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Determination of Appropriate Cutting time of Perennial Elite Lowland Adaptive Forage Grass Species of Dirk Ayifera/*Andropogon Gayanus*/ for Optimum Yield and Quality of Hay in Metekel Zone of Benishangul Gumuz

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Abstract— *The presence of lignified forage is a major problem in lowland agro-ecology. The study was conducted at Pawe Agricultural Research Center, Pawe District, Metekel Zone, Benishangul Gumuz Regional State, Ethiopia for three consecutive years during 2016 to 2018 cropping seasons, to determine the appropriate cutting stage of Dirk Ayifera(Andropogon Gayanus) perennial forage species for optimum and quality yield of hay. Six different cutting stage Before heading but ready to heading (BH), 10%Heading, 25%Heading, 50%Heading, 75%Heading and 100%Heading of cutting were evaluated for their forage yield agronomic traits and chemical composition in randomized complete block design with four replications. Data on plant height (Ph), leaf to stem ratio (LSR), fresh biomass yield (FBY), dry matter yield (DMY) 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 treatments, years and the interaction effects vary significantly for yield and measured agronomic traits. The combined analysis for Ph significantly ($P<0.05$) different, ranging from 191.56 to 231.25cm with a mean of 217.73cm. 75%heading cutting gave the highest mean Ph followed by 100%, 50%, 25%, and 10%heading while before heading cutting stage gave the lowest over years. The highest mean DMY was recorded in 50%heading (15.48t/ha) followed by 75%heading (13.74 t/ha) 10%heading (12.32t/ha),100%heading (12.14t/ha),25%heading (11.79t/ha and BH (8.59t/ha). The combined analysis indicated that DMY varied significantly ($P<0.05$) between before heading and the other five treatments and the yield ranged from 8.59 to 15.48 t/ha with a mean of 12.35 t/ha. CP content were significantly($P<0.05$) different, which ranged from 6.07 to 7.59% with a mean of 6.66%. It is suggested that Dirk Ayifera(Andropogon Gayanus) should be harvested at appropriate time in order to have high nutritive values with relatively high biomass hay production. Therefore, among tested treatments cutting Dirk Ayifera(Andropogon Gayanus) grass at 10%heading stage is recommended for higher biomass and good quality hay production and for future works it is good to confirm this harvesting stage by observing animal response.*

Keywords— *Dirk Ayifera grass, cutting date, quality, dry matter yield, leaf to stem ratio, crud protein.*

I. INTRODUCTION

Ethiopian grasslands account for over 30% of the land cover and constitute to 66 percent of feed resources for livestock (CSA, 2011). Natural pasture, crop residue, improved pasture and agro industrial by products and other by-products like food and vegetable refusal are major livestock feed resources of which the first two contribute the largest feed type (Alemayehu, 2003). As in many parts of the country, livestock farmers, are highly dependent on grazing lands and crop residues. Native feed resources contribute over 75% of the total feed supplies in this area (BoARD, 2006) while the contribution of natural pastures to livestock feeding as conserved hay is limited to 2.8% (CSA, 2011). Alemayehu (2002) indicated that hay produced from natural grasses, improved forage legumes and browse legumes is the most appropriate conserved forage for small-scale fattening or dairy production in Ethiopia.

Seasonality in quality and quantity of forage supplied is one of the prior problems of livestock owners in tropical lowland climate. As quality and quantity of hay is highly dependent on growth stage of the grass, considerable attention should be given to harvesting time. At early stage of growth plants put most of their energy into vegetative growth and contain high concentrations of starches, proteins and minerals, the biomass yield is lower. On the other hand, as plants mature, their fiber component increases and traps the nutrients within indigestible cell walls. Thus, compromising biomass yield and nutritive value is an important issue when we decide the appropriate cutting age of the grass for quality hay. The high temperature in tropical countries changes the nutritive values of the grass component rapidly during the late growth stages of the grassland (McDonald *et al*.,2002) and harvesting management is predominantly responsible for these changes (Cop *et al*., 2009).

In Metekel zone there is a problem of feed shortage during dry season, because farmers are not practicing hay making to conserve the excess forage in wet season for dry season use. Grasses stay for a long period of time on field leading it to advanced maturity. As a plant matures, its losses essential nutrient contents. Various species of grasses, legumes and other browse plants are available in the area, however, there is considerable loss of livestock productivity in the dry season as the animals are restricted only on crop residues and on the inadequate dry swards of grasses. Thus, if grasses are cut at the right growth stage and dried for later use, the existing feed problems in the area can significantly be reduced.

Time and frequency of harvesting, botanical composition, fertility of the soil and climatic conditions are the major factors that determine biomass yield and nutritive value of pastures (Adane and Berhan, 2005; Yihalem *et al*., 2005; Tessema *et al*., 2010).

The most important adaptive lowland perennial grass species Dirk Ayifera/*Andropogon gayanus*/ is the fast-growing tropical grass forage variety which was release by Ethiopian institute of agricultural research Pawe research center since 2009 by collecting from different centers and with continuous screening in different locations. Which are found 10-22 tone of dry matter and 600-800kg seed yield per hectare. It contains 94.0, 7.7, 6.6, 92.3, 50.5, 80.1 and 59.2 DM %, ASH %, CP %, OM %, IVOMD%, NDF% and ADF%, respectively. The grass is dominant in the area and to be demonstrated for farmers. However, a detailed knowledge of seasonal growth and nutritive value of forage is necessary to utilize the available pasture from the grass efficiently. By determining appropriate cutting date of the Dirk Ayifera(*Andropogon Gayanus*) forage grass it is possible to conserve quality forage in the form of hay. Therefore, the objective of this study was to identify the appropriate cutting time of perennial elite lowland adaptive Dirk Ayifera/*Andropogon gayanus/*for optimum quality and yield of hay.

II. Materials and Methods

Descriptions of the Study Areas

The experiment was conducted for three consecutive years during 2016 to 2018 main cropping season at Pawe Agricultural Research Center (On-station), Metekel Zone, Benishangul Gumuz Regional State, Ethiopia. Pawe Agricultural Research Center is located at latitude of 11° 19' North and longitude of 36° 24' East, an altitude of 1120 masl and it is at a distance of 572 km North Western of Addis Ababa.

Climate

According to National Meteorology Agency weather data from 2016 to 2018, the mean minimum and maximum temperatures of the study area were 17.1 and 32.7 °C, respectively. The mean annual rainfall is 1587.6 mm with main wet season from June to September usually continued with a less pronounced wet period up to November (Figure 1).

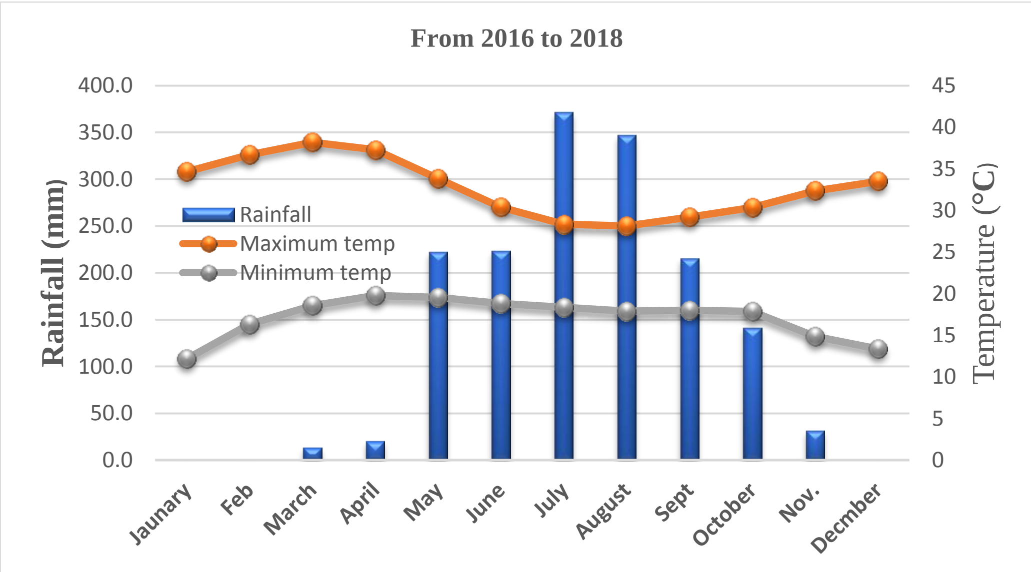

Figure 1. Mean monthly rainfall, minimum and maximum temperature of the study area based on three Consecutive years records at the Pawe Agricultural Research Meteorological Station.

Soil Type and Test

The soil types of the study area are Nitisols and clay texture class shown in Table 1. 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	Value
Soil type	Nitisols
Textural class	Clay
P^H(1.2.5 H_2O)	4.72
Total organic matter(%)	3.34
Total nitrogen(%)	0.156
Available phosphorous mg kg^{-1}	5.39
Organic carbon %	1.94

Experimental Design and Treatments

Six harvesting time treatments were used by using flowering phenology of Dirk Ayifera(*Andropogon Gayanus*) (Table 2). The Dirk Ayifera(*Andropogon Gayanus*) seed were sown at the seed rate of 10kg/ha in 3 m x 4 m prepared plot size using a randomized complete block design (RCBD) with four replications at the main rainy season of mid-June. To keep proper spacing and avoid nutrient competition, spacing used between rows were 30 cm. 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. All other necessary agronomic practices were done uniformly to all plots.

Table 2. Description of flowering phenology for harvesting time treatments used in the experiment

Trt No.	Harvesting time	Description of the flowering phenology (Visual observation per plot)
1	Before heading but ready to heading	when heads observed for the first time with in the leaf sheath
2	10%heading	when 10% of heads emerge/visually observed
3	25%heading	when 25% of heads emerge/visually observed
4	50%heading	when 50% of heads emerge/visually observed
5	75%heading	when 75% of heads emerge/visually observed
6	100%heading	when 100% of heads emerge/visually observed

Data Collection and Measurement

Forage biomass yield

Plant height of the Dirk Ayifera(*Andropogon Gayanus*)(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. For determination of biomass yield, each treatment was harvested from the total plot at 5cm above the ground level. Weight of the total fresh biomass yield (FBY) was recorded from one m^2 quadrant sample in each plot and converted to hectare. Afresh biomass representative sample weighing 300g was randomly 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 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). The N content of the samples was determined by the Micro 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 treatments of Dirk Ayifera(*Andropogon Gayanus*) were used for the statistical analysis. General Linear Model (GLM) procedure of SAS system computer software was employed for the analysis of variance (SAS; 2009). Least significance difference (LSD) at 5% significance level was used for comparison of means. The data was analyzed using the following model: $Y_{ijk} = \mu + T_i + Y_j + (TY)_{ij} + B_k + e_{ijk}$; Where, Y_{ijk} = measured response of treatment i in block k of year j; μ = grand mean; T_i = effect of i^{th} treatment ; Y_j = effect of j^{th} year; TY= effect due to interaction between i^{th} treatment and j^{th} year; B_k (j) = effect of k^{th} block; e_{ijk} = random error effect of treatment i in block k of year j

III. RESULT AND DISCUSSION

Combined Mean Squares ANOVA for Treatments

The combined mean square values for the tested parameters are presented in Table 3. The effect of year is highly significant ($p<0.01$) among most parameters except LSR and OM. The effect of replication is not significant ($p>0.05$) in all parameters. The effect of treatment is highly significant at ($p<0.05$) for Ph, DMY, DM, CP and IVDMD, while at ($P>0.05$) not significant in LSR, FBY, Ash, OM, NDF ADF and ADL. The effect of year*treatment is significant ($p<0.05$) for Ph, FBY, DMY, IVDMD, ADL, Ash and ADF. But the differences in other parameters were not significance($P>0.05$). According to Dixon and Nukenine (1997), the interaction is a result of changes in a treatments relative performance over years due to different responses of the treatments to various edaphic, climatic and biotic factors. Agro-metrological variables such as rainfall, soil and temperatures have major impacts on crop growth and development (Hoogenboom, 2000). The mean value of LSR, DMY, CP and IVDMD were 1.17, 12.35 (t/ha), 6.66% and 36.89% its respective order.

The Performance of Treatment in Each Year

The performance of treatments in Ph, LSR, FBY and DMY in each consecutive year was different at Table 4. All most all parameters were recorded lower value in second year of experiment, whereas higher treatment performance was recorded on the first and third year of experiment. This variation may be environmental factors that affect the performance of treatments like edaphic, climatic and biotic factors were not constant in each year. Agro-metrological variables such as rainfall, soil and temperatures have major impacts on crop growth and development (Hoogenboom, 2000)

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Table 3: Combined mean squares for agronomic traits and chemical composition of different treatments evaluated over three consecutive years from 2016 to 2018.

Source of variation	DF	Ph(cm)	LSR	FBY t/ha	DMY t/ha	DM%	Ash%	OM%	CP%	NDF%	ADF%	ADL%	IVDMD%
Year	2	30590.27**	0.12	2313.96**	194.40**	7.33**	32.33**	24.72	123.51**	298.92**	914.33**	18.74**	298.67**
Replication	3	97.63	0.01	246.85	24.98	0.04	0.16	93.92	0.05	1.18	1.38	0.46	12.53
Treatment	5	2610.42**	0.03	238.82	63.01**	1.32**	1.01	99.95	4.19**	2.04	8.57	0.06	33.23**
yr*trt	10	1573.29**	0.07	410.06**	54.71**	0.22	1.55*	108.52	0.61	2.76	15.95*	0.63**	26.99**
Error	51	155.91	0.06	113.34	15.94	0.13	0.65	95.80	1.08	2.84	7.65	0.18	6.74
GM		217.73	1.17	42.42	12.35	90.55	8.64	90.23	6.66	77.14	49.79	8.56	36.89
SEM		1.47	0.03	1.25	0.47	0.04	0.10	1.15	0.12	0.20	0.33	0.05	0.31
CV%		5.73	20.27	25.09	32.32	0.40	9.34	10.84	15.59	2.18	5.55	4.97	7.03
LSD(0.05)		10.23	0.19	8.72	3.27	0.30	0.66	8.02	0.85	1.38	2.26	0.34	2.12
R^2		0.92	0.28	0.65	0.62	0.77	0.72	0.28	0.83	0.82	0.84	0.83	0.76

*** Significant at alpha 0.001; **Significant at alpha 0.01; *Significant at alpha 0.05;NS: Non-significant Ph=plant height 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 4. The performance of treatment in each year

Treatments	Ph(cm)			LSR			FBY t/ha			DMY t/ha		
	2016	**2017**	**2018**	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**
Before Heading	196.60[c]	192.03	186.08[d]	1.24	1.02	1.11	50.75[ab]	34.12	33.75	10.36[b]	8.74	6.68[b]
10%Heading	229.25[ab]	161.25	242.82[c]	1.25	1.35	0.99	40.75[bc]	35.50	58.25	10.89[b]	9.83	16.25[a]
25%Heading	236.37[ab]	163.75	254.80[bc]	1.22	1.42	1.152	47.50[bc]	28.25	44.50	15.09[ab]	7.47	12.82[ab]
50%Heading	244.57[a]	177.43	256.72[b]	1.01	1.32	1.155	67.00[a]	29.75	52.50	21.58[a]	8.97	15.63[a]
75%Heading	241.50[ab]	186.35	265.92[ab]	1.05	1.22	1.16	40.25[bc]	29.50	59.25	12.54[b]	9.42	19.27[a]
100%Heading	225.85[b]	185.70	272.17[a]	0.99	1.18	1.27	28.75[c]	31.00	52.25	8.75[b]	10.53	17.15[a]
Mean	229.02	177.75	246.42	1.13	1.25	1.14	45.83	31.35	50.08	13.25	9.16	14.63
SEM	2.37	3.14	1.67	0.04	0.05	0.06	2.63	1.18	2.51	0.97	0.34	1.00
CV%	5.07	8.66	3.33	16.37	18.89	25.69	28.10	18.52	24.54	36.09	19.20	33.49
p-value	**	ns	**	Ns	Ns	Ns	**	Ns	Ns	**	ns	*

*** Significant at alpha 0.001; **Significant at alpha 0.01; *Significant at alpha 0.05; NS: Non-significant Means within a column with different superscripts are significantly different. PH=plant height LSR= leaf stem ratio FBY=fresh biomass yield DMY=dry matter yield

Mean Performance of Treatments

Plant height at different cutting stage (Ph)

Mean plant height differences among the treatments was presented in Table (5). The highest mean plant height was recorded at cutting of 75% heading followed by 100%, 50%, 25%, 10% cutting heads, while the lowest plant height was recorded at cutting before heading but ready to heading. This shows that when the plant was cut at early stage the plant height is lower as compared to when the plant is cut at advanced maturity stage. The variation of treatments in cutting heights could be due to variations in stage of growth, and selection of sampled plants for plant height measurement in each plot. Similar to the current result variation in plant height due to stage of growth 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). The current result cutting at 10% heading of Ph was higher than Mezgebu *et al*, (2020) who reported 178.39cm.

Leaf to stem ratio (LSR)

The combined mean analysis for leaf to stem ratio indicated that there was not a significance difference among treatments. The current result coincides with (Alexander *et al*.,1998) who reported the three grass species of *Panicum virgatum, Andropogon geradii and Bromus inermis leyss* leaf stem ratio declined at maturity stages. The current result also cutting at 10% heading of LSR was coincide with Mezgebu et al, (2020) who reported 1.29 from Chifir Beqoa (*Pennisetum Polystachion*). The LSR is associated with high nutritive value of the forage because leaf is generally of higher nutritive value (Tudsri *et al*., 2002) and the performance of animals is related to the amount of leaf in the diet. Decrease in LSR with longer cutting intervals is a function of the longer periods of physiological growth with reduced defoliation frequency stimulating stem growth at the expense of leaf production (Butt *et al*. 1993).

Fresh biomass yield (FBY)

Forage fresh biomass yield was not significant (P>0.05) variation among the tested treatments (Table 5). The fresh biomass yield (t/ha) ranged from 37.33 to 49.75. The highest fresh biomass was recorded in 50%heading stage of cutting followed by 10%, 75%, 25%, before heading but ready to heading and 25%. The current result cutting at 10% heading of FBY was lower than Mezgebu *et al*, (2020) who reported 61.75t/ha in Chifir Beqoa (*Pennisetum Polystachion*). The higher fresh biomass enables for cut and carry system for using the higher herbage yield.

Dry matter yield (DMY)

Forage Dry matter yield between before heading and the other five treatments showed significant (P<0.05) variation among the tested treatments, whereas there was no significance (p>0.05) difference among 10%, 25%,75% and 100% and 10%, 50% and 75%heading stage of cutting (Table 5). The dry matter yield (t/ha) ranged from 8.59 to 15.48. the highest dry matter yield was recorded in 50%heading stage of cutting followed by 75%, 10%, 100%, 25% and before heading but ready to heading. The current result higher than Mezgebu *et al.*, (2020) who reported Chifir Beqoa (*Pennisetum Polystachion*) have the potential of producing 6.64 to 11.49 t/ha/year. The highest dry matter biomass enables for cut and carry system for using the higher herbage yield. The different DM yield observed due to variation among stage of plant during cutting and species of grass. Tessema *et al.*, (2003) reported that increasing foliage height increased DM yield. Generally, as grass matures, herbage yield is increased due to the rapid increase in the tissues of the plant (Minson, 1990)

Table 5. Combined mean performance of Dirk Ayifera (*Andropogon Gayanus*) in different cutting stage

Treatments	Ph (cm)	LSR	FBY t/ha	DMY t/ha
Before Heading	191.56[d]	1.12	39.54	8.59[c]
10%Heading	211.11[c]	1.20	44.83	12.32[ab]
25%Heading	218.31[bc]	1.26	40.08	11.79[bc]
50%Heading	226.24[ab]	1.16	49.75	15.48[a]
75%Heading	231.25[a]	1.14	43.00	13.74[ab]
100%Heading	227.91[ab]	1.15	37.33	12.14[b]
Mean	217.73	1.17	42.42	12.35
SEM	1.47	0.03	1.25	0.47
CV%	5.73	20.27	25.09	32.32
P-value	**	ns	ns	**

*** Significant at alpha 0.001; **Significant at alpha 0.01; *Significant at alpha 0.05; NS: Non-significant Means within a column with different superscripts are significantly different. PH=plant height LSR= leaf stem ratio FBY=fresh biomass yield DMY=dry matter yield

Chemical Composition

The chemical composition of Dirk Ayifera in different cutting stage is shown in Table 6. The overall mean value of DM, CP and IVDMD were significantly ($p<0.05$) different among treatments, while Ash, OM, NDF, ADF and ADL were not significantly ($p>0.05$) different among treatments. The higher value of DM was recorded in 100% heading cutting stage, whereas lower DM was recorded at before heading but ready to heading stage of cutting. This shows that when the plants mature the dry matter content is increases. The current result of ash content was lower than Mezgebu *et al.*, (2020) who reported the Ash content of Chifer Biqoa (*Pennisetum Polystachion*) ranges from 10.29-11.18%.

The overall CP content was 6.66%, this shows that the CP content lower than the minimum threshold level (7%) for optimal rumen microbial activity. However, the result of two consecutive early stages of cutting before heading and 10% were higher CP content than the minimum threshold level. 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 treatments were highly significant ($p<0.05$), higher value of CP was recorded at early stage of cutting than late maturity stage of cutting. The current result agreed with Chifir Beqoa (*Pennisetum Polystachion*) protein concentration range from 6.48 to 7.79% who reported (Mezgebu *et al.*, 2020).

The mean value of NDF (77.14%), ADF (49.79%) and ADL (8.56%) was recorded from tested treatments. The combined mean value of IVDMD content of the Dirk Ayifera (*Andropogon Gayanus*) at different stage of cutting were 36.53%. The high content of fiber in the treatments could negatively affect the digestibility of the sample. Van Soest (1982) reported a lignin content value above 60 g/kg DM to affect digestibility of forage negatively

The high fiber content and low CP content of different Dirk Ayifera (*Andropogon Gayanus*) hay could be explained by different factor affecting the nutritive value of Napier grass hay. This factor could be varietal difference, location or climate, fertility of the land, stage of maturity at harvest, morphological fractions (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 increase in age in grasses is usually negatively associated with CP content (Minson, 1990). Generally, tropical forages are more fibrous than temperate forages and a higher proportion of their nitrogen is not available to ruminants because it is bound within the indigestible vascular bundles (Van Soest, 1982).

Table 6. Effect of cutting date on chemical composition of Dirk Ayifera (*Andropogon Gayanus*)

Treatments	DM%	Ash%	OM%	CP%	NDF%	ADF%	ADL%	IVDMD%
Before Heading	90.06[b]	8.33	91.66	7.59[a]	77.56	49.84	8.59	35.85[bc]
10%Heading	90.23[b]	8.88	84.36	7.04[ab]	76.86	49.18	8.475	36.79[b]
25%Heading	90.58[a]	9.03	90.96	6.80[abc]	77.13	49.44	8.476	34.64[c]
50%Heading	90.76[a]	8.69	91.30	6.34[bc]	77.31	50.02	8.61	36.83[b]
75%Heading	90.79[a]	8.60	91.39	6.16[c]	77.49	51.32	8.63	37.75[ab]
100%Heading	90.87[a]	8.31	91.68	6.07[c]	76.48	48.97	8.57	39.53[a]
Mean	90.55	8.64	90.23	6.66	77.14	49.79	8.56	36.89
SEM	0.04	0.10	1.15	0.12	0.20	0.33	0.05	0.31
CV%	0.40	9.34	10.84	15.59	2.18	5.55	4.97	7.03
P-value	**	ns	Ns	**	Ns	Ns	Ns	**

*** Significant at alpha 0.001; **Significant at alpha 0.01; *Significant at alpha 0.05; NS: Non-significant 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.

IV. CONCLUSIONS AND RECOMMENDATIONS

Yield and quality of hay from Dirk Ayifera(*Andropogon Gayanus*) in different stage of cutting respond differently for the measured parameters across the testing years. With increasing cutting/growth stage, plant height, DM yield and all fiber content (NDF, ADF, ADL) of the plant is higher, whereas the CP and Ash content of the plant is reduced. It is

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suggested that Dirk Ayifera(*Andropogon Gayanus*) should be harvested at appropriate time in order to have high nutritive values with relatively higher biomass production. In this case, the treatment which comprise good quality of hay with higher biomass yield were selected. Therefore, among tested treatments cutting Dirk Ayifera(*Andropogon Gayanus*) grass at 10%heading stage is recommended for higher biomass and good quality hay production and for future works it is good to confirm this harvesting stage by observing animal response.

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