were within the same range and consistent with values reported by Butterworth[19] for tropical forages.

Table 2 presents chemical composition of the three states of *R.exaltata* (hay, wilted or fresh) with foliage of *F. macrophylla*. To improve the CP content of *R. exaltata* a corresponding amount of the foliage of *F. macrophylla* was added to each dietary treatment. The mean CP content of 14.3% for all diets was high for goats and the mean CP content is higher than that reported for goats of

Table 2: Chemical composition of mixtures of *Rottboellia exaltata* (hay, wilted and fresh) and *Flemingia macrophylla*

	Proportion of *R. exaltata and F. macrophylla*		
Nutrients (%)	T1, 26. 1:73.9*	T2, 33. 3:66.7*	T3, 46. 3:53.7*
Dry matter (DM)	89.9	89.9	90.0
On DM basis			
Crude protein	14.1	14.5	14.3
Crude fibre	27.9	25.8	24.2
NDF	66.7	66.5	66.7
ADF	55.3	55.6	55.6
Hemicellulose	11.4	10.9	11.1
Ash	6.9	7.9	10.5
Organic matter	93.1	92.1	89.5
Energy MJ/kg DM	14.7	14.6	13.8

* T1 - *Rottboellia exaltata* hay + *Flemingia macrophylla*; T2 - wilted *Rottboellia exaltata*+ *Flemingia macrophylla* and T3 - fresh *Rottboellia exaltata* + *Flemingia macrophylla*

Table 3: Performance characteristics and apparent nutrients digestibility

Parameters	Proportion of *R. exaltata and F. macrophylla* T1, 26.1:73.9*	T2, 33.3:66.7*	T3, 46.3:53.7*
Mean average live-weight(kg)	19.3	19.8	20.1
Mean live-weight (kg $W^{0.75}$)	9.2	9.3	9.5
Final average live-weight(kg)	17.2	21.5	22.8
Body weight gain/loss	-0.07	57	0.09
Voluntary feed intake (g kg^{-1})	408^{a}	1167^{b}	1013^{b}
DM intake (g kg^{-1} $W^{0.75}$/day)	90.7	199.6	182.5
Daily protein (g protein N/ /$kg^{0.75}$/d) intake	1.95	4.30	4.03
Metabolizable energy intake (Kj/kg DM)	4.59	7.79	6.48
Nutritive value index	505.3^{a}	1891.3^{b}	1443.1^{b}
Nutrient Digestibility (%)			
Dry matter	38.7^{a}	67.4^{b}	61.9b
Crude protein	45.6^{a}	66.7^{b}	64.9^{b}
Crude fibre	54.1^{a}	66.8^{b}	59.8^{ab}
NDF	42.9^{a}	72.5^{b}	64.6^{b}
ADF	20.9^{a}	56.9^{b}	48.0^{b}
Organic matter	42.2^{a}	68.4^{b}	63.2^{b}
Energy	37.9^{a}	64.9^{b}	57.3^{b}
Digestible energy	5.6	9.5	7.9

* T1 - *Rottboellia exaltata* hay + *Flemingia macrophylla*; T2 - wilted *Rottboellia exaltata*+ *Flemingia macrophylla* and T3 - fresh *Rottboellia exaltata* + *Flemingia macrophylla*. ^{a,b} Means within the same row followed by different superscripts are significantly different (p<0.05)

that age in Samoa[20,21]. Ahn *et al.*,[22] and Getachew,[23] reported that the value of browse as supplement was mainly dependent on its ability to correct for nutrients that are deficient in the basal diet and this includes their ability to provide essential nutrients to the rumen microbial population and/or critical nutrients to meet the host animal requirement thus increasing the efficiency of feed utilization. Fibre fractions of the diets were not above levels that would affect feed intake[24]. It has been observed that grass–legume mixtures have higher crude protein concentration and lower fiber concentration than pure grass stands and this was true for nutrient composition of the three dietary treatments. The energy contents of the dietary treatments are within the level recommended as suitable for goats in Samoa[20].

Data on voluntary Dry Matter Intake (DMI), Body Weight Change (BWC), daily protein and energy intake and apparent nutrients digestibility is presented Table 3. Voluntary feed intake was 408, 1167 and 1013 g/head/d and when expressed on a metabolic weight basis as g $kg^{-1}W^{0.75}$/DM, DMI was 90.7, 199.6 and 182.5 g kg^{-1} $W^{0.75}$/day. The state of presentation of *R. exaltata* with the foliage of *F. macrophylla* significantly affected (p<0.05) DMI. DMI was low in T1 (*R. exaltata* hay + *F. macrophylla*) than in T2 and T3 (p<0.05). DMI was higher in the wilted compared to the fresh however, there was no significant difference (p>0.05) between wilted and fresh states of *R. exaltata* with the foliage of *F. macrophylla*. The higher feed intake in the wilted may be due to the wilting of the stiff hairs that causes irritation to animals.

Animal performance is determined by feed availability, feed nutrient content, intake, extent of digestion and metabolism of the feed digested, but availability and intake most often determine animal performance. Low DMI presents one of the major constraints to ruminant production in the tropic therefore, an understanding of the feed characteristics and processing option that affects feed acceptability is important for future improvement in DMI. In this study it was observed that the state of presentation had effects on all the parameters measured. The goats on T1 (*R. exaltata* hay + *F. macrophylla*) had low DMI, daily protein and metabolizable energy intake and subsequently a negative BWC, while those on T2 and T3 had positive BWC.

The high DMI observed in T2 (wilted *R. exaltata* + *foliage of F. macrophylla*) influenced daily protein and metabolizable energy intakes and subsequently resulted in positive body weight change and this seems to indicate that wilting is the ideal method of processing this unnoticed emerging weed in Samoa as a ruminant feed. Flemingia is reported to contain high content of tannins[25] and generally tannins affect palatability and intake. DMI in all treatments was considered adequate and even if there was palatability problem due to tannins it was disguised by mixing with *R. exaltata* grass.

Nutrient digestibility followed the trend of DMI. The digestibility of DM, CP, NDF, ADF, OM and energy was significantly lower (p>0.05) in the goats that received *R. exaltata* hay + *F. macrophylla*. However, there was no statistical significant difference (p>0.05) in nutrients digestibility between the goats on wilted *R..exaltata* + *F. macrophylla* and fresh *R.. exaltata* + *F. macrophylla*. Goats on wilted *R..exaltata* + foliage of *F. macrophylla* had higher organic matter and energy digestibility and subsequently had positive BWC and this observation supports Aganga *et al.*,[26].

In vitro enzymatic degradability of DM, OM, NDF and ADF of feeds and dietary treatments is presented in Table 4. DMD and OMD were low in both the foliage of *F. macrophylla and R..exaltata* and there was no significant difference (p>0.05). The low *In vitro* DMD and OMD observed in foliage of *F. macrophylla* is in agreement with Asare[27] Getachew[23] and Samol and Ly. Asare[22] reported that *In vitro* digestibility of DM for ruminants was less than 40%. Bwire *et al.*,[19] however reported IVOMD of 53.6% for *R.. exaltata* compared to the average of 35.5% obtained in this trial. IVDMD values for foliage range from 11-53%, most values tending to be in the lower part of the range however, in this study IVDMD of feeds and dietary treatments were in the range of 36.5-47.9 %.

Table 4: *In vitro* enzymatic degradability of nutrients

Feeds	DMD	OMD	CPD	NDFD	ADFD
Flemingia *macrophylla foliage*	36.6	31.4	67.2	66.4	46.3
Rottboellia exaltata (hay)	42.7	38.2	56.6	67.9	51.8
Rottboellia exaltata (wilted)	47.9	37.4	69.0	51.7	42.8
Rottboellia exaltata (Fresh)	32.5	31.7	50.9	53.7	44.9
Dietary treatments					
T1 – R. exaltata hay + *F. macrophylla*	38.0	37.5	43.3^{b}	66.4	48.3
T2- *R. exaltata* (wilted)+ *F. macrophylla*	36.5	35.7	66.8^{a}	55.8	46.9
T3 – *R. exaltata* (fresh) + *F. macrophylla*	40.7	40.2	55.3^{ab}	62.6	42.9

* DMD, Dry matter degradability; OM, Organic matter degradability; CPD, Crude protein degradability; NDFD, Neutral detergent fibre degradability; ADFD, Acid detergent fibre degradability. [a,b] Means within the same row followed by different superscripts are significantly different ($p<0.05$)

CPD of foliage of *F. macrophylla* at 67.2% and *R..exaltata* at 50.9 – 69.0 % (mean 58.8 %) were high for both feeds. The high CPD obtained in foliage of *F. macrophylla* seems to indicate low level of tannins. Condensed tannins bind to protein and decrease ruminal protein degradability of forage. Consequently, the high CPD of foliage of *F. macrophylla* indicate low levels of anti-nutritive factors (polyphenolics) and fibre to affect enzymatic degradability. The high CP intake by the goats results in a higher amount of digested CP.

DMD, OMD, NDFD and ADFD of the dietary treatments were low, however, CPD was relatively high in T2 (wilted *R..exaltata* + foliage of *F. macrophylla*) while NDFD was high in T2 and T3 (fresh *R.. exaltata + foliage of F. macrophylla*). CP and NDF degradability of T2 and T3 are higher than the degradability necessary to provide maintenance requirement of adult ruminant livestock[29]. The nutritive value of the feeds and dietary treatments in terms of CP (%) was fairly high with CP at 16.4% for *F. macrophylla*, average of 9.6% for *R.. exaltata* and 13.6 – 20.2% (Mean 17.1%) for T1 – T3, however, IVDMD and IVOMD were less than 50%. Van Soest reported that forage digestibility is dependant on the cell wall (neutral detergent fiber) content and availability is determined by lignification and other factors. The nature of plant cell wall and the quality of NDF are variable because of variable lignification. There were differences ($p<0.05$) between mean *In vivo* and *In vitro* digestibility of some nutrients (Table 5). Nutrient digestibility of T1 (*R. exaltata* hay with foliage of *F. macrophylla*) was significantly lower than those of T2 and T3, respectively.

In goat feeding there is no single perfect forage or hay therefore as long as it is digestible a wide variety of plants and hays will be consumed. Goats generally are very selective,"picky" eaters, choosing only those hays and forages which will give them the nutrients they need. The quality of hay, for example, varies greatly, based on how mature it was when it was cut and processed. DMI of available protein and energy are major factors affecting animal performance in the tropics. The mixing of R. exaltata with foliage of *F. macrophylla*, reduced any

Table 5: Mean values of dry matter, crude protein, organic matter, neutral detergent fibre and acid detergent fibre digestibility in *In vivo* and *In vitro* methods (%)

Diets*	Nutrients** (%)	*In vivo*	*In vitro*
T1	DM	38.7^{1}	38.0
	CP	45.6^{1}	43.3^{1}
	OM	42.2^{1}	37.5^{1}
	NDF	42.9^{a1}	66.4^{b}
	ADF	20.9^{a1}	48.3^{b}
T2	DM	67.4^{a2}	36.5^{b}
	CP	66.7^{2}	66.8^{2}
	OM	68.4^{a2}	35.7^{b}
	NDF	72.5^{a2}	55.8^{b}
	ADF	56.9^{a2}	46.9^{b}
T3	DM	61.9^{a2}	40.7^{b}
	CP	64.9^{a2}	55.3^{b2}
	OM	63.2^{a2}	40.2^{b1}
	NDF	64.6^{2}	62.6
	ADF	48.9^{2}	42.9

* T1 - *Rottboellia exaltata* hay + *Flemingia macrophylla*; T2 - wilted *Rottboellia exaltata*+ *Flemingia macrophylla* and T3 - fresh *Rottboellia exaltata* + *Flemingia macrophylla*.** DM, Dry matter; CP, Crude protein; OM, Organic matter; NDF, Neutral detergent fibre; ADF, Acid detergent fibre,[a,b] Means within the same row followed by different superscripts are significantly different ($p<0.05$); [1,2] Means within each treatment for each variable of different superscript differ ($p<0.05$)

palatability problem and the goats fed the wilted and fresh *R. exaltata* were better in all parameters measure in this study.

Based on DMI it may be adduced that the processing of *R. exaltata* grass into hay and mixing with *F. macrophylla* was not ideal for goats in confinement as the hay did not improve DMI, rather the wilting process was more effective in all parameters measured probably because it reduced the stiff hairs in *R. exaltata* that causes irritation to animals. It is hypothesized that *R. exaltata* hay may likely be more accepted by grazing or confined goats during the dry season if it is supplemented with foliage of other browse/multipurpose trees such as *Leucaena leucocephala* or *Gliricidia sepium* or when alternative feed is limited or less attractive.

CONCLUSIONS

In this trial it was observed that the state of presentation of *R. exaltata* grass (hay, wilted or fresh) in mixture with the foliage of *F. macrophylla* had effect on voluntary DMI, daily protein and metabolizable energy intake, body weight change and apparent nutrients digestibility of the goats. Based on nutritive value index, digestible crude protein and energy intakes, voluntary DMI, body weight change; *In vivo* and *In vitro* digestibility it could therefore be recommended that wilting of the *R. exaltata* grass is the most effective method of processing the grass for feeding of goats in confinement. Processing of *R. exaltata* into hay may not be the best option since it does not make it ideal roughage for ruminants during the dry season period even when supplemented with foliage of *F. macrophylla*. It is hereby suggested that the foliage of other legume/browse species be tested with the hay of *R. exaltata*. Furthermore, the high *In vitro* digestibility of CP demonstrates low level of tannins in the foliage of *F. macrophylla*.

ACKNOWLEDGEMENTS

I am grateful to Messrs Samson Vuilu and Steglar Tabi Aga, who assisted with feed preparation, feeding and data collection; Mr. Daya Perera, (Senior Technician) and Staff of the USP Alafua Agricultural Chemistry Laboratory for proximate chemical analysis, staff of Prof. Jones Ng'ambi Laboratory, University of Limpopo, South Africa for the fibre analyses and *In vitro* degradability evaluation and finally to the University of the South Pacific Research Committee (Vote Code 6060-1111-70105) for providing funds for the study.

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