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Screening of Napier Grass (Pennisetum Purpureum) Accessions Tolerant to Acid Soils in Some Areas of Ethiopia

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Abstract— *A chronic feed deficit is found in highland agro-ecology. The study was conducted at Banja sub-station in Banja district of Awi administrative zone, Amhara Regional State, Ethiopia for three consecutive years during 2016 to 2018 cropping seasons, to evaluate the adaptable and promising Napier grass accessions that can tolerate acidic soil and to analyze the nutrient content of Napier grass accessions. Ten Napier grass accessions 15743, 16783, 16791, 16792, 16794, 16813, 16815, 16817, 16819 and local check. were evaluated for their agronomic traits and its chemical composition in randomized complete block design with three replications. Data on plant height number of tillers, leaf to stem ratio, fresh biomass yield, dry matter yield and chemical composition were analyzed using the general linear model procedures of SAS and least significance difference was used for mean comparisons. The combined analysis of variance indicated that the main effect differences among genotypes, years and the interaction effects vary significantly for measured agronomic traits. The combined analysis for plant height significantly ($P<0.05$) different, which ranged from 71.6 to 178.5 cm with a mean of 103.3 cm. The local accession gave the highest mean plant height followed by accession 16791 and 16815 while accession 16783 gave the lowest over years. The highest mean dry matter yield was recorded in 16791 (10.5 t/ha) followed by Local(9.7 t/ha) and 15743(7.5 t/ha).The combined analysis indicated that dry matter yield varied significantly ($P<0.05$) among the tested accessions and the yield ranged from 3.9 to 10.5 t/ha with a mean of 6.4 t/ha. The combined analysis for CP significantly ($P<0.05$) different, which ranged from 5.4 to 7% with a mean of 6.12%. Generally, Napier grass accessions respond differently across the testing years due to differential responses of the genotypes to various edaphic, climatic and biotic factors. It is suggested that Napier grass should be harvested at appropriate time in order to have high nutritive values with relatively high biomass production. Therefore, among tested genotypes 16791 and 15743 Napier grass accessions will be promoted in the study area and similar environment.*

Keywords— *Napier grass accessions plant height dry matter yield leaf to stem ratio crud protein*.

I. INTRODUCTION

A chronic feed deficit represents a major constraint to animal production in many developing countries. The situation manifests itself in poor animal performance, low growth rates, reduced reproductive efficiency, high mortality rates, etc. The genetic potential of many farm animals is inadequately exploited and the outputs of animal production such as meat, milk, eggs, fiber and skins, often fall far short of national requirements.

In the highlands, because of expansion of cultivation, the area of land allocated to grazing progressively declined through time (Alemayehu, 2002; Zerihun, 2002), which affected the availability of feed resources which in turn affect livestock production in the highlands of Ethiopia, where natural pasture and crop residues are the major sources of feed supply to livestock (Seyoum and Zinash, 1995; Zinash *et al.*, 1995; Zerihun, 2002).

In Awi Zone, at Injibara district, almost all small-scale farmers' livestock are highly dependent on grazing lands and crop residues for few months. However most of the areas have no communal grazing lands or very little in size or over-grazed or there is no forage conservation management practice (informal survey and personal communication). Besides, due to low fertility acidic soil the existing pasture productivity is decreasing and degrading. Until and unless the feed supplies are increased, it is impossible to maximize productivity from the indigenous animals with the existing traditional rearing system even to fulfill the maintenance requirement.

Introducing different types of improved forage species with different mode of use like over sowing, under sowing, mixed or pure stand is essential. Besides evaluating and characterizing the existing indigenous forage resources, research efforts have to be made to define the physiological basis of plants' to increase ability of adaptation to acid soils, that could in turn, will lead to improved selection and breeding; the identification of plant-soil, plant-plant, and soil-plant-animal nutrient interactions in forage-based production systems; and improved identification of ecological niches for forage germplasm (CIAT).

Napier grass (Pennisetum purpureum), also known as elephant grass, originated from Sub-Saharan tropical Africa (Clayton et al., 2013). Napier grass is a tall and deep-rooted perennial bunch grass well known for its high yielding capability and mainly used for cut-and-carry feeding systems (FAO, 2015) and fed in stalls, or it is made into silage or hay. It performs well in low, mid and highland areas of Ethiopia (Seyoum et al., 1998; Tessema, 2005). It grows best at high temperatures but can tolerate low air temperatures under which the yield can be reduced and ceases to grow at a temperature below 10°C (Fekede et al., 2005).

Thus, tackling feed problems by screening of most adaptable and promising forage species should be given priority to develop superior genotypes that combine several

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desirable traits (like acidic soil tolerance as well as suitability to agro ecology of the zone) to improve pasture productivity and combat pasture degradation

Objectives:

- To select adaptable and promising grass lines/accessions that can tolerate acidic soil within Injibara agro ecological zone.
- To analyze the nutrient content of well performed forage grass lines /accessions.

II. MATERIALS AND METHODS

Descriptions of the study Areas

The experiment was conducted for three consecutive years during 2016 to 2018 cropping season at Banja sub-station in Banja district of Awi administrative zone, Amhara Regional State, Ethiopia. The sub-station is located at latitude of 10° 56' 27-53'' north and longitude of 36° 52' 27-55'' east, an altitude of 2489 masl and 130 km South of the regional city Bahir Dar and 460 km North of Addis Ababa(Figure 1).

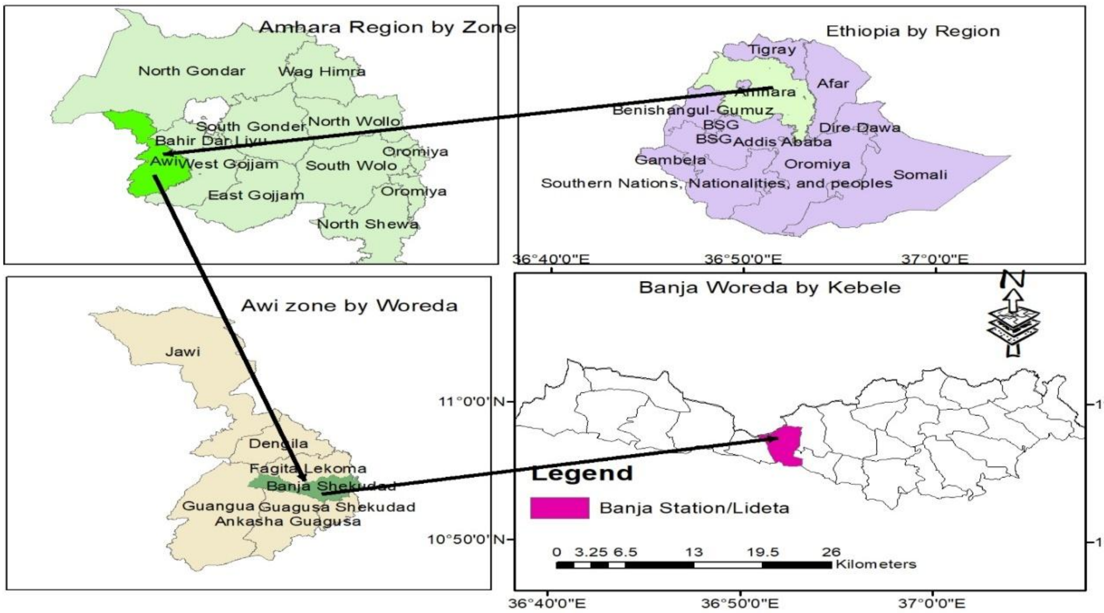

Figure 1. Location map of the study area, Banja district, north western Ethiopia

Climate

According to National Meteorology Agency weather data from 1984 to 2017, the mean minimum and maximum temperatures of the study area were 10.3 and 22.5 °C, respectively. The mean annual rainfall is 1344 mm with main wet season from June to September usually continued with a less pronounced wet period up to November (Figure 2).

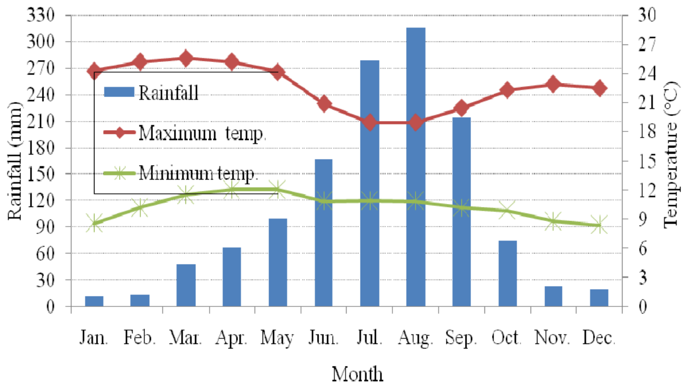

Figure 2. Mean monthly rainfall, minimum and maximum temperature of the study area based on three decades records at the Debre-Markos Meteorological Station

Soil Type and Test

The soil types of the study area are Nitisols and characterized with shallow, moderate to deep and very deep in depth and sandy clay to clay texture types (Bireda, 2015).The soil sample were taken before planting in the experimental location. Five representative sites were selected by using X Fashion and soil sample was taken by using Auger 20 cm depth. After taking the sample make composite sample. The composite sample were dried and grind. The $_{P}$H, organic carbon and organic matter parameters were analyzed.

TABLE 1. Soil physio-chemical properties before establishment of the experiment

Soil property	Unit	Value
Soil type		Nitisols
Texture class		clay
$_{P}$H(1:2.5) soil to H_2O ratio		5.16
Total organic matter	%	4.72
Total organic Carbon	%	2.74
Available phosphorous (ppm)		13.59

Experimental Design and Layout

Ten accessions of Napier grass considered for this research experiment were 15743, 16783, 16791, 16792, 16794, 16813, 16815, 16817, 16819 and local check. The seedling material of the accessions were brought from Holetta Agricultural Research Center. The vegetative parts in the form of root splits

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planted at Injibara to evaluate their agronomic performance. The accessions were planted in 2 m x 4 m plot using a randomized complete block design (RCBD) with three replications at the beginning of the main rainy season. Root splits at Injibara were planted in rows per plot. A total of 16 root splits were planted per plot with the intra and inter row spacing of 0.5 m and 1 m respectively, giving a density of 20,000 plants/ha. There was 2m between blocks and 1.5m width between plots. A blanket basal phosphorus fertilize was uniformly applied to all plots in the form of diammonium phosphate (DAP) at the rate of 100 kg/ha. After every harvest, the plots were top dressed with 50 kg/ha urea of which one-third applied at the first shower of rain and the remaining two-third applied during the active growth stage of the plant. All other necessary agronomic practices were done uniformly to all plots as required.

Data Collection and Measurement

Forage biomass yield

Plant height of the Napier (PH): Ten plants height were randomly selected from each plot, measured using a steel tape from the ground level to the highest leaf, summed up and divided for ten selected plants to get the average value. Number of tillers per plant (NT): immediately when the forage becomes too ready for cut live tillers of ten bunch of grass stubble were counted, summed up and divided by ten to get the average number of tillers per plant. For determination of biomass yield, accessions were harvested at forage harvesting stage from the total plot at 5 cm above the ground level. Weight of the total fresh biomass yield (FBM) was recorded from each plot in the field and converted to hectare. Afresh biomass representative sample weighing 300g wasrandomly taken. Leaf to stem ratio (LSR): From each plot, 300g fresh biomass weights were taken and splited in to leaf and stem. The fresh weights of the separated leaf and stem were recorded on the field using sensitive balance. After measuring leaf and stem fresh weight the sample were pooled and transferred to known weight paper bags and put in forced draft oven at 65^{o}C to constant weight for 72 hours. The partial dried sample were measured in each plot and converted to hectare for calculating dry matter yield (DMY).

Forage chemical analysis

This was done at Holotta Agricultural Research Center Animal Nutrition Laboratory. The dried sample were ground to pass 1mm Wiley mill sieve size and labeled for easy identification. Dry matter (DM), Ash, and Organic Matter (OM) according to the procedures of AOAC (1995). Neutral detergent fiber (NDF), Acid Detergent fiber (ADF) and Acid detergent lignin (ADL) were determined by the method of Van Soest and Robertson (1985). Invitro organic matter digestibility (IVOMD) of the sample was determined according to the procedure outlined by Tilley and Terry (1963). Hemicellulose and cellulose were calculated as NDF-ADF and ADF (ADL+ADF ash), respectively. The N content of the samples was determined by the Kjedhal method and CP was calculated as Nx6.25.

Statistical Analysis and Model

Mean DM yield components, agronomic parameters and chemical composition data for different accessions of Napier grass were used for the statistical analysis. General Linear Model (GLM) procedure of SAS system computer software was employed for the analysis of variance (SAS;9.4.2019). Least significance difference (LSD) at 5% significance level was used for comparison of means. The data was analyzed using the following model: $Y_{ijk} = \mu + G_i + Y_j + (GY)_{ij} + B_k + e_{ijk}$; Where, Y_{ijk} = measured response of genotype i in block k of year j; μ = grand mean; G_i = effect of ith genotype ; Y_j = effect of jth year; GY= effect due to interaction between ith genotype and jth year; Bk (j) = effect of kth block; e_{ijk} = random error effect of genotype i in block k of year j

III. Result and Discussion

Combined Mean Squares ANOVA for Different Napier Grass Accessions

The combined mean square values for genotypes for three years for Ph, NT, LSR, FBY DM, Ash, OM, CP, NDF, ADF, ADL and IVDMD are presented in Table 2: The effect of year is highly significant (p<0.01) differences among most traits except DMY and ADL. The effect of replication is highly significant (p<0.01) differences among Ph, NT, FBY, DMY and significant (p<0.05) differences on CP. The effect of treatment is highly significant (p<0.01) differences among all forage biomass yield and most forage chemical composition traits. The effect of year*treatment is significant (p<0.05) differences on plant height and some chemical composition traits. Where year effect is greater, it may be expected that the interaction will also greater. The G x E interaction is important for plant breeding because it affects the genetic gain and selection of cultivars with wide adaptability (Deitos et al., 2006; Souza et al., 2009). Statistically, G x E interactions are detected as significantly different patterns of response among the genotypes over years, this will occur when the contributions /expression of the genes regulating the trait differ among environments (Basford and Cooper, 1998). Major difference in genotypes stability is due to crossover interaction effect of genotype and environment, therefore, changes in their rank vary in different environmental conditions. According to Dixon and Nukenine (1997), the interaction is a result of changes in a cultivar's relative performance across environments due to differential responses of the genotypes to various edaphic, climatic and biotic factors. Therefore, evaluation of yield performance and adaptation patterns of Napier grass genotypes over year are very important for proper management and utilization.

The Performance of Treatment in Each Year

The performance of all treatments in each year are presented in Table 3. The performance of genotypes in most traits in each consecutive year was different. Higher performance value of most traits was recorded in third year of experiment, whereas lower treatment performance was recorded on the first and second year of experiment. This variation may be the performance of forage at establishing year is poor as compared to other time of harvesting and also

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various environmental factors that affect the performance of genotypes like edaphic, climatic and biotic factors were not constant in each year.

TABLE 2. Combined mean squares for agronomic traits and chemical composition of different Napier grass accessions evaluated over three years from 2016 to 2018.

Source of variation	DF	Ph	NT	LSR	FBY	DMY	DM	Ash	OM	CP	NDF	ADF	ADL	IVDMD
Year	2	26219.87**	2874.63**	5.17**	468.8*	0.39	0.74	67.77**	67.77**	12.74**	132.82**	92.98**	0.24	1045.3**
Replication	2	7079.30**	634.31**	0.83	5655.6**	210**	0.03	3.64	3.64	3.79*	5.38	4.35	0.09	65.26
Treatment	9	8959.66**	388.4**	3.02**	1484.6**	43.4**	0.27	5.11**	5.11**	1.99*	11.03**	11.53**	0.09	80.77*
yr*trt	18	423.07*	94.86	0.75	143.2	4.7	0.41	1.96	1.96	1.14	6.83**	4.1	0.12	27.45
Error	58	221.46	75.79	0.48	118.5	4.5	0.29	1.38	1.38	0.92	2.59	2.5	0.12	25.9
CV%		14.4	31.7	40.2	29.9	32.9	0.59	9.28	1.34	15.74	2.1	2.51	4.7	9.1
LSD(0.05)		14.04	8.21	0.65	10.27	2.01	0.51	1.1	1.1	0.9	1.52	1.49	0.33	4.8
GM		103.3	27.4	1.73	36.3	6.4	91.23	12.67	87.32	6.1	76.6	40.93	7.47	55.89
R2		0.92	0.73	0.65	0.8	0.77	0.39	0.73	0.73	0.57	0.76	0.71	0.38	0.69

*=significant at 5% **=highly significant at 5% Ph=plant height NT=number of tiller per plant LSR= leaf stem ratio FBY=fresh biomass yield DMY=dry matter yield DM=dry matter OM=organic matter CP=crud protein NDF=neutral detergent fiber ADF=acid detergent fiber ADL= acid detergent lignin and IVDMD=invitro dry matter digestibility

TABLE 3. The performance of treatment in each year

Treatments	Ph			NT			LSR			FBY			DBY		
	2016	**2017**	**2018**	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**
15743	98.5^{bc}	64.4^{cd}	124.4^{cd}	16.1^{bc}	15.3^{bc}	42.3^{ab}	1.3^{bc}	2.1^{a}	3.3^{ab}	52.3^{abc}	38.3^{ab}	37.5^{b}	9.3^{ab}	7.4^{ab}	6^{b}
16783	57.6^{f}	56.1^{cd}	101.3^{e}	30.9^{a}	32.5^{a}	64.5^{a}	1.2^{bc}	1.4^{bcd}	2^{bcd}	16.3^{e}	22.9^{bc}	27.4^{b}	2.6^{d}	4.6^{b}	4.7^{b}
16791	120.3^{b}	108.5^{b}	157.4^{b}	22.3^{bc}	27.8^{ab}	46.8^{ab}	0.9^{c}	1.14^{ed}	1.1^{d}	67.1^{a}	46.7^{a}	58.3^{a}	12.1^{a}	9.2^{a}	10.2^{a}
16792	91^{cd}	71.7^{cd}	131^{cd}	18.9^{bc}	20.4^{abc}	40.1^{bc}	1.3^{c}	$1.4b^{cd}$	1.5^{cd}	32.7^{cde}	19.6^{c}	31^{b}	4.4^{cd}	3.8^{b}	5.1^{b}
16794	95.7^{cd}	78^{c}	142.4^{bc}	21.3^{bc}	25.5^{abc}	26.5^{c}	2^{ab}	1.6^{bc}	3.3^{abc}	46.3^{bcd}	33.8^{abc}	28.8^{b}	8.1^{b}	6.1^{ab}	4.6^{b}
16813	64.9^{ef}	46^{d}	112.4^{de}	22.1^{bc}	20.9^{abc}	35.2^{bc}	2.5^{a}	1.7^{b}	4.3^{a}	46^{bcd}	39.2^{ab}	33.5^{b}	6.5^{bc}	6.9^{ab}	5.6^{b}
16815	93.9^{cd}	117.1^{ab}	121.2^{cde}	15.3^{bc}	24.5^{abc}	26.3^{c}	1.3^{bc}	1.4^{cd}	1.4^{d}	19.4^{e}	22.3^{bc}	25.5^{b}	4^{cd}	6^{ab}	4.5^{b}
16817	$74d^{ef}$	52.3^{cd}	121^{cde}	19.8^{bc}	18.7^{bc}	32.9^{bc}	1.4^{bc}	1.7^{b}	1.4^{d}	30.8^{de}	32.9^{abc}	36.9^{b}	5.8^{bcd}	6.4^{ab}	6^{b}
16819	83.3^{cde}	55.9^{cd}	123.9^{cd}	22.9^{b}	32.7a	39.7^{bc}	1.79^{abc}	1.7^{bc}	2.4^{bcd}	25.2^{e}	25.8^{bc}	25.7^{b}	4.1^{cd}	5.7^{ab}	5.2^{b}
LOCAL	164.2^{a}	142.9^{a}	228.5^{a}	15.1^{c}	13.4^{c}	31.8^{bc}	0.97^{c}	1^{e}	1.3^{d}	64.4^{ab}	40.4^{ab}	64.3^{a}	8.5^{b}	9.3^{a}	11.4^{a}
GM	**94.34**	**79.3**	**136.3**	**20.4**	**23.2**	**38.6**	**1.47**	**1.5**	**2.2**	**40**	**32.2**	**36.8**	**6.54**	**6.54**	**6.34**
CV%	14.6	22.1	9.4	21.7	33.2	30.3	3.8	12.4	46.8	30.2	33	27.1	31.2	38.5	24
LSD(0.05)	23.7	30.1	22.2	7.6	13.2	20.1	0.96	0.32	1.78	20.8	18.2	17.1	3.5	4.3	2.6
R2	0.90	0.85	0.92	0.65	0.6	0.65	0.53	0.84	0.64	0.83	0.75	0.81	0.83	0.73	0.85

Means within a column with different superscripts are significantly different. Ph=plant height NT=number of tiller per plant LSR= leaf stem ratio FBY=fresh biomass yield DMY=dry matter yield

Mean Performance of Treatments

Plant height at forage harvesting stage (Ph/cm)

Mean plant height of Napier grass accessions were significantly ($p<0.05$) different among them table (3). The result indicated that the highest mean plant height at forage harvesting stage was recorded from local accession followed by accession 16791, 16815, 16794, 16792, 15743, 16819,16817, while the list plant height was recorded from 16813 and 16783. This variation could be genotypic difference among difference accession of Napier grass. The result of local accession and 16791 is higher than Gezahagn *et al* (2016) who reported the performance of local accession and 16791 was 132.03cm and 118.44cm at combined result of five location Holetta, D/zeit, Adamitulu, Areka and Hawassa. Whereas accession 16792, 16794 and 16815 were slightly agreed with Gezahagn et al (2016) who reported 103.80cm, 113.09cm and 113.57cm its respective order. The rest accessions were lower value than Gezahagn *et al* (2016). This variation could be due to the difference in moisture content and soil fertility condition of tested environment. Height at cutting is reported to affect the growth and productivity of Napier grass (Mureithi and Thrope, 1996). On the other hand, plant height at cutting significantly affects the fodder yield of Napier grass in Kenya (Muinga *et al*., 1992). Amongst the major agronomic practices required, harvesting of Napier grass at appropriate cutting height and defoliation frequencies are very important to improve DM yield and nutritive values of this plant (Tessema *et al.*, 2003). A higher cutting height of Napier grass may result in underutilization and the quality of forage is reduced by a higher cutting height (Tessema *et al*., 2003).

Number of tillers per plant at forage harvesting stage (NT)

The mean number of tillers per plant of each treatment indicated that most Napier grass accessions 15743, 16792, 16794, 16813,16815,16817 and local were not significance difference among them. The highest number of tillers were recorded in 16783 followed by 16791 and 16819, whereas the list number of tillers recorded in local accession.

Leaf to stem ratio (LSR)

The combined analysis for leaf to stem ratio indicated that most Napier grass accessions 16783 16791, 16792,16815,16817 and local were not significance difference among them. The highest leaf proportion were recorded in 16813 followed by 16794 and 15743, whereas the list value of leaf proportion recorded in local accession. The presence of higher leaf proportion enables the nutritive value of the feed is good.

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Fresh biomass yield (FMY/t/ha)

Forage fresh biomass yield showed significant (p<0.05) variation among the tested Napier grass accession (Table 4). The fresh biomass yield (t/ha) ranged from 22.2 to 57.3. the highest fresh biomass was recorded in 16791 followed by Local, 15743, 16813, 16794 and 16817. The rest accessions were not significance difference with lower value. The higher fresh biomass enables for cut and carry system for using the herbage yield.

Dry matter yield (DMY /t/ha)

Forage DM yield showed significant (p<0.05) variation among the tested Napier grass accession (Table 4). The forage DM yield (t/ha) ranged from 3.9 to 10.5 with a mean of 6.4 t/ha. the highest fresh biomass was recorded in 16791 followed by Local, 15743, 16813, 16794 and 16817. The rest accessions 16819, 16815, 16792 and 16783 were not significance difference with lower value. The higher forage DM yield enables for cut and carry system for using the herbage yield. The different DM yield occurred due to variation among the tested genotypes, testing duration and interaction effect. Tesema *et al* (2003) who reported that increasing foliage height increased biomass yield. Napier grass could play an important role in providing asignificant amount of high-quality forage to the livestock (Tessema, 2005). The DM yield of Napier grass increased as frequency between cutting increased and this indicates that a long harvest interval is necessary to achieve high herbage yields (Tessema *et al*., 2010).

The current result is slightly agreed with Gezahagn *et al*., (2016) who reported the mean forage DM yield(t/ha) of different accession of Napier grass 15743(7.4), 16791(10.51), 16794(6.9), 16813(5.49), 16815(4.57) and 16817(6.17) at Holetta and lower than who reported at D/zeyit, Adamitulu, Areka and Hawassa.

TABLE 4. Combined mean performance of treatments in the study districts

No	Treatments	Ph	NT	LSR	FBY	DMY
1	**15743**	95.7^{efd}	24.6^{bcd}	2.25^{ab}	42.7^{b}	7.5^{b}
2	**16783**	71.6^{h}	42.6^{a}	1.56^{cd}	22.2^{e}	3.9^{d}
3	**16791**	128.7^{c}	32.2^{b}	1.07^{d}	57.3^{a}	10.5^{a}
4	**16792**	97.9^{cde}	26.4^{bcd}	1.4^{cd}	27.7^{cde}	4.4^{cd}
5	**16794**	105.3^{cd}	24.4^{bcd}	2.3^{ab}	36.26^{b}	6.3^{bc}
6	**16813**	74.4^{gh}	26.1^{bcd}	2.82^{a}	39.5^{b}	6.3^{bc}
7	**16815**	110.76^{c}	22^{d}	1.34^{cd}	22.4^{e}	4.8^{cd}
8	**16817**	82.4^{fgh}	23.8^{cd}	1.56^{cd}	33.5^{bcd}	6.1^{bc}
9	**16819**	87.6^{efg}	31.75^{bc}	1.9^{bc}	25.5^{de}	5.01^{cd}
10	**LOCAL**	178.5^{a}	20.1^{d}	1.09^{d}	56.3^{a}	9.7^{a}
	GM	**103.3**	**27.4**	**1.73**	**36.3**	**6.4**
	CV%	14.4	31.7	40.2	29.9	32.9
	LSD (0.05)	14.04	8.21	0.65	10.27	2.01
	R2	0.92	0.73	0.65	0.8	0.77

Means within a column with different superscripts are significantly different. Ph=plant height NT=number of tillers per plant LSR= leaf stem ratio FBY=fresh biomass yield DMY=dry matter yield

Chemical Composition

The chemical composition of different accessions of Napier grass is shown in table 5. The overall mean value of Ash, OM, NDF, ADF and IVDMD were significant (p<0.05) different among treatments, while dry matter and acid detergent lignin were not significant (p>0.05) different among treatments. The higher value of DM was recorded in 16791 followed by 15743 and 16794. The higher ash content was recorded in 16813 and 16783, whereas the lower value was recorded in 16791 and 16819 as compared to the rest accessions. The organic matter of most accessions was not significant difference with the control, but the value of 16791 and 16819 accessions is higher than the control.

TABLE 5. Chemical composition of different accession of Napier grass

No	Treatments	DM%	Ash%	OM%	CP%	NDF%	ADF%	ADL%	IVDMD%
1	**15743**	91.46	12.64^{bcd}	87.35^{abc}	5.94^{bcd}	76.64^{bcd}	41.74^{abc}	7.51	58.72^{a}
2	**16783**	91.14	13.5^{ab}	86.49^{dc}	7^{a}	75.58^{d}	39.1^{f}	7.5	58.22^{ab}
3	**16791**	91.6	11.9^{d}	88.09^{a}	5.6^{cd}	77.39^{abc}	42.6^{a}	7.55	57.27^{abc}
4	**16792**	91.24	13.02^{be}	86.97^{bc}	5.95^{bcd}	76.54^{bcd}	40.5^{cdef}	7.18	58.78^{a}
5	**16794**	91.25	12.87^{bcd}	87.12^{abc}	5.97^{bcd}	78.8^{a}	42.1^{ab}	7.52	55.88^{abc}
6	**16813**	91.08	14.2^{a}	85.79^{d}	6.59^{ab}	75.16^{d}	39.5^{ef}	7.52	58.79^{a}
7	**16815**	91.19	12.14^{cd}	87.85^{ab}	6.39^{abc}	75.76^{b}	40.05^{def}	7.5	53.08^{dc}
8	**16817**	91.05	12.51^{bcd}	87.49^{abc}	6.30^{abcd}	76.61^{bcd}	40.9^{bcde}	7.47	54.62^{abcd}
9	**16819**	91.08	11.84^{d}	88.15^{a}	5.4^{d}	77.8^{ab}	41.1^{bcd}	7.52	50.14^{d}
10	**LOCAL**	91.22	12.09^{ed}	87.9^{ab}	5.90^{bcd}	76.06^{dc}	41.4^{abcd}	7.47	53.42^{bcd}
	GM	**91.23**	**12.67**	**87.32**	**6.12**	**76.6**	**40.93**	**7.48**	**55.89**
	CV%	0.59	9.28	1.34	15.74	2.1	3.87	4.7	9.1
	LSD (0.05)	0.51	1.1	1.1	0.09	1.5	1.49	0.33	4.8
	R2	0.39	0.73	0.73	0.57	0.76	0.72	0.35	0.69

Means within a column with different superscripts are significantly different. DM=dry matter OM=organic matter CP=crud protein NDF=neutral detergent fiber ADF=acid detergent fiber ADL= acid detergent lignin and IVDMD=invitro dry matter digestibility

The overall CP content was 6.12%, this shows that the CP content falls below the minimum threshold level (7%) for optimal rumen microbial activity, which necessities supplementation with feeds having high protein content. According to Lonsdale (1989), feeds that have <120,120-200 and >200gCP/kg DM and <9, 9-12 and >12 MJ ME/kg DM are classified as low, medium and high protein and energy source, respectively. The value of CP among 16783, 16813, 16815 are 16817 were not significance (p>0.05) difference but higher value of CP was recorded as compared to other. The mean value of NDF (76.6%), ADF (40.93%) and ADL (7.48%) was recorded from tested genotypes. The presence of this high content of fiber in Napier grass hay which lowered the digestibility of the sample and it requires supplementary protein source.

The high fiber content and low CP content of different Napier grass accessions hay could be explained by different factor affecting the nutritive value of Napier grass hay. These

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factors could be varietal difference, location or climate, fertility of the land, stage of maturity at harvest, morphological fractions (e.g leaf to stem), harvesting and transporting practices, length and condition of storage time (Archimede *et al*, 2000; Ru and Fortune, 1999 and preston and Leng, 1984). The combined mean value of IVDMD content of the Napier grass accessions were 55.89%. The highest value of IVDMD was recorded in 16813 followed by 16792, 15743,16783, 16791, 16794, 16817, Local, 16815 and 16819. This variation could be genotype effect and environmental effect on the performance of the treatments. The presence of higher IVDMD enables nutritive value of the feed is high for better digestion.

IV. CONCLUSSIONS AND RECOMMENDATIONS

Napier grass accessions respond differently for measured agronomic performance across the testing year due to different responses of the genotypes to various edaphic, climatic and biotic factors. Measured agronomic traits showed variations among the tested genotypes and the years. The highest mean DM yield was obtained in 16791 and 15743, besides to the control. It is suggested that Napier grass should be harvested at appropriate time in order to have high nutritive values with relatively high biomass production. Therefore, among tested genotypes 16791 and 15743 Napier grass accessions will be promoted in the study area and similar environment.

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