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Article

Study on cutting intervals on biomass yield, nutritive value and their oxalate content of different high yielding napier (*P. purpureum*) cultivars

Ruhul Amin[1], Nathu Ram Sarker[1] Md.Yousuf Ali[1*], Md. Abul Hashem[2] and Mahfuza Khatun[1]

[1]Bangladesh Livestock Research Institute, Savar, Dhaka-1341, Bangladesh
[2]Department of Animal Science, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

[*]Corresponding author: Md. Yousuf Ali, Bangladesh Livestock Research Institute, Regional Station, Shahjadpur, Sirajgonj, Bangladesh. E-mail: 113yousuf.bau@gmail.com, myousuf@blri.gov.bd

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Abstract: The aim of the experiment was to determine the biomass yield, morphological characteristics and nutritive value of different high yielding Napier cultivars according their cutting intervals. This study mainly discussed about four Napier cultivars named BLRI-Napier-4, Wruk-Wona, Napier-Hybrid (Japan) and MarkEron. The cutting interval was 45 days. The result showed significant difference ($p<0.05$) in 3rd cutting into these three cutting in case for biomass yield, number of hill, number of tiller and plant height. The stem and leaf ratio was higher in 2nd cutting in BLRI-Napier-4. For botanical fraction, leaf contained more dry matter than stem. Crude protein was higher in leaf portion for different Napier cultivars. As considering the cutting interval, the 3rd cutting contained higher dry matter compare to other cut. MarkEron cultivar showed more significant difference ($p<0.001$) for Ash and CP content into its three cutting. High level of oxalate found in BLRI-Napier-4. Considering biomass yield, BLRI-N-Hybrid was the higher value. Crude protein was higher in MarkEron cultivar.

Keywords: biomass; BLRI-Napier-4; Wruk-Wona; Napier-Hybrid (Japan); MarkEron

1. Introduction

Feed shortage is the major reason for low productivity of livestock. The demand of fodder production is increasing today because we have a limited listed livestock feed resource in our country. Our animal mainly survives on the common local grasses that are not available throughout the year. For this reason, BLRI is still working for the developing of different high yielding fodder variety ultimately it will be able to give a better nutrition to our livestock. Napier grass (*Pennisetum purpureum*) is a perennial grass grown widely as a fodder crop and feed for the cut-and-carry zero-grazing dairy systems (Bayer, 1990) and constitutes up to 80 % of forage for smallholder dairy farms (Stall *et al*., 1987). It is the forage of choice not only in the tropics but also worldwide (Hanna *et al*., 2004) due to its desirable traits such as tolerance to drought and a wide range of soil conditions, and high photosynthetic and water-use efficiency (Anderson *et al*., 2008). Napier grass [*Pennisetum purpureum* (Schum.)], also known as elephant grass, is a deep-rooted high yielding perennial bunch grass that is native to eastern and central Africa (Boonman, 1993). It is the most popular perennial fodder recommended for the intensively production. Oxalates occur naturally in quite a large number of plants in both soluble and insoluble forms or in Free State. Oxalic acid may combine with calcium, iron, sodium, magnesium, or potassium to form less soluble salts known as oxalates in plants. Since oxalic acid binds with important nutrients, making them inaccessible to the body, regular consumption of large amounts of feeds containing high in oxalic acid over a period of weeks to months may result in nutrient deficiencies, most notably of calcium (http://www.ars-grin.gov/duke/highchem.html).When oxalates are absorbed from the gastrointestinal tract, the soluble oxalates (sodium, potassium and ammonium oxalates) rapidly combine with serum calcium and magnesium, causing a sudden decrease in available serum calcium and magnesium (http://www.ivis.org). This situation generally occurs when quantity of oxalate-accumulating grasses are grazed by cattle that are not accustomed to eat the grasses. If this situation continues, calcium and magnesium are drained out from the body. Thus, animals suffer from negative calcium balance though the supply in the ration is adequate. Absorption and metabolism of phosphorus is also hampered as its absorption and metabolism is correlated with that of calcium leading to phosphorus deficiency in animals. So, it is important to determine the oxalate content of different cultivars of Napier grass used by farmers. Considering the above discussion the present work was, thus, undertaken with the following objectives-

a) To determine the biomass yield & nutritive value of different high yielding Napier cultivars.
b) To determine the oxalate content of Napier cultivars.
c) To evaluate the variation of nutrient content according to their cutting interval and their botanical fraction.

2. Materials and Methods

2.1. Site of the experiment

The experiment was conducted at the Pachutia Research Station, Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka from 15 March to 6 July, 2013. The chemical analyses of Napier cultivars sample were done in the Animal Nutrition Laboratory of BLRI.

2.2. Cultivation procedure of Napier cultivars

An agronomic trial was conducted with five Napier (*Pennisetum purpureum var.*) cultivars including one check (BLRI Napier- hybrid) collected from Japan and BLRI-Napier-4 at the red soil Madhupur tract of Savar with objectives to investigate the biomass yield, morphological characteristics, botanical fractions and nutritive value. The selected Napier cultivars were grown under identical condition having plot size of 5 x 5 sq.m with 4 replications in each cultivar. Therefore, a total of 20 plots were made for this agronomical trial and each cultivar was placed in four plots at random. All the agronomical practices were step by step as per recommended practices developed by Bangladesh Livestock Research Institute. During land preparation fermented cow dung was applied @ of 35 kg/decimal. The cuttings were transplanted at 70 cm distance from line to line and 35 cm distance in row to row. Weeding and irrigation were done when necessary. During land preparation fertilizer only Phosphate (TSP) and MP were applied @ 150 and 125 kg/ha. Urea at the rate of 50 kg was applied 20-30 days after transplanting followed by 50 kg urea was applied after 10-12 days of each cutting. Green fodder from each plot was harvested manually after 45 days of transplantation approximately 5-6 cm above ground. The biomass yield was determined in each plot and converted the yield in tons/ha. The representative samples from taken, chopped approximately 2-3 cm length and send to the lab for nutritive evaluation. Biomass yield of five Napier cultivars was measured by weighing the mass. Height and number of hill (thousand/ha) and tiller number per hill was counted. 1-kg fodders from each cultivar were fractionated manually into three fractions namely leaf blade, leaf sheath and stem (DM basis). Measurements of DM yields were taken from whole plots. Morphological characteristics were determined by measuring the plant height and leaf characteristics from representative tillers.

2.3. Chemical analysis

The chemical analysis of the sample was done by the following methods described by AOAC (1995). Acid detergent fiber (ADF) was estimated by using the methodsof Goering and Van Soest. Kjeldhal method was used for determining the nitrogen (N) content of the sample and the crude protein content was estimated as N×6.25. The ME (MJ kg-1 DM) was estimated according the Ketelaars and Tolkamp (1992) as follows: DOMD (%) = 75.73-(0.269 × ADF%); ME (MJ kg-1 DM) = DOMD (%) x 0.15.

2.4. Oxalate determination

The oxalate contents of four Napier cultivars were analyzed by titration method. Two grams of dried and ground representative samples were taken into a 250 ml volumetric flask and mixed with 10 ml 6N HCl and 190 ml distilled water, and the content was heated for one hour on a boiling water bath. The digested sample was cooled at room temperature and distilled water was added to make 250 ml. The sample was mixed, allowed to settle and filtered in a conical flask. Fifty millilitres of the filtrate and 20 ml 6N HCl were mixed in another 250 ml volumetric flask and evaporated to half of its volume on a hot water bath. The mixture was filtered in a beaker and the volume was made to 125 ml by washing the precipitate several times with warm distilled water, 3 to 4 drops of methyl red indicator was added in the filtrate in the beaker, and ammonium hydroxide was mixed gradually until the color of the content becomes faint yellow. The content in the beaker was heated to just

boiling, cooled and filtered for removing the precipitate containing ferrous compounds. The filtrate was boiled, 10 ml of calcium chloride solution was added while continuously stirred with a glass rod having rounded tip, and kept overnight undisturbed beneath a bell jar. Glass road was left in the beaker**.** In the following day, it was filtered through Whatman filter paper No. 41 and the precipitate was made free of calcium ions after washing several times with hot distilled water (70^{o}C). The washed precipitate on filter paper was transferred back to original beaker by washing with hot distilled water (70^{o}C), diluted sulfuric acid (1:4) was added with the help of a graduated pipette, and the content was stirred with a glass rod to dissolve the precipitate completely. The filter paper was put back on the funnel. The content in the beaker was heated (70 to 80^{o}C) and titrated against 0.05N KMnO4 solution while hot indicating the end point by a faint pink color. The calculation of oxalate content was done by the following formula.
Oxalate in sample (% sample DM) = 0.5625V %
V = Volume of KMnO4 used (ml)
1ml 0.05N KMnO4 = 0.00225g oxalate

2.5. Design and layout of the experiment
The experiment was conducted in a Completely Randomized Design (CRD). The layout of the experiment is shown in Table 1.

Table 1. Design and layout of the experiment.

Treatment / Replication	Cutting Interval		
	To First cut	**T1 Second cut**	**T2 Third cut**
BLRI-Napier-4	4	4	4
Napier-Hybrid	4	4	4
Wruk-Wona	4	4	4
MarkEron	4	4	4
Mean	**4**	**4**	**4**

2.6. Statistical Analysis
An analysis of variance was done to determine the varietals differences. Collected data were analyzed statistically by using Compare Means (CM) procedure of one-Way Analysis of variance (ANOVA): Post Hoc Multiple Comparisons of SPSS 11.5 for windows (SPSS Inc. 2002) following the method of Randomized Complete Block Design (RCBD).

3. Results
3.1. Morphological characteristics of Napier cultivars
The Morphological measurements like number of hills, tillers and plant height for different cuts of different Napier cultivars are given in Table 2. It shows that number of hills for different cultivars does not differ significantly for first cut but differ in 2nd and 3rd cut. In the 1st cutting of different Napier cultivars, there were no significant differences for biomass yield, no. of hill, no. of tiller but except the plant height, higher value for MarkEron and lower value for Napier-Hybrid for plant height in 1st cut. On the other hand, the 2nd cutting, there was significant variation ($p<0.05$) in no. of hill and plant height. The result of 3rd cutting was very significant compare to 1st and 2nd cutting. Here, significant difference was observed for biomass yield, no. of hill, no. of tiller and the plant height. MerkEron contained the highest hill and the Napier-Hybrid contained the lowest hill for all cut. For plant height, in the overall cut significant difference was observed the no. of hill ($p<0.001$).

3.2. Biomass yield ratio of botanical fraction for different Napier cultivars
From Table 3 Stem and leaf ratio was higher in Wruk-Wona and lower in Napier-Hybrid. Stem and leaf ratio were comparatively more in 2nd cutting than the 1st cutting. Here, the higher ratio was in BLRI-Napier-4 and lower ratio was in Wruk-Wona. Stem and leaf ratio were decreasing in 3rd cut compare to 2nd cutting but the ratio was greater in BLRI-Napier-4.

Table 2. Biomass yield and Morphological characteristics of different Napier cultivars.

Variety	Biomass (ton/hectare)	No. of hill/ hec. (thousand)	No. of tiller/hill	Plant Height (feet)
		1st cutting		
BLRI-Napier-4	45.92 ± 6.53	29.02 ± 1.17	32.04 ±1.98	5.01[a] ± 0.16
Napier-Hybrid	62.02 ± 14.04	24.70 ± 1.89	36.5 ± 1.60	4.32[b] ± 0.16
Wruk-Wona	67.80 ± 3.31	28.36 ± 1.41	35.8 ± 0.61	4.43[b] ± 0.19
MerkEron	48.46 ± 5.51	29.24 ± 1.28	36.56 ± 4.1	4.36[b] ± 0.11
Mean	55.74 ± 4.07	27.99 ± 0.76	35.16 ± 1.23	4.54 ± 0.09
Significance	NS	NS	NS	*
		2nd cutting		
BLRI-Napier-4	82.25 ± 12.95	28.55 ± 1.42[a]	17.25 ± 1.65	5.99 ± 0.41[b]
Napier-Hybrid	86.10 ± 5.18	22.83 ± 0.77[b]	18.50 ± 2.10	5.86 ± 0.81[b]
Wruk-Wona	75.35 ± 8.06	27.23 ± 1.96[ab]	15.40 ± 1.10	6.39 ± 0.27[ab]
MerkEron	72.56 ± 2.46	29.54 ± 1.08[a]	16.62 ± 0.65	6.94 ± 0.24[a]
Mean	78.68 ± 3.70	27.18 ± 0.88	16.92 ± 0.69	6.33 ± 0.16
Significance	NS	*	NS	*
		3rd cutting		
BLRI-Napier-4	67.05[a]±3.14	29.07[a]±0.90	23.08[b]±1.07	6.4[a]±0.28
Napier-Hybrid	45.22[c]±5.17	24.40[b]±1.05	23.30[b]±1.14	5.8[b]±0.20
Wruk-Wona	58.05[b]±1.52	26.63[b]±1.57	38.60[a]±1.75	5.3[c]±0.11
MerkEron	47.67[c]±2.72	30.15[a]±1.15	20.75[b]±1.64	5.8[b]±0.25
Mean	54.26±2.88	27.62±0.79	25.62±1.86	5.87±0.14
Significance	**	**	**	*
		Overall cutting		
BLRI-Napier-4	65.07±10.53	28.88[a]±0.17	24.12±4.30	5.80±0.41
Napier-Hybrid	64.45±11.86	23.97[c]±0.58	26.10±5.38	5.33±0.50
Wruk-Wona	67.07±5.00	27.41[b]±0.51	29.93±7.31	5.37±0.57
MerkEron	56.23±8.17	29.64[a]±0.28	24.64±6.08	5.58±0.54
Mean	62.89±7.90	27.59[b]±0.23	25.90±5.28	5.56±0.22
Significance	NS	***	NS	NS

* = p<0.05; NS=p>0.05; ***=p<0

Table 3. Biomass yield ratio of botanical fraction for different Napier cultivars.

Variety	Stem Wt./kg	Sheath Wt./kg	Leaf Wt./kg	Stem : Leaf
		1st cutting		
BLRI-Napier-4	500	200	300	5:3
Napier-Hybrid	300	300	400	3:4
Wruk-Wona	550	170	280	5.5:2.8
MerkEron	320	220	460	3.2:4.6
		2nd cutting		
BLRI-Napier-4	650	50	300	6.5 : 3
Napier-Hybrid	650	100	250	6.5 : 2.5
Wruk-Wona	600	150	250	6 : 2.5
MerkEron	600	100	300	6 : 3
		3rd cutting		
BLRI-Napier-4	650	100	250	6.5:2.5
Napier-Hybrid	510	160	330	5.1:3.3
Wruk-Wona	500	150	250	5:2.5
MerkEron	520	180	300	5.2:3

N.B.: *=p<0.05;**=p<0.01; NS=Non-Significant

Table 4. Biomass yield and morphological composition and characteristics of different Napier cultivars.

Cultivars	Yield (ton/ha/cut)			Composition
	Biomass	DM	CP	DM (%)
BLRI-Napier-4	23.00[ab]±3.84	2.94[ab]±0.48	2.48[a]±0.43	12.82[b]±0.17
Napier-Hybrid	8.50[c]±1.95	1.23[c]±0.19	1.06[b]±0.31	15.41[a]±1.74
Wruk-Wona	20.45[ab]±1.40	2.32[bc]±0.19	2.45[a]±0.21	11.35[b]±0.48
MerkEron	29.35[a]±4.23	3.89[a]±0.73	3.60[a]±0.54	12.94[b]±0.94
Level of Sig.	**	**	**	*

*=p<0.05;**=p<0.01

Table 5. Nutrient composition of different Napier cultivars.

Parameters	Name of cultivars					Sig.
	BLRI N hybrid	BLRI-Napier-4	N. Japan	Wruk-Wona	MerkEron	
%DM Fresh basis	15.71±0.32	14.11 ± 0.56	14.37± 0.61	14.53± 1.05	12.74± 0.73	NS
g/100g DM						
Ash	10.98± 0.78	10.26±0.90	9.10±1.36	11.55±0 .36	9.87±1.40	NS
OM	89.02±0.67	89.71±0.91	90.89±1.36	88.44±0.36	91.29.±1.4	NS
ADF	45.91[b]±0.45	41.24[a]±0.29	43.23[a]±0.50	37.38[b]±1.56	29.90[c]±0.77	*
CP	10.40[a]±0.21	11.49[a]±0.57	12.85[a]±0.39	13.71[ab]±0.21	14.43[b]±0.50	*
ME (MJ/kg DM)	9.15[d]±0.3	9.70b[c] ± 0.01	9.61[c] ± 0.02	9.82[b] ± 0.08	10.08[a] ± 0.07	**

N.B.: *=p<0.05;**=p<0.01; NS=Non-Significant

Table 6. Comparative Nutrient content of different Napier cultivars for all cut.

Nutrient content(g/100g DM)	N	Mean ±SE of different cultivars					Sig. level
		N.hybrid	Wruk-Wona	BLRI-Napier 4	MerkEron	Overall	
Dry matter	12	16.53±0.89	14.66±0.89	14.98±1.27	15.60±1.02	15.44±0.52	NS
Ash	12	06.84[b]±0.68	09.82[a]±0.95	11.16[a]±1.14	10.77[a]±1.02	09.65±0.53	*
CP	12	11.35±0.53	10.37±0.42	11.41±0.58	10.56±0.41	10.92±0.25	NS

N.B.: *=p<0.05; NS=Non-Significant.

Table 7. Nutrient contents of different cut for BLRI-Napier 4 cultivar.

Nutrient content (g/100g DM)	N	Mean ± SE of different cut			Level of Significance
		1st cut	2nd cut	3rd cut	
Dry matter	4	14.4075[b]±1.47	10.5375[c]±.53	20.0050[a]±.26	***
Ash	4	10.8850[ab]±.31	14.9025[a]±2.17	7.6875[b]±.92	*
CP	4	11.3850[ab]±1.12	13.2325[a]±.19	9.6025[b]±.40	*

***=p<0.001;**=p<0.01;*=p<0.05

Table 8. Oxalate content of different Napier cultivars.

Parameter	N	Mean ± SE of Oxalate (%) of different cultivars				Level of Significance
		Napier-Hybrid	Markeron	Wrukwona	BLRI-Napier 4	
Oxalate (%)	4	.136[b]±.025	.257[b]±.102	.111[b]±.012	.82[a]±.212	*

N.B.: *=p<0.05;**=p<0.01; NS=Non-Significant

3.3. Biomass yield and morphological composition and characteristics of different Napier cultivars

Significant different (p<0.01) is observed in Table 4 between the effect of bio-mass production of different napier cultivar. Biomass yield and morphological characteristics was taken only for Napier varieties. Biomass yield was in the order of BLRI-Napier-4 >MERKERON > WRUK-WONA > Napier-Hybrid. Table 6 also impressed that, DM yield & CP yield, were significantly differed ($p<0.01$). The DM content of all cultivars was mostly similar (Table 3) but the DM (t/ha/cut) yield was significantly ($p<0.01$) higher in BLRI N.hybrid and the lower in Napier-Hybrid. Similarly, CP yield (t/ha/cut) was also higher in MERKERON and the lower in Napier-Hybrid.

3.4. Nutrient composition of different Napier cultivars

The results indicated that the CP content was significantly higher ($p<0.05$) in MERKERON (14.43) and lower in BLRI N.hybrid (10.40). There was significant difference ($p<0.05$) in CP among BLRI N. hybrid, BLRI-Napier-4, Napier Japan and WRUK-WONA. The ADF content was higher in BLRI N.hybrid compared to other cultivars. The mean of calculated ME (MJ kg/DM) were significantly varied from 9.15 to 10.08 among the cultivars (Table 5). The results so far obtained revealed that in terms of bio-mass and nutritive values BLRI N hybrid is better than other cultivars. Further, intake and digestibility studies including all cultivars are planning to achieve final conclusion.

3.5. Comparative Nutrient content of different Napier cultivars for all cut

In Table 6, for DM and CP content, there was no significance difference for different Napier cultivars. But, in case for Ash content, significant difference ($p<0.05$) was observed whereas the highest value was in BLRI-Napier-4 and the lowest value was in N. Hybrid.

3.6. Nutrient contents of different cut for BLRI-Napier 4 cultivar

In Table 7, for BLRI-Napier-4, there were significant difference for the nutrient content here, the DM content for different cut was highly significant ($p<0.001$). Ash and CP content also showed significant ($p<0.05$) difference. Highest DM found in 3rd cut, highest Ash found in 2nd cut and highest CP found in 2nd cut.

3.7. Oxalate content of different Napier cultivars

Oxalate percentage for different Napier cultivars, variation ($p<0.05$) was observed into the cultivars. The greater value of oxalate content was in BLRI-Napier and the lower value was in Wruk-Wona (Table 8).

4. Discussion

The experiment was conducted at the Pachutia Research Station, Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka. The objectives of the experiment were determination of the variation of nutrient and oxalate content for different Napier cultivars according to their cutting intervals at 45 days. Biomass yield, no. of hill, no. of tiller and the plant height were taken from three different cutting. In the first cutting, significance difference was only observed in plant height. The greater value (5.01 ft) for plant height was in BLRI-Napier-4 cultivar (Table 4). Among three cuttings, the highest variation was observed in 3rd cutting but the value for stem and leaf ratio was higher in 2nd cutting. The highest stem and leaf ratio was observed in BLRI-Napier-4 cultivar (Table 5). The leaf: stem ratio of the grass shows that the leaf fraction increased significantly over time which is similar to the findings of Shokri Bin Jusoh, 2005. From the experiment it showed that leaf & stem ratio was higher in 2nd cut compare to 1st cut.

Napier-Hybrid and MarkEron contained more dry matter than other cultivars. There are varietal differences in the proportions of different botanical fractions and chemical composition (Islam *et al*., 2003; Mwendia *et al.*, 2008) which is in agreement with the present findings. From the Table 5, it was observed that the proportion of leaf fraction was higher in MarkEron and from Table 7 it showed that CP content was also higher in MarkEron. The proportion of leaf fractions is positively correlated to the concentration of plant CP and digestible energy (Islam *et al*., 2003) and in turn determines the intake and animal performance (Gwayumba *et al*., 2002; Islam *et al*., 2003).

In 3rd cutting significance ($p<0.01$) differences were observed for the biomass yield, no. of hill and no. of tiller. The highest biomass yield (67.05ton/ha) was in BLRI-Napier-4, the highest no. of hill (30.15thousand/ha) was in Merk-Eron and the highest no. of tiller (38.60) was in Wruk-Wona cultivar (Table 4). The biomass yield was higher in the 2nd cutting compare to 1st and 3rd cutting. In the 2nd cutting, the biomass yield was BLRI-Napier-4 (82.25ton/ha), Japan-Hybrid (86.10ton/ha), Wruk-Wona (75.35ton/ha) and MerkEron (72.56ton/ha). On the other hand, 3rd cutting biomass yield was BLRI-Napier-4 (67.05ton/ha), Japan-Hybrid (45.22ton/ha), Wruk-Wona (58.05ton/ha) and MerkEron (47.67ton/ha) (Table 4). For different Napier cultivars, biomass yield was higher in BLRI-N-Hybrid (48.21ton/ha) and %DM was also higher in BLRI-N-Hybrid (15.71g/100gm DM). DM yield for BLRI-N-Hybrid was 7.57 ton/ha and dry matter yield was 3.89 ton/ha for Mark-Eron. CP Yield was higher in Merk-Eron (3.60ton/ha) cultivar (Table 6). In our experimental cultivar, it is possible to get five cut/year, so expected dry matter from the cultivar could be BLRI-Napier-4 (14.7t/ha/year), Napier-Hybrid (6.15t/ha/year), Wruk-Wona (11.6t/ha/year) and MarkEron (19.45t/ha/year). The dry matter yield in the experimental Napier-Hybrid cultivar was lower as compare to Schreuder *et al.* (1993) result. This variation may be due to soil condition and the fertilizer dose. Napier grass has been the most promising and high yielding fodder giving dry matter yields that surpass most tropical grasses (Humphreys, 1994; Skerman & Riveros, 1990). Reported on-farm dry matter yields from different regions of the country averaged about 16 tones/ha/year (Wouters, 1987) with little or no fertilizer, while according to Schreuder *et al*. (1993) yields on research stations vary between10-40 tones dry matter per hectare depending on soil fertility, climate and management factors. Here, the result of the present experiment showed the higher DM and CP in 3rd cutting which is similar to the findings of Ova *et al*., (1985). Dry matter yield generally increases with increasing fertilizer rate and cutting interval (Carvalho *et al.,* 2000). Different studies have revealed a strong association between cutting and increased dry matter and a decline in nutritive value because crude protein levels, cell content, digestibility and proportion of leaf declined with age while fibre level increased (Ova and Chheda, 1985; Okwori, 1989). Oyenuga (1966) showed that the older the forage materials, the lower the crude protein contents, the higher the fibre content, the lower the digestibility and the poorer nutritive quality and intake Akinola (1981). Forages when harvested at early stages of their development have relatively higher crude protein content, other extract and ash content, but crude fiber, acid detergent lignin, hemicelluloses and cellulose increase with later harvesting resulting in decreased dry digestibility(Mirza *et al.*, 2002). In Kenya, the average dry matter yields vary between 10 and 40 t DM ha-1 yr-1 depending on soil fertility, climate, and management (Schreuder *et al*., 1993). Napier grass on average contains 20% DM, 7 to 10% CP, 70% NDF, 45% ADF (Gwayumba *et al*., 2002; Islam *et al*., 2003).

Chemical composition of different Napier cultivars is shown in Table 8. There were significance difference for %DM fresh basis, Organic matter (OM), Acid Detergent Factor (ADF) and the Metabolizable Energy (ME). %DM fresh basis was less significant ($p<0.05$) than that of OM, ADF and ME. Organic Matter was higher in Hybrid-Japan (90.93 g/100gm DM). Acid Detergent Factor was higher in Wruk-Wona (51.21 g/100gm DM) and the greater ME value was in Merk-Eron (10.27 MJ/kg DM) (Table 8). Nutrient content of different Napier cultivar for the respective three cut, significant ($p<0.05$) difference found only in Ash content (Table 6). Ash content was higher in BLRI-Napier-4(11.16 g/100gm DM) (Table 6). There were highly significant ($p<0.001$) variation for DM and CP content for the botanical fraction of different Napier cultivars. The highest DM and CP found in leaf (Table10). When the botanical fraction considered for different cultivars separately, it was observed more significant ($p<0.01$) difference in CP content for Wruk-Wona cultivar (highest value-16.316g/100gm DM). In case of Ash content, the four cultivars had no significant differences. Except the CP content of Wruk-Wona cultivar, the DM and the CP content of all cultivar had significant ($p<0.05$) variation. So, It might be concluded that when all the cultivars analyzed in together, there was highly significant ($P<0.001$) difference for DM and CP.But, when it is calculated separately, only significant ($P<0.05$) variation found in DM & CP. DM was higher in leaf of all varieties and DM was lower in Stem for all cultivars. CP content for all cultivars was higher in leaf (Tables11, 12, 13 and 14).

For different cut of Napier cultivars significant ($p<0.05$) difference was observed only in DM content (Table15). But when all the cultivars analyzed separately highly significant ($p<0.001$) difference noticed in DM content for Wruk-Wona and BLRI-Napier-4 (Tables16 and18). For Mark-Eron, the Ash and CP content were highly significant ($p<0.001$) (Table16).

5. Conclusions

From the findings of this study following conclusions may be drawn, in case of Biomass Yield, the order was BLRI N.hybrid > BLRI-Napier-4 >MERKERON > WRUK-WONA > Napier –Japan .The number of tiller per hill was higher in Wruk-Wona and lower in Napier-Japan. DM content was higher in BLRI-Napier-Hybrid and lower in Napier-Japan. CP yield was higher in Merk-Eron and lower in BLRI-Napier-Hybrid. Stem and Leaf ratio was higher in 2nd cutting than compare to 1st and 3rd cutting. BLRI-Napier-4 was the tallest plant in case of height. Leaf contained the highest Dry Matter and Crude Protein compare to other botanical fraction that was similar to other study. Into the 1st, 2nd and 3rd cut, third cutting contained more Dry Matter than compare to 2nd & 3rd cut. Oxalate content was more in BLRI-Napier-4 compare to other cultivars.

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Conflict of interest

None to declare.

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