SRI LANKA JOURNAL OF ANIMAL PRODUCTION

2015/ 2016 **Volume 7 & 8**

Contents

VOLUNTARY INTAKE OF FODDER GROWN IN SALINE MARSHY LANDS AS A RUMINANT FEED

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Abstract

Salty soils are unfit for crop production but some saline-tolerant forage species can be grown for animals in these lands. The objective of the present study was to find out the intake and feeding value of Kalanduru (Kyllinga melanosperma, a spikesedge) and Tikiya (Eliocharis dulcis) grown in saline soils. A stall feeding (Ad-libitum) trial was conducted using twelve lactating buffalo cows and four fodders namely, Kalanduru, Tikiya, Hybrid Napier variety (CO-3) (Cross between Pennisetum purpureum-Napier and Pennisetum americarnum-Pearl millet) or whole vegetation, which consisted of grass, legumes, sedges and other herbs. Feed intake and milk production were measured for 60d. The data were analysed using GLM of SAS and means were separated using LSD. Major component of the whole vegetation was grass (55.7%), and the dominant grass species was Etora (Panicum psilopodium). Legumes represented about 8.9 % of the vegetation. Tikiya had the highest (P<0.05) dry matter and crude fibre compared to other fodders. Whole vegetation had the highest (P<0.05) percentage of ash and crude protein compared to other fodders and this high amount of crude protein in whole vegetation can be due to legumes. CO-3 had the highest (P<0.05) amount of crude fat, compared to other fodders. Animals fed Tikiya showed the highest (P<0.05) dry matter intake (105 g/d/kg $^{0.75}$) compared to CO-3 (99.3 g/d/kg $^{0.75}$), whole vegetation (99.1 g/d/kg $^{0.75}$) or Kalanduru (97.8g/day/kg$^{.75}$). Average milk yield of cows fed CO-3 was higher (p<0.05) compared to other fodders. In conclusion it can be said that Tikiya is palatable and can be used for feeding buffaloes in salty soils when improved forage are lacking.

Keywords: *Forage, Saline Soils, Buffaloes, Dry Matter Intake, Milk Production*

INTRODUCTION

The scarcity of water and increasing salinization in some parts of the world has rendered millions of acres of productive land unfit for conventional agriculture. Saline water and saline land have been considered as waste in the past, however with the increase in human population, it is essential to utilize these resources for crop and livestock production. In several countries, grass and fodder have been successfully grown under highly saline areas to produce fodder for ruminants (Taha and Ismail, 2008; El Shaer, 2010). Salt tolerant plants appear to be a major resource for the survival of ruminants particularly in coastal areas of the world.

Coastal salinity is experiencing in the areas near to the sea. Most of the salts in coastal areas of Sri Lanka contains high amount of soluble salts such as sodium, magnesium, and calcium sulphate with lesser amount of chlorides (Weerasinghe, 1994). Much of these saline lands are caused by the presence of shallow water table and most of it is a threat to the farmers. Salinity in coastal areas in Sri Lanka has been increased severely after the tsunami disaster (Mapa et al., 2005). In addition, changes in the natural hydrological regime due

to implementation of different flood protection schemes and river diversification programmes have led to severe acidification of paddy fields in southern Sri Lanka (Weerasinghe et al., 1996) resulting abandoning of large extents of paddy lands which have been previously cultivated. Even though these lands are not suitable for agricultural purposes, some saline tolerant forage species can be grown in these lands. Use of saline tolerant varieties is the best way to tackle coastal salinity. As an alternative, these areas are being used as grazing lands for cattle and buffaloes with naturally grown salt tolerant grass or sedges. Therefore, cattle and buffalo farming have assumed a greater significance in these areas (Seresinghe and Pathirana, 2000). According to Wikipedia, Tikiya (*Eliocharis dulcis*), more often called simply the water chestnut in China, is a grass-like sedge grown for its edible corms (http://enwikipedia.org). The water chestnut is actually not a nut at all, but an aquatic vegetable that grows in marshes, underwater in the mud. It has tube-shaped, leafless green stems that grow to about 1.5 meters. Tube shaped, leafless green stems are consumed by buffaloes and cattle in Sri Lanka (Premaratne, personnel communication). Kalanduru *(Kyllinga melanosperma)* is a species of sedge, covered with dark brown scales that culm together to form rhizomes that are about 30–100 centimeters (12–39 inches) long (http://enwikipedia.org). The rhizomes are 2.5–4.0 millimeters (0.10–0.16 inches) thick with a purple-brown sheath at the bottom. *Kyllinga melanosperma* is found in tropical Africa, southern and southeastern Asia. *Kyllinga melanosperma* propagates by seed. This is also a saline tolerant variety which can be seen in and around saline marshy lands in Sri Lanka. Intake and feeding value of these varieties as a ruminant feed under national and international level are lacking. Therefore the main objective of this study was to compare the intake and feeding value of two selected saline tolerant forage namely, Kalanduru and Tikiya with two standards feeds namely, Hybrid Napier CO-3 grass (Cross between *Pennisetum purpureum* and *Pennisetum americarnum*) and whole vegetation cover.

MATERIALS AND METHODS

Location

The feeding trial was conducted at Harischandra farm in Matara district, Sri Lanka.

Selection of animals

Twelve lactating buffalo cows (Niliravi, Murrah, and crosses) weighing 522 $\pm$ 58kg in third/forth parity at latter part of lactation, producing 2 $\pm$ 0.5l of milk were divided in-to three groups based on body weight (four animals per group). There were three blocks of animals namely large, medium and small, and animals within a block were allocated to four fodders. Therefore, each treatment had 3 replicates representing a large, medium and a small animal.

Fodders used

Two fodders grown in saline marshy lands namely, Tikiya and Kalanduru were tested against CO-3 and whole vegetation (grass, legume, sedges, other shrubs) as standard or control fodders which were grown in normal soils. All fodders except CO-3 were naturally grown and purchased from farmers where intensity and frequency of defoliation were not controlled therefore it simulated the natural grazing conditions.

Feeding

Stall feeding was practiced. Each animal was fed 10% of body weight + 20% in excess (*Ad-libitum*) of fresh fodder. In addition, each animal was fed 03 kg of rice (*Oryza sativa*) bran and 50 g of mineral mixture (Ibrahim, 1988). Half the requirement of fodder was fed in the evening and half on the next morning. There was an adaptation period of 4 days followed by a two day preliminary period. Feeding trial was

conducted for 60 days. Fodder offered and refused was measured every day for each animal. Live weight of animals was measured before and after the trial. Cows were milked twice daily, and milk yield per animal was recorded at each milking.

Sample collection

Samples of fodder and refused were taken every day for each animal for dry matter determination and chemical analysis (AOAC, 1990). Botanical composition of whole vegetation was observed every day.

Determination of nutritive value

Samples of fodders and refused were dried at 60^{o}C for about 72 hours and dried samples were ground to pass a 1 mm sieve using a laboratory mill. Samples were analyzed for crude protein, crude fibre, crude fat, dry matter and ash using standard laboratory methods (AOAC, 1990).

Statistical analysis

The milk yield and dry matter intake data were statistically analysed using "General Linear Model" (GLM) procedure of SAS system (1997) and means were separated using LSD.

RESULTS AND DISCUSSION

Botanical composition of whole vegetation

Botanical composition of whole vegetation during the experimental period can be divided in to 4 categories namely, Grass, Legumes, Sedges and other herbs. Major component of the whole vegetation was grass (55.7%), and the dominant grass species was Etora (*Panicum psilopodium*). Legumes represented about 8.9% of the vegetation whereas Sedges represented a value of 14.2%. Main plant of the "other herbs" was Kang-kung (*Ipomoea aquatica*) which contains latex so that animals ate this too. Amount of other herbs represented about 21.3% of the total.

Tikiya had the highest (P<0.05) dry matter and crude fibre compared to other fodders (Table 1). Whole vegetation had the highest (P<0.05) percentage of ash and crude protein compared to other fodders and this high amount of crude protein in whole vegetation can be due to legumes. CO-3 had the highest (P<0.05) amount of crude fat, compared to other fodders. According to literature, when harvested at correct stage, CO-3 grass contains 18-20% dry matter and 15-16% crude protein, 9.8-12.8% ash and 34-37% crude fibre on dry matter basis (Premaratne and Premalal, 2006).

Table 1: Chemical composition of fodder (%)

Diet	Dry matter	Ash	CP	CF	Crude fat	Gross Energy, Mcal/kg DM[$]
Whole vegetation	18.45±1.10[b]	14.78±0.42[a]	13.63±0.46[a]	24.98±0.88[b]	4.92±0.20[b]	1.422
CO-3	17.42±1.10[b]	12.06±0.42[b]	11.95±0.46[b]	30.58±0.88[a]	6.19±0.20[a]	2.975
Tikiya	26.86±1.10[a]	9.00±0.42[c]	10.66±0.46[c]	31.11±0.88[a]	4.30±0.20[c]	2.956
Kalanduru	20.72±1.20[a]	12.71±0.47[b]	13.00±0.41[a]	26.34±0.99[b]	5.36±0.19[a]	1.349

[$]Chemical composition data were used to calculate gross energy content of fodder
[a,b,c] Means with the common superscript in a column are not significantly different (P<0.05)

Chemical composition of CO-3 in the present study lies within the range reported by Premaratne and Premalal (2006). Gross energy content of CO-3 was 2.975 Mcal/kg DM followed by Tikiya which had a gross energy content of 2.956 Mcal/kg DM (Table 1). The lowest gross energy content of 1.349 Mcal/kg DM was observed in Kalanduru compared to other fodder.

Fodder dry matter intake

Figure 1 shows the average fodder dry matter intake of cows fed with Tikiya, CO-3, Whole vegetation and Kalanduru. Animals fed Tikiya showed the highest (P<0.05) dry matter intake compared to other fodders. The low dry matter intake of CO-3 and whole vegetation may be related to their low dry matter content (Table 1). Animals fed those two fodders must have consumed more water.

No significant differences (P>0.05) in fodder dry matter intake were observed between Kalanduru, whole vegetation or CO-3 (Figure 1).

Total dry matter intake

Figure 2 shows the average daily dry matter intake of cows fed with different fodders. Total dry matter intake of cows fed Tikiya was higher (P<0.05) compared to other fodders.

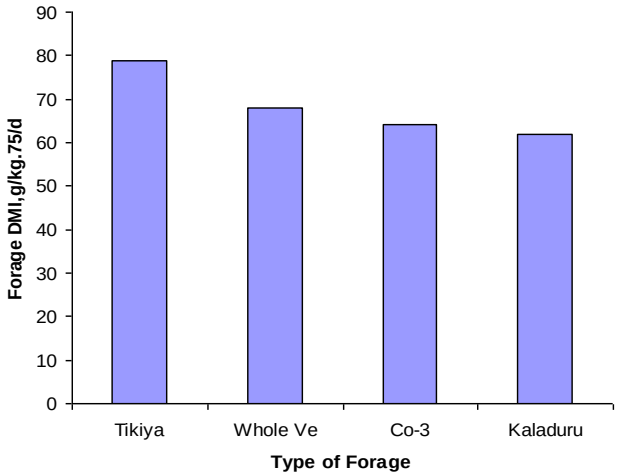

Figure 1: **Average fodder dry matter intake by buffalo cows**

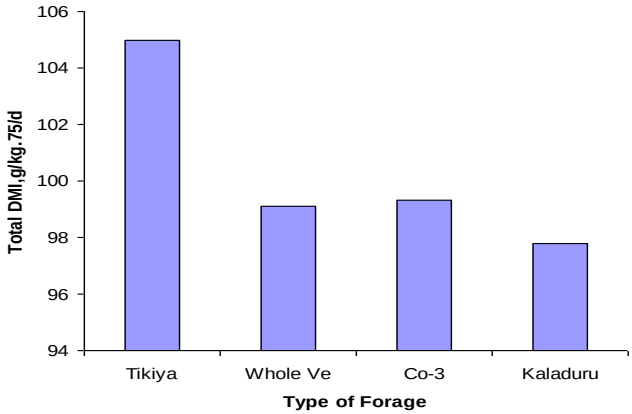

Figure 2: Average total dry matter intake by buffalo cows

Total dry matter intake of Tikiya was 105 g/ kg $^{0.75}$ /d whereas intake of whole vegetation cover and CO-3 was similar (99.08 and 99.25 g/ kg $^{0.75}$ /d respectively) and followed by Kalanduru (97.79 g/ kg $^{0.75}$ /d). Kalanduru reported the lowest total dry matter intake by buffaloes

under *ad-libitum* feeding. According to Minson and Milford (1966), intake of forage can be 39-140 g/ kg $^{0.75}$ /d for mature to immature temperate pasture. In the present study, intake of Tikiya and Kalanduru which are saline tolerant tropical fodders were within the acceptable range. Nguyen Van Thu (1997) conducted two experiments using four fistulated swamp buffaloes to evaluate local feed resources using the *in-sacco* method to study degradability and effects on the rumen environment of swamp buffloes in Vietnam. The rumen environment study was a Latin square arrangement with four different diets: rice straw (RS), rice straw and molasses-urea cake (MUC), rice straw, MUC and grass (0.5% body weight), and rice straw and grass (0.5% DM of body weight). Feed intake was 96.0, 99.0, 113 and 109 gDM/$W^{0.75}$, respectively. These intake values are lower than the values obtained in our study. Of the feed resources tested in the same study, the water plant *Eleocharis dulcis* had a degradability value of 41.1% for 24 hour degradability (Nguyen Van Thu, 1997). No other information is available on intake and chemical composition of Tikiya or Kalanduru under local or international conditions.

Milk production

Milk yield of cows fed CO-3 was higher ($P<0.05$) than animals fed Tikiya, Kalanduru or whole vegetation (Figure 3).

CO-3 is one of the highest yielding perennial tropical fodder grasses and considered as cut-and-carry forage for stall feeder system. The characteristic features of CO-3 fodder grasses are profuse tillering, high yield potential, high dry matter and crude protein content , quick generation capacity, high leaf to stem ratio, high palatability, free from pests and diseases and low in adverse factors (Premaratne and Premalal, 2006). However, no significant differences were observed between Tikiya, whole vegetation and Kalanduru on milk production of buffaloes ($P>0.05$). There was an increase in milk yield in all animals for every fodder when compared to milk yield at the start and this may partly be due to higher feed intake by the animals during the trial, (*ad-libitum* feeding) and, partly due to better feed.

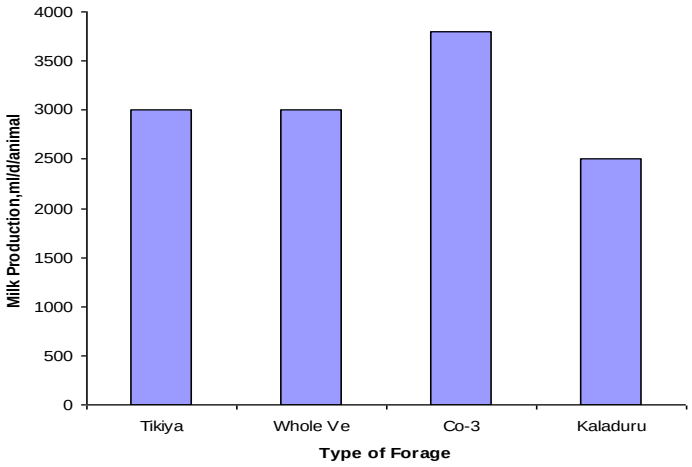

Figure 3: Average milk yield of buffalo cows

Being an improved variety of fodder, CO-3 showed a higher milk yield compared to Tikiya even though the feed dry matter intake was lower than that of Tikiya (Figure 1 and 2).

CONCLUSION

Tikiya is a salt-tolerant plant and can be considered as palatable forage for feeding buffaloes in saline marshy lands because consumption of Tikiya by animals was higher than that of standard fodders grown in normal soils. Milk production of cows fed Tikiya was comparable to those fed whole vegetation. On saline marshy lands, Tikiya can serve as a complementary nutrient source to other conventional feed stuffs such as CO-3. These fodders could be used advantageously as alternative feeds in buffalo diets when improved forage is lacking and thereby to alleviate feeding cost of buffaloes.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the financial support given by the CARP, which made this study possible. They wish to thank. N.D. Seneviratne, M.A.G. Bandaranayake, Staff at the Forage laboratory at VRI and Dept. of Animal Science, University of Peradeniya for their valuable help during the study. The facilities provided by the Harishchandra Farm, Matara is also greatly appreciated.

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