Identification and assessment of nutritive value of widely used feedstuffs for dairy cattle during Yala season in Vavuniya and Mullaitivu districts of Northern Province, Sri Lanka

1Thelaksan, T., 1*Kumara Mahipala, M.B.P., 2Weerasinghe, W.M.P.B.,

1Chathurika, W.V.A.H.
1Faculty of Agriculture, University of Peradenya, Peradeniya.
2Veterinary Research Institute, Gannoruwa, Peradeniya.
**pmahi@pdn.ac.lk*

Abstract -Major roughage and concentrate feedstuffs used for dairy cattle feeding during Yala season in Vavuniya and Mullaitivu districts were investigated. A survey was conducted in 50, medium-scale cattle farms to identify the most widely used roughage and concentrate feedstuffs. Identified feedstuff samples collected from randomly selected farms were analyzed for dry matter (DM), ash and crude protein (CP) contents. They were further assessed for organic matter digestibility (OMD) and metabolizable energy (ME) content through in vitro gas fermentation assay.

Most of the stall-fed farms largely fed the cattle with hybrid fodder sorghum (Sugargraze) and CO-3. Gliricidia, ipil-ipil and azolla are included to improve the quality of ration while straw and guinea grass are included to overcome feed shortage during Yala season. Grazing cattle largely depend on naturally grown, low quality guinea grass. More available rice polish, dhal dust, wheat bran and coconut meal are included in the cattle rations of many farms while less available black gram husk, gingelly meal and maize are included in rations of fewer farms.

Nutritive value of roughage and concentrate feedstuffs for dairy cattle feeding varies ($P<0.05$). Guinea grass, CO-3 and Sugargraze are the potentially more digestible (OMD), energy (ME) rich roughages while Sugargraze would be the best option for dairy cattle feeding in Yala season. However, they should be harvested at proper maturity stage. Gliricidia, ipil-ipli and azolla can be recommended as protein (CP) supplementing forages. Coconut meal, black gram husk and gingelly meal could be recommended as energy (ME) and protein (CP) supplementing concentrates whilst maize could be recommended as the major energy (ME) supplement of the rations. Present study suggest to increase the availability of black gram husk, gingelly meal and maize for dairy cattle feeding and avoid adulteration of rice polish in order to prosper dairy cattle farming in Vavuniya and Mullaitivu districts.

Keywords: Dairy cattle, Crude protein, In-vitro gas fermentation assay, Metabolizable energy, Organic matter digestibility.

I. Introduction

Animal husbandry plays an important role for improving the living conditions of Sri Lankan farmers [1]. Domestic neat cattle population of 1 million produced 327.6 million liters which was adequate to meet only 40% of the domestic dairy consumption [2]. Despite commendable efforts of the Sri Lankan governments during past several decades, productivity of cows still lag behind. Among several other reasons, poor nutrition is one of the major attributes led to the low productivity of dairy cows of the island. Dairy cattle feeding of the country largely depends on natural grass, introduced fodder varieties and crop residues and agro-industrial byproducts. Lack of good quality fodder and inadequate feed resources were the main constraints for poor nutrition of dairy cows in the country [3]. The efficient use of the available feed resources is especially important as it is the primary determinant of animal performance, productivity and the profit of dairy cattle farming. Supplementation of feed with legumes and concentrates is made to fulfill and maintain the nutrient requirements as well as improve feed intake and performance of animals.

Nutritive value of feed stuffs is a crucial factor to be concerned in balancing rations. Nutritive value of many locally available feedstuffs for dairy cattle are yet to be assessed. They are currently determined mainly through chemical analyses. Yet, chemical analyses alone is inadequate to assess the true biological value of feedstuffs such as organic matter digestibility (OMD) and metabolizable energy (ME) content. The in-vitro gas fermentation assay provides the opportunity to assess the OMD and ME with high degree of accuracy [4]. Therefore, this study was undertaken to identify and asses the nutritive value (i.e. using in-vitro gas fermentation assay) of widely used ruminant feedstuffs by medium-scale dairy cattle farmers in Vavuniya and Mullaitivu districts of Northern province of Sri Lanka.

Materials and methods

Identification of widely used ruminants' feedstuffs

The study was carried out during Yala season of 2017 in Vavuniya and Mullaithivu districts of Northern Province, Sri Lanka. A survey was conducted among selected (i.e. Stratified random sampling), fifty (50), medium-scale (i.e. herd production 50 L/day) dairy cattle farms in the study area.. A pre-tested, structured questioner focused to collect information on herd composition, feeding system, use of forage and concentrate feedstuffs and milk production was used. Considering the percentage of farms using different forage and concentrate feedstuffs for dairy cattle feeding, most widely used eight forage and seven concentrate feedstuffs were identified.

Analysis of nutritive value of feedstuffs

Samples (about 500g) of most widely used feedstuffs identified from the survey were collected from randomly selected five

farms in each district. The samples were oven dried overnight at 60°C, ground to pass through 1 mm sieve and stored at-4 C° until analysis were carried out. Dry matter, ash and crude protein (CP) contents of feedstuffs were determined according to the procedures of AOAC [6].

Ruminal fluid for use in the in vitro gas fermentation assay was obtained about 1 h before the morning feed, from three ruminally fistulated sheep wethers, fed roughage (i.e Brachiaria brizantha hay) adlibitum and 200 g of concentrate ration. In-vitro OMD and ME content were determined using 24 h gas production from triplicate feedstuff samples (0.5g) according to the procedure described by [5]. Differences in in-vitro gas production due to variations in ruminal fluid collected on different days were accounted by using triplicate blanks and Hohenheim hay (Lolium perenne) standards in every batch of incubation.

Data on nutritive value of forage and concentrate feedstuffs were subjected to analysis of variance (ANOVA) procedures of Complete Randomized Design (CRD). Duncan's Multiple Range Test (DMRT) was used to separate means [7].

Results and Discussion

Most widely used dairy cattle feeding systems in Vavuniya and Mullaithivu districts have been presented in Figure (a). Stall-feeding was found to be popular feeding system among many dairy cattle farms (93.5%). A considerable proportion of farms (34.8%) practice zero-grazing system alone while free-grazing alone is practiced in few (6.5%) farms.

Nutritive value of forage and concentrate supplements used for dairy cattle feeding during Yala season in Vavuniya and Mullativu districts significantly (P<0.05) varied. Guinea grass, hybrid fodder sorghum (Sugargraze), CO-3, azolla, groundnut leaves, gliricidia, ipil-ipil, and paddy straw were found to be the most widely used forage for dairy cattle feeding in Yala season (Figure 1 (b).

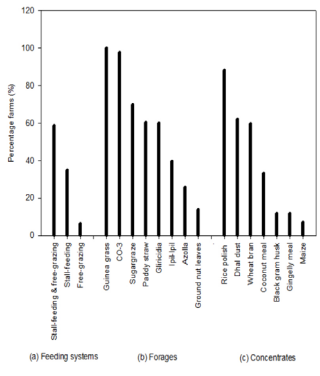

Figure 1: Most widely used (a) feeding systems (b) forages and (c) concentrates for dairy cattle feeding during Yala season in Vavuniya and Mullaitivu districts of Nothern Province

It is enco…der varieties (i.e. CO-3… and become the mostly… ms (93.5%). Guinea gr… rally grown throughou… e end of both Yala and … guinea grass and paddy… shortage for stall-fed dairy cattle in Yala season. Gliricidia, ipil-ipil and recently introduced azolla are included in stall-fed dairy cattle ration to improve the quality. Cattle on free-grazing system often depend on poor quality guinea grass abundant pasture is not a favorable situation.

Rice polish, dhal dust, wheat bran, coconut meal (poonac), black gram husk, gingelly meal (poonac) and maize were found to be the most widely used concentrate supplements for dairy cattle feeding in Yala season (Figure 1 (c). As paddy is cultivated extensively in the district, greater availability of rice polish led 88% farmers to supplement them for dairy cattle. Other concentrate supplements are purchased from the nearby markets. Dhal dust, wheat bran and coconut meal are also supplement for dairy cattle in considerable segment of farms. Despite acceptable quality, low availability of black gram husk, gingelly meal and maize resulted less use of them for dairy cattle feeding.

Nutritive value of most widely used roughages and concentrate supplements for dairy cattle feeding during Yala season in Vavuniya and Mullaitivu districts are presented in Table 1 and Table 2, respectively. Gliricidia and ipil-ipil are terrestrial legumes which form a symbiotic relationship with rhizobium bacteria capable of fixing atmospheric nitrogen. Azolla is a floating aquatic fern which also form a symbiotic relationship with cyanobacteria capable of fixing atmospheric nitrogen through the symbiotic relationship. Thus, as expected, gliricidia, ipil-ipli and azolla recorded greater content of CP. Therefore, they can be recommended as protein supplements in dairy cattle rations. However, high

Table 1: Nutritive value of most widely used roughages for dairy cattle feeding during Yala season in Vavuniya and Mullaitivu districts of Nothern Province.

Roughage	Nutritive Value (Mean±SE)														
	DM (%)†*			CP (%)*			Ash (%)*			OMD (%)*			ME (MJ/kg DM)*		
Guinea grass	21.63^{c}	±	0.48	9.80^{f}	±	0.19	12.80^{d}	±	0.12	42.93^{c}	±	3.48	6.25^{cd}	±	0.53
CO-3	16.30^{e}	±	0.33	13.36^{d}	±	0.28	14.93^{c}	±	0.28	42.48^{cb}	±	3.49	6.11^{bcd}	±	0.53
Sugargraze	19.46^{d}	±	0.13	11.45^{e}	±	0.17	11.45^{e}	±	0.23	48.91^{b}	±	3.51	7.15^{b}	±	0.54
Paddy straw	89.89^{a}	±	0.26	4.28^{g}	±	0.18	18.08^{b}	±	0.26	37.36^{c}	±	2.90	5.40^{d}	±	0.44
Gliricidia	22.56^{b}	±	0.18	21.94^{b}	±	0.18	9.32^{f}	±	0.23	47.15^{b}	±	2.96	6.78^{cb}	±	0.45
Ipil-Ipil	21.64^{c}	±	0.37	24.36^{a}	±	0.26	9.13^{f}	±	0.23	36.43^{cd}	±	3.12	5.11^{d}	±	0.48
Azolla	6.19^{f}	±	0.32	22.01^{b}	±	0.27	21.97^{a}	±	0.28	27.97^{d}	±	0.21	3.72^{e}	±	0.05
Groundnut leaves	22.74^{b}	±	0.22	15.12^{c}	±	0.22	9.59^{f}	±	0.24	57.27^{a}	±	1.51	8.59^{a}	±	0.25

DM; Dry matter, CP; Crude protein, OMD; Organic matter digestibility, ME; Metabolizable energy.

†, Expressed on fresh matter basis.

*, Means with a column followed by different superscripts are significantly different (P<0.05).

Table 2: Nutritive value of most widely used concentrate supplements for dairy cattle feeding during Yala season in Vavuniya and Mullaitivu districts of Nothern Province.

Table 2: Nutritive value of most widely used concentrate supplements for dairy cattle feeding during *Yala* season in Vavuniya and Mullaitivu districts of Nothern Province.

Concentrate supplement	Nutritive Value (Mean±SE)					
	DM (%)†*	CP (%)*	Ash (%)*	OMD (%)*	ME (MJ/kg DM)*	
White rice polish	$88.85^{c} \pm 0.45$	$11.90^{g} \pm 0.01$	$6.78^{b} \pm 0.37$	$44.90^{e} \pm 0.39$	$6.25^{c} \pm 0.05$	
Red rice polish	$90.01^{b} \pm 0.19$	$12.99^{f} \pm 0.01$	$5.02^{c} \pm 0.46$	$39.63^{f} \pm 2.34$	$5.77^{d} \pm 0.34$	
Dhal dust	$89.21^{c} \pm 0.26$	$15.02^{e} \pm 0.01$	$2.53^{d} \pm 0.02$	$46.91^{e} \pm 0.40$	$6.89^{c} \pm 0.06$	
Wheat bran	$87.64^{d} \pm 0.10$	$16.41^{d} \pm 0.01$	$4.98^{c} \pm 0.04$	$64.20^{cd} \pm 0.14$	$9.50^{b} \pm 0.05$	
Coconut meal (poonac)	$92.41^{a} \pm 0.10$	$18.95^{c} \pm 0.12$	$4.83^{c} \pm 0.23$	$67.46^{cb} \pm 0.17$	$9.97^{b} \pm 0.12$	
Black gram husk	$89.55^{c} \pm 0.44$	$22.25^{b} \pm 0.04$	$5.09^{c} \pm 0.08$	$62.36^{d} \pm 0.01$	$9.15^{b} \pm 0.02$	
Gingelly meal (poonac)	$86.87^{a} \pm 0.45$	$39.78^{a} \pm 0.15$	$12.37^{a} \pm 0.13$	$69.08^{cb} \pm 2.77$	$9.90^{b} \pm 0.43$	
Maize	$84.79^{e} \pm 0.19$	$6.04^{h} \pm 0.01$	$2.82^{d} \pm 0.01$	$73.18^{a} \pm 1.42$	$11.02^{a} \pm 0.21$	

DM; Dry matter, CP; Crude protein, OMD; Organic matter digestibility, ME; Metabolizable energy

†, Expressed on fresh matter basis.

***, Means with a column followed by different superscripts are significantly different (P<0.05).**

moisture and ash contents of azolla and high content of deleterious factors in gliricidia and ipil-ipil have to be taken into consideration when included in dairy cattle rations. Most probably due to delayed harvesting, Sugargraze and CO-3 recorded lower OMD and ME content than expected[8]. If harvest at correct early stage, guinea grass, CO-3 and Sugargraze are possible energy rich roughages with Sugargraze would be the best option for dairy cattle feeding in the districts. Although, the CP content of white and red rice polish agree with published values, low OMD and ME contents recorded in the present analysis suggests possible adulteration of rice polish with paddy husk. Despite slightly low CP content recorded for coconut meal, high OMD and ME content qualify coconut meal as an ingredient in dairy cattle rations. The CP, OMD and ME contents of black gram husk, gingelly meal and maize agree with published information [8]. The present study concludes that, coconut meal, black gram husk and gingelly meal available in Vavuniya and Mullaitivu districts could be recommended as both energy and protein supplements whilst maize as a major energy supplement for dairy cattle rations. Further, the low availability of black gram husk, gingelly meal and maize and adulteration of rice polish possibly with paddy husk are major issues to be addressed inorder to prosper dairy cattle farming in the northern province.

References

1. Alahakoon, A.U., Jo, C. and Jayasena, D.D. (2016). An overview of meat industry in Sri Lanka: A comprehensive review. Korean journal for food science of animal resources. 36(2), p.137.
2. Central Bank of Sri Lanka (2017). Annual Report. Central Bank of Sri Lanka, Colombo.
3. Perera and Jayasuriya (2008). The dairy industry in Sri Lanka: current status and future directions for a greater role in national development. Journal of National Science Foundation, Sri Lanka. 36. Pp. 115-126.
4. Makkar H.P.S (1997). Recent advances in the in vitro gas method for evaluation of nutritional quality of feed resources. Assessing quality and safety of animal feeds. International Atomic Energy Agency, Vienna, Austria.
5. Makkar, H.P.S. (2003). Quantification of Tannins in Tree and Shrub Foliage. Kluwer Academic Publishers, P.O. Box 17, [6].AOAC (2004–5). Official Methods of Analysis. 17th ed. Association of Official Analytical Chemists Inc., Arlington, VA, USA.
6. Duncan, D.B. (1995). Multiple ranges and multiple F-test. Biometrics. 11. Pp. 1-42.3300 AA Dordrecht, The Netherlands.
7. Chamberlain, A,T. and Wilkinson, J.M. (1996). Feeding the dairy cow. Chalcombe Publications, Lincoln, United Kingdom, pp. 216-223.