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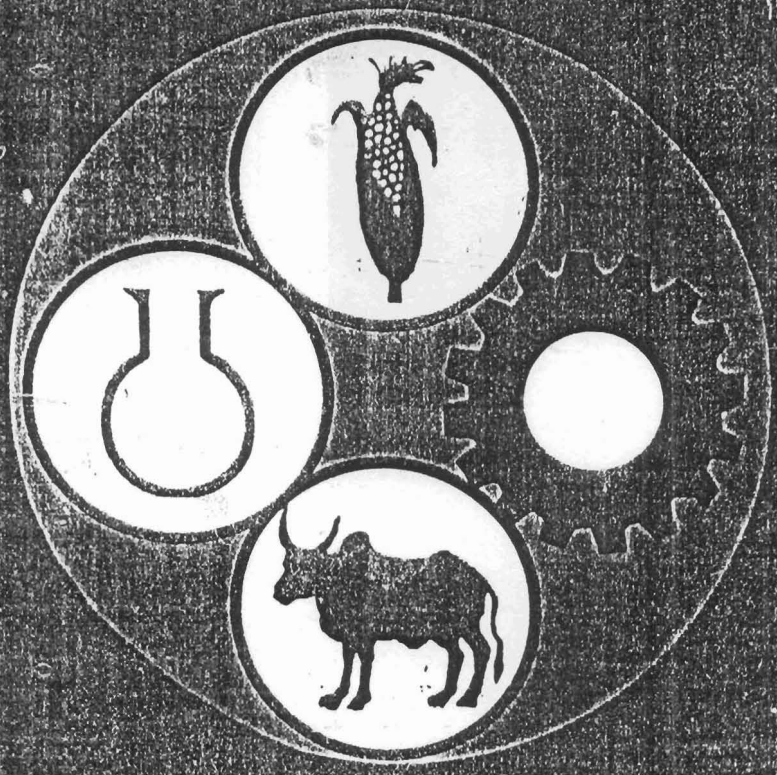

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CONTENTS

Forage Yield and Nutritive Value Assessments in Some Accessions of Panicum Maximum JACQ.

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ABSTRACT

Twenty accessions of *Panicum maximum* Jacq. were assessed for their forage yield and nutritive value attributes. Results revealed that number of tillers per plant stand and dry matter yields of culm, leafy portion and above ground plant were the parameters involved in the determination of forage yield. The nutritive value studies showed that Crude Protein, Potassium, Nitrogen, Sodium and Calcium concentrations were within the recommended range for animal feed, while Magnesium and Phosphorus levels were below the recommended range.

KEY WORDS: Forage yield, nutritive value, tillers, dry matter yield.

INTRODUCTION

The genus *Panicum* belongs to the tribe Paniceae, sub-family Panicoideae in the family Poaceae. The Paniceae is a very large tribe containing about 101 genera and about 2,000 species (Clayton and Renvoize, 1986). It is represented in Nigeria by 27 genera (Lowe, 1989). Guinea grass (*P. maximum*) is the largest species of the genus *Panicum*. It is a tufted perennial with a short underground root-stock.

The two most important practical characters of a herbage plant are firstly, the capacity to establish rapidly under field conditions and secondly, the ability to regrow well after grazing (Boonman, 1993). The stage of growth of herbage plants has a marked effect on chemical composition and digestibility. Grasses have a character of fast growth during the rainy season, rapid development of the flowering culm within a few weeks and a rapid decline in quality with flowering and with start of the dry season (Bredon and Wilson, 1963; McKay, 1971). The most striking change in grass with advancing maturity is on cell wall materials, crude protein and chemical contents. Review of some previous works revealed that a lot of work has been done on the natural types of *Panicum maximum* existing in East Africa, its area of origin. This cannot be said of the state of knowledge on *Panicum maximum* in Nigeria. This work is planned basically to assess the forage yield and nutritive value in twenty accessions of *Panicum maximum* in Nigeria.

MATERIALS AND METHODS.

Plant materials were collected from wild populations in the geographical South-western part of Nigeria which falls within the lowland rainforest and derived savanna ecological zone, encompassing Osun, Oyo, Ogun Ondo and Kwara States. These were planted in the Botanical Garden in Obafemi Awolowo University (O.A.U.) Ile-Ife, Osun State, Nigeria.

The accessions were brought into cultivation by transplanting root-stocks of the accessions from the wild in the experimental plot. In all, thirty-five accessions were raised in the nursery. Twenty accessions representing all areas of collection were used for this study. Table 1 shows the sources, locations, distinguishing characters and collectors of the accessions.

Forage yield studies were done by excising four tillers from the root stocks, and transplanting them on the same day using a Randomized Complete Block Design with 3 replicates each for the twenty accessions. After 2 weeks of transplanting, all tillers were clipped down to a height of 5 cm above ground level. At sexual maturity, about six and a half weeks after initial pruning, readings, were taken for 11 forage yield attributes according to Ene-Obong and Omaliko (1986) as follow:

- Number of leaves/tiller
- Number of tillers/plant stand
- Leaf area
- Length of panicle
- Length of culm
- Length of leafy portion
- Above ground plant height
- Dry matter (DM) yield of panicle
- Dry matter (DM) yield of culm
- Dry matter (DM) yield of leafy portion
- Dry matter (DM) yield of above ground plant.

The forage yield parameters were subjected to Simple Correlation, Principal Components Analysis, Complete Linkage Cluster Analysis to elicit information on the

Table 1: Accessions of *Panicum maximum* Jacq. Studied and their sources.

Accession number	Location	Description	Collector
1 – 2	Directly behind Faculty of Agriculture Obafemi Awolowo University Campus, Ile-Ife. 7°30" N 4°31" E, Nigeria.	Broad leaves, heavy tillering, culm diameter fairly big. Plant type generally robust.	Adedeji & Faluyi
3	Ruderal behind Fa culty of Agriculture, on the way to quarters, O.A.U., Ile - Ife.7°30" N 4°31" E, Nigeria.	Narrow leaves, intermediate tillering, culm diameter thin. Plant type not so robust.	"
4 – 6	Inside the bush on Road 18, O.A.U. Staff quarters, Ile-Ife 7°30" N 4°31" E, Nigeria.	Broad-leafed, heavy tillering, culm diameter fairly big. Plant type robust.	"
7 – 9	Ruderal on Road 18, O.A.U. Staff quarters, Ile-Ife. 7°30" N 4°31" E, Nigeria.	Narrow leaves, heavy tillering, culm diameter small. Plant type not robust.	"
10	Inside the bush on Road 8, O.A.U. Staff quarters, Ile-Ife., 7°30" N 4°31" E, Nigeria.	Broad leaves, heavy tillering, culm diameter big. Plant robust.	"
11	Inside Odeda quarters, Abeokuta, Ogun State. 7°10" N 3°21" E, Nigeria.	Broad le aves, heavy tillering, culm diameter big. Plant robust.	Faluyi & Nwokeocha
12	Ruderal, Abeokuta – Ibadan Road 7°15" N 3°5" E, Nigeria.	Narrow leaves, heavy tillering, culm diameter small. Plant type robust	
13	Abeokuta – Ibadan road, inside the bush 7°15" N 3°25" E, Nigeria.	Narrow leaves, heavy tillering, culm diameter small. Plant robust	
14 – 15	Ruderal, Abeokuta – Ibadan road. 7°15" N 3°25" E, Nigeria.	Narrow leaves, low tillering, culm diameter small. Plant not robust.	
16	National Cereals Research Institute (N.C.R.I.), Apata Ibadan, Oyo State. 7°17" N 3°30" E, Nigeria.	Broad leaves, heavy tillering, culm diameter big. Plant robust.	"

Table 1: Continued

Location	Description	Collector
Inside the bush, Apa ta, Ibadan, Oyo State 7°17"N 3°30"E, Nigeria.	Broad leaves, heavy tillering, culm diameter big. Plant robust.	Faluyi & Nwokeocha
Ruderal, Apata, Ibadan, Oyo State. 7°17"N 3°30"E, Nigeria.	Narrow leaves, low tillering, culm diameter small. Plant type not robust.	"
Teaching and Research farm O.A.U., Ile-Ife 7°30"N 4°31"E, Nigeria.	Broad leaves, heavy tillering, culm diameter big. Plant robust.	Adedeji & Faluyi
Ruderal, Federal University of Technology, Akure (F.U.T.A.) School area, Ondo State 7°15"N 5°14"E, Nigeria.	Narrow leaves, low tillering, culm diameter small. Plant not robust.	Adedeji
F.U.T.A. Staff quarters, Akure, Ondo State. 7°15"N 5°14"E, Nigeria.	Broad leaves, heavy tillering, culm diameter big. Plant robust.	
Ruderal in front of a house, F.U.T.A. Staff quarters, Akure, Ondo State. 7°15"N 5°14"E, Nigeria.	Narrow leaves, heavy tillering, culm diameter small. Plant not so robust.	
Abandoned farmland, F.U.T., Akure, Ondo State. 7°15"N 5°14"E, Nigeria.	Broad leaves, heavy tillering, culm diameter big. Plant robust.	
Ruderal, F.U.T.A. Ondo State 7°15"N 5°14"E, Nigeria.	Narrow leaves, low tillering, culm diameter small. Plant type not robust.	"
Oil p alm plantation Apoje, Ijebu-Igbo, Ogun State, in the open 6 °58" N 4 °00" E, Nigeria.	Broad leaves, heavy tillering, culm diameter big. Plant robust.	Adedeji & Faluyi
Oil palm plantation Apoje, Ijebu-Igbo, Ogun State, in the shade 6 °58" N 4 °00"E, Nigeria.	Narrow leaves, intermediate tillering, culm diameter small. Plant not so robust.	"
Ruderal, Ilorin-Offa road on the Kwara State – Osun State boundary 8 °32" N 4°34"E, Nigeria.	Narrow leaves, low tillering, culm diameter small. Plant not robust.	Faluyi

interactions and relationships among forage yield attributes and the accessions studied.

For the Nutritive value studies, analysis were carried out on above ground plant. Fibre and Lignin contents of the samples were determined by the method of Goering and Van Soest (1970) after drying at 60°C. The fibre content was determined as Acid-Detergent Fibre (ADF) and the lignin as Acid-Detergent Lignin (ADL). Subsamples were further oven-dried at 105°C to a constant weight for the determination of the dry matter used in computing the results of the chemical analysis.

Crude Protein (CP) determination was done by determining the total nitrogen in the sample by the Kjedahl method adopted in the International Institute of Tropical Agriculture (I.I.T.A) Manual series No. 7 (Tel and Rao, 1982) and multiplying the nitrogen content by 6.25.

Sodium (Na) and Potassium (K), were determined by flame photometry and Calcium (Ca) and Magnesium (Mg) on an Atomic Absorption Spectrophotometer according to Allen *et. al.* (1976). Nitrogen (N) and Phosphorus (P) analyses were carried out according to the method contained in the I.I.T.A. Manual series No. 7 (Tel and Rao, 1982).

RESULTS.

Number of leaves per tiller is lowest in accessions 7, 26, and 31 (4 leaves/culm; Table 2) and highest in accessions 12, 14, 15, 16, 18, 26, 30, 31, 33, 34 and 35.

Number of tillers/plant stand range from 7 in accession 33 and 35 to 57 in accession 31. Noteworthy in this study is the fact that *Panicum maximum* expands from its rootstock and tiller fast. It was observed that the accession that now has 57 tillers was transplanted about two months earlier as 4 tillers. Leaves are generally long and broad with leaf area of 384.47 cm^2 501.11 cm^2 in all accessions except in accessions 34 and 35 where it is 263.83 cm^2 and 312.21 cm^2, respectively (Table 2).

Panicle length is lowest, (48.13 cm) in accession 16 and highest (68.97 cm) in accession 18. Culm length is shortest, (193.67 cm) in accession 7 and tallest, (254.83 cm) in accession 33. Length of Leafy portion range from 161.67 cm in accession 7 to 224.17 cm in accession 33. Accession 35 has the shortest plant height, (245.10 cm) while accession 18 is the tallest with a height of 322.50 cm. It can be seen that accession 18 combine both the highest panicle length and the tallest plant. It also has the highest dry matter yield of panicle (29.17 g), the lowest (10.23 g) occur in accession 34. Dry matter yield of culm (455.67 g) is also highest in accession 18 again and it is lowest (127.67 g) in accession 33 which also has the lowest dry matter yield of leafy portion (116.5 g), while accession 18 has the highest (395.67 g). The trend is the same in the dry matter yield of above ground plant: it is highest (880.51 g) in accession 18 and lowest (250.5 g) in accession 33 (Table 2).

Table 2: Forage Yield Attributes of the Accessions Studied.

Serial No	Accession No	No of leaves / tiller	No of tillers/ plant stand	Leaf area (cm^2)	Length of panicle (cm)	Length of culm (cm)	Length of leafy portion (cm)	Above ground plant height (cm)	Dry matter yield of panicle (g)	Dry matter yield of culm (g)	Dry matter yield of leafy portion (g)	Dry matter yield of above ground plant (g)
1	1	6.57±0.14 (5-8)	34.33± 8.88 (24-52)	393.68± 16.98	55.27± 1.28	205.47± 4.56	178.4± 5.60	260.97± 4.99	19.90± 7.45	354.67± 108.12	345.67± 100.17	720.23 ± 211.97
2	5	6.4±0.13 (5-8)	29.50±16.5 (13-46)	421.42± 12.04	58.23± 1.55	202.27± 3.74	172.63± 4.13	260.63± 4.23	16.07± 7.56	263.67± 90.89	222.0± 78.36	501.74 ± 174.68
3	6	6.5±0.16 (5-8)	40.00±6.08 (29-50)	434.45± 19.67	55.93± 1.72	209.67± 6.46	179.17± 6.10	266.83± 6.56	19.07± 1.07	294.00± 100.55	345.83± 57.91	658.90 ± 135.33
4	7	6.2±0.14 (4-7)	39.0±5.69 (28-47)	501.11± 22.86	57.53± 1.29	193.67± 6.76	161.67± 8.05	261.03± 4.87	19.63± 4.01	371.67± 100.73	324.0± 73.55	715.3 ± 110.26
5	11	6.33± 0.13 (5-8)	31.67±10.27 (16-51)	396.66± 20.83	55.97± 1.57	207.5± 4.99	176.33± 5.24	266.4± 5.20	20.00± 9.16	269.0± 129.3	245.33± 108.0	569.43 ± 234.56
6	12	7.43±0.13 (6-9)	15.00±2.00 (13-19)	497.35± 15.66	65.20± 1.36	231.93± 7.53	204.07± 8.31	294.47± 7.45	17.0 ± 2.57	157.0± 27.54	180.33± 20.09	354.17 ± 46.69
7	14	7.50± 0.19 (5-9)	21.30±7.69 (10-36)	451.43± 15.14	58.40± 1.51	237.67± 7.54	214.17± 8.55	298.87± 8.78	21.5± 10.69	248.33± 164.09	287.5± 131.22	657.33 ± 303.41
8	15	7.40 ± 0.15 (6-9)	30.67±8.35 (14-40)	384.47± 2.77	57.97± 1.50	231.7± 7.80	201.17± 8.50	260.0± 13.29	22.83± 8.25	382.00± 186.04	331.67± 130.95	613.57 ± 336.61
9	16	7.20±0.17 (5-9)	29.00±10.41 (9-44)	389.48± 12.69	48.13± 1.11	201.5± 6.61	170.67± 6.13	251.83± 6.19	15.93± 5.01	365.33± 148.12	289.83± 127.65	671.09 ± 106.15
10	18	7.37±0.23 (5-9)	33.67± 6.17 (22-43)	464.63± 18.19	68.97± 1.62	247.83± 6.67	198.40± 10.81	322.50± 7.05	29.17± 9.60	455.67± 162.05	395.67± 85.19	880.51 ± 133.30

Table 2 continued.

Serial No	Accession No	No of leaves / tiller	No of tillers/ plant stand	Leaf area (cm^2)	Length of panicle (cm)	Length of culm (cm)	Length of leafy portion (cm)	Above ground plant height (cm)	Dry matter yield of panicle (g)	Dry matter yield of culm (g)	Dry matter yield of leafy portion (g)	Dry matter yield of above ground plant (g)
11	23	6.47±0.15 (5-8)	32.67±3.71 (28-40)	413.29 ±14.18	53.73± 1.24	211.5± 5.85	177.1± 7.26	268.67± 5.58	16.83± 0.35	335.00± 38.16	317.17± 17.68	669.0 ± 55.69
12	24	6.23±0.18 (5-8)	32.33±4.98 (23-40)	423.78 ±19.04	55.03± 1.19	230.23 ± 6.04	190.70± 8.43	287.40± 6.13	16.40± 3.25	445.00± 83.19	387.0± 93.90	792.23 ± 231.47
13	25	6.97±0.14 (5-8)	37.33±8.41 (21-49)	470.43± 20.21	55.63± 1.50	242.5± 7.33	203.57± 7.14	294.13± 8.98	16.53± 1.53	392.0± 41.50	390.33± 59.25	798.86 ± 122.08
14	26	7.27±0.20 (4-9)	22.00±4.72 (13-29)	451.66± 16.75	57.10± 1.91	200.83± 6.28	169.37± 6.56	264.8± 7.09	16.03± 5.37	315.33± 133.39	295.33± 89.33	626.7 ± 227.88
15	30	6.60± 0.22 (5-9)	29.67±8.35 (13-39)	447.62± 16.50	53.57± 1.21	211.30± 5.42	189.93± 6.25	265.77± 5.58	21.93± 8.96	360.33± 140.62	287.67± 104.82	669.93 ± 253.69
16	31	6.47±0.24 (4-9)	32.67±12.33 (17-57)	482.34± 17.18	58.77± 1.61	248.37± 5.62	222.70± 7.38	308.97± 6.18	20.5± 7.40	449.67± 152.73	363.00± 102.00	833.17 ± 259.45
17	32	6.57±0.11 (5-8)	25.67±7.80 (12-39)	444.33± 11.96	52.43± 1.18	201.5± 4.40	168.83± 4.42	253.70± 4.32	13.40± 4.14	325.67± 85.36	215.67± 64.55	554.57 ± 128.47
18	33	7.27±0.17 (6-9)	10.33±1.67 (7-12)	457.83± 25.54	57.83± 1.64	254.83± 8.17	224.17± 8.38	306.63± 8.28	6.17± 0.73	127.67± 62.88	116.5± 31.00	250.5 ± 94.02
19	34	7.20±0.13 (6-9)	25.33±4.91 (19-35)	263.83± 11.19	52.07± 0.92	203.1± 4.05	175.23± 3.90	251.9± 4.88	10.23± 1.13	132.0± 40.00	122.0± 19.29	264.23 ± 39.03
20	35	7.20±0.15 (6-9)	25.67±9.61 (7-39)	312.21± 13.37	51.47± 1.25	191.20± 4.75	166.0± 4.30	245.10± 6.24	13.33± 4.32	210.67± 99.88	170.33± 66.99	391.33 ± 60.19

Statistical Analysis of Forage Yield Parameters

The simple statistics (Table 3) show that dry matter yield of culm (X 10) has the Coefficient of Variation (C.V.) of 31.12% followed by dry matter yield of leafy portion (X 11) with a C.V. of 30.62% and dry matter yield of above ground plant (X 12) with a C.V. of 29.34%. Dry matter yield of panicle (X 9) with a C.V. of 27.6% and number of tillers/plant stand (X 3) with a C.V. of 26.07% fall in the next category based on the magnitude of the C.V. It is clear that both dry matter yield and number of tillers/plant stand contributed more to the variability in the population.

Table 4 shows the factor loadings of the first three principal components. The first principal component show high positive loadings for X 3 (number of tillers/plant stand), X 4 (leaf area), X 5 (length of panicle), X 8 (above ground plant height), dry matter yield of panicle, dry matter yield of culm, dry matter yield of leafy portion, dry matter yield of above ground plant. X 9, X 10, X 11 and X 12, respectively are however outstanding. These parameters are dry matter factors. This component contributes 50% of the total variability. The second component shows high positive loading for X 2 (number of leaves/tiller), X 5 (length of panicle), X 6 (length of culm), X 7 (length of leafy portion) and above ground plant height and contributes 37% of the total variability. The third component does not show high positive loading for any variable.

The first component is obviously the most important and it is characterized by high loadings on a group of related variables such as number of tillers/plant stand, leaf

Table 3: Simple Descriptive Statistics of Forage Yield Attributes of the Accessions Studied.

Variable	Minimum	Maximum	Mean	Standard Deviation	Standard Error	CV (%)
X2	6.20	7.50	6.86	0.46	0.10	6.67
X3	10.33	40.0	28.89	7.53	1.68	26.07
X4	263.83	501.11	425.08	58.47	13.07	13.75
X5	48.13	68.97	56.46	4.59	1.03	8.14
X6	193.67	254.83	218.38	19.97	4.46	9.14
X7	161.67	224.17	187.21	19.19	4.29	10.25
X8	245.00	322.50	274.52	22.35	5.00	8.14
X9	6.17	29.17	17.61	4.87	1.09	27.67
X10	127.67	455.67	317.73	98.87	22.11	31.12
X11	116.50	395.67	281.64	86.23	19.28	30.62
X12	250.50	880.51	609.79	178.89	40.00	29.34

X2 Number of leaves/tiller
X3 Number of tillers/plant stand
X4 Leaf Area (cm^2)
X5 Length of panicle (cm)
X6 Length of culm (cm)
X7 Length of leafy portion (cm)
X8 Above ground plant height (cm)
X9 Dry matter yield of panicle (g)
X10 Dry matter yield of culm (g)
X11 Dry matter yield of leafy portion (g)
X12 Dry matter yield of above ground plant (g).

Table 4: Factor Loadings of the First Three Principal Components of Forage Yield Attributes of the Accessions Studied.

Variable	Communality estimates	Principal components			Eigen value
		I	II	III	
X2	0.445	-0.208	0.628	-0.082	3.680
X3	0.845	0.556	-0.727	0.083	1.235
X4	0.542	0.641	0.307	-0.191	0.898
X5	0.8627	0.534	0.563	-0.510	0.481
X6	0.933	0.491	0.804	0.213	0.367
X7	0.870	0.375	0.830	0.201	0.189
X8	0.918	0.597	0.747	0.061	0.120
X9	0.750	0.809	-0.167	-0.259	0.061
X10	0.925	0.854	-0.318	0.308	0.033
X11	0.940	0.902	-0.317	0.161	0.013
X12	0.970	0.899	-0.339	0.216	0.002
Variance explained by each factor		4.921	3.680	1.235	
%		50%	37%	13%	

X2 Number of leaves/tiller
X3 Number of tillers/plant stand
X4 Leaf Area (cm^2)
X5 Length of panicle (cm)
X6 Length of culm (cm)
X7 Length of leafy portion (cm)
X8 Above ground plant height (cm)
X9 Dry matter yield of panicle (g)
X10 Dry matter yield of culm (g)
X11 Dry matter yield of leafy portion (g)
X12 Dry matter yield of above ground plant (g)

Table 5: Correlation Analysis Among Forage Yield Attributes of the Accessions Studied.

	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12
X2		-0.6041	-0.1485	0.2602	0.3466	0.3607	0.2308	-0.0545	-0.3025	-0.3011	-0.3458
X3			0.0216	-0.1176	-0.2351	-0.3430	-0.1761	0.5370	0.6560***	0.7445***	0.7237***
X4				0.5591	0.4433	0.4069	0.6070	0.3310	0.3824	0.4091	0.4381
X5					0.5860	0.4897	0.7321***	0.5078	0.1138	0.2052	0.1678
X6						0.9518***	0.9131***	0.1768	0.2018	0.2310	0.1883
X7							0.8324***	0.1094	0.090	0.1024	0.0668
X8								0.2828	0.2507	0.2930	0.2979
X9									0.7076***	0.7224***	0.7369***
X10										0.9224***	0.9667***
X11											0.9660***
X12											

*** Significance at P = 0.001

X2 Number of leaves/tiller
X3 Number of tillers/plant stand
X4 Leaf Area (cm^2)
X5 Length of panicle (cm)
X6 Length of culm (cm)
X7 Length of leafy portion (cm)
X8 Above ground plant height (cm)
X9 Dry matter yield of panicle (g)
X10 Dry matter yield of culm (g)
X11 Dry matter yield of leafy portion (g)
X12 Dry matter yield of above ground plant (g)

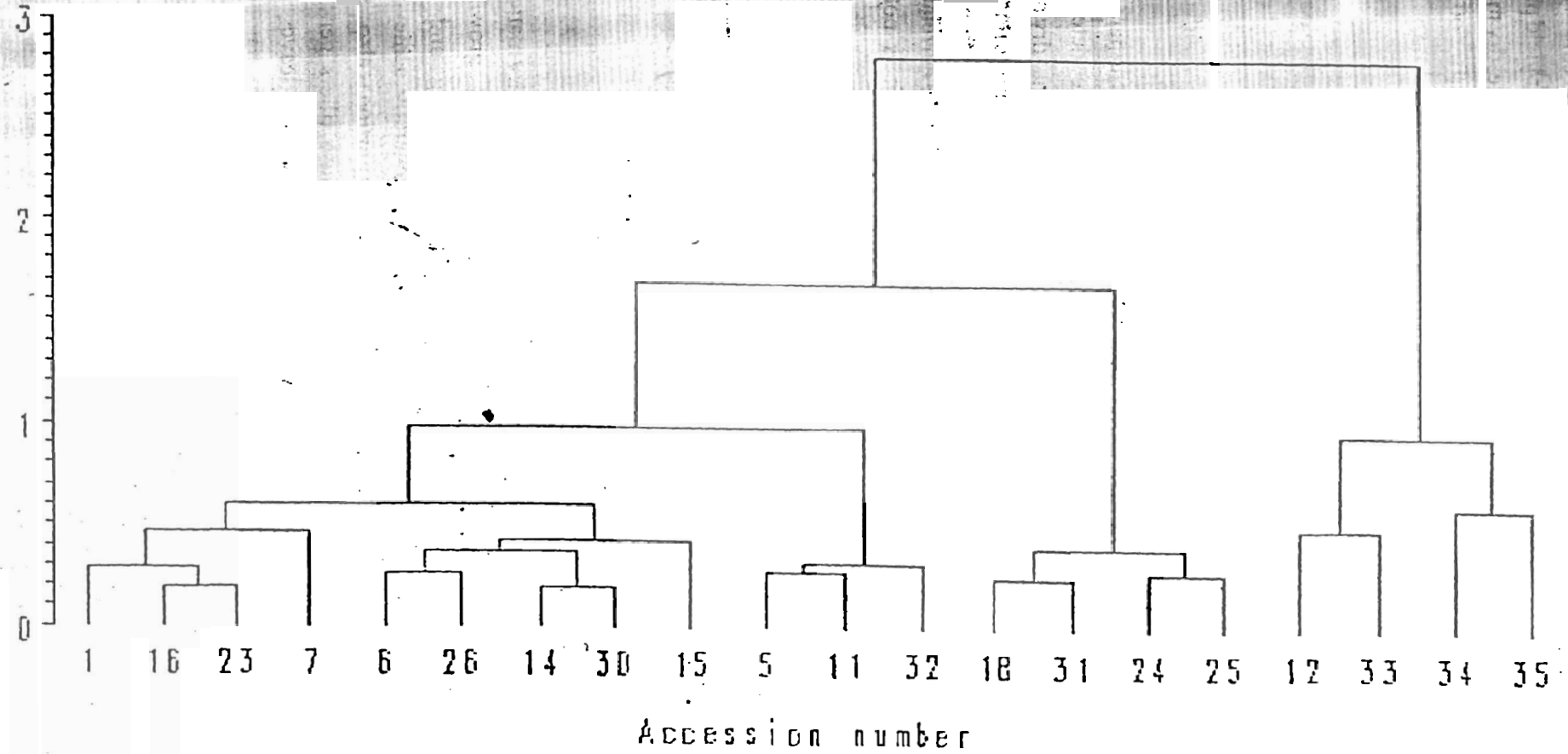

Fig. 1: Complete linkage cluster diagram showing relationships among the accessions of *Panicum maximum* studied.

Nutritive Value (Chemical Analysis).

Acid Detergent Fibre (ADF) concentration is lowest (35.80%) in accession 23 and highest (53.07%) in accession 1 (Table 7). Acid Detergent Lignin (ADL) concentration is lowest (1.17%) in accession 24 and highest (5.86%) in accession 14. Crude protein has the highest concentration (14.96%) in accession 26 and lowest 11.03% in accession 7. ADF concentrations are generally the highest, followed by Crude Protein and ADL in all the accessions studied. No accession can be said to be consistently high or low in concentration for any parameter.

Potassium concentration range from 2.25% in accessions 25 and 33 to 3.70% in accession 26 (Table 8). This is followed by Nitrogen which range from 1.764 2.394% with the lowest concentration occurring in accession 7 and the highest in accession 26. Nitrogen concentration is followed by Calcium concentration with the lowest value (0.074%) occurring in accession 33 and the highest (0.34%) occurring in accession 16. This is followed by Sodium concentration which ranged from 0.01 0.15% with the lowest concentration in accession 1 and highest in accessions 5 and 18 (Table 8). Next is Magnesium with concentration from 0.003 0.015%, the least concentration occurring in accessions 14, 31 and 33 and highest in accession 16. Lastly, Phosphorus concentration ranges from 0.002 0.013%, lowest in accession 11 and highest in accession 23. In decreasing order of concentration, we have K>N>Ca>Na>Mg>P.

DISCUSSIONS

Forage Yield

From this study, it was observed that 4 tillers multiplied and expanded to 57 tillers in just about ten weeks. This is because of the ability of these accessions to tiller and expand fast through the root-stock. This attribute enhances forage or herbage yield.

The factor analysis (Table 4) show high positive loadings for dry matter yield parameters ---------- dry matter yield of panicle, dry matter yield of culm, dry matter yield of leafy portion and dry matter yield of above ground plant. Low positive loadings occurred for number and length parameters ---- number of tillers per plant stand, leaf area, length of panicle, length of culm, length of leafy portion and above ground plant height.

The high positive correlations between number of tillers or culms per plant stand and dry matter yields of culm, leafy portion and above ground plant suggests that these parameters form the character complex in the determination of forage yield. It is significant that dry matter above ground plant is highly positively correlated with dry matter culm and dry matter of leafy portion. Dry matter culm is highly positively correlated with dry matter of leafy portion but it is not as highly positively correlated with number and tillers per plant stand. The value of correlation between dry matter above ground plant and number of tillers per plant stand is of the same order of magnitude as that between dry matter of leafy portion and number of tillers per plant stand. The order of correlation between dry matter panicle and dry matter above ground plant is the same as that between dry matter panicle and dry matter leafy portion as well as that between dry matter panicle and dry matter culm.

Grasses have distinct growth phases: germination, tillering, booting and flowering. Maximal biomass is generally achieved through tillering. The total leafy portion is also a function of number of tillers because tillers generally have minimally variable number of leaves. The low positive correlation between dry matter culm and number of tillers per plant stand can be explained on the basis that tillering reaches an optimum at the end of the tillering phase. Beyond this phase, additional tillers produced do not grow fully and many of them do not bear full panicles and really do not contribute significantly to the above plant yield.

Table 7: Acid Detergent Fibre (ADF), Acid Detergent Lignin (ADL) and Crude Protein (CP) in the Accessions of *P. maximum* Studied.

Accession Number	% ADF	% ADL	% CP
1	53.07	2.15	11.81
5	41.32	3.82	11.81
6	40.93	4.74	11.81
	36.24	3.00	11.03
11	49.22	2.34	11.81
12	42.70	5.17	13.78
14	41.65	5.86	14.57
15	46.82	4.47	13.78
16	36.61	1.94	12.60
18	41.64	5.61	13.78
23	35.80	2.49	12.21
24	42.09	1.17	12.99
25	42.20	2.22	14.57
26	43.25	2.50	14.96
30	46.88	4.39	14.57
31	42.58	2.25	13.78
32	39.63	2.76	12.60
33	39.72	2.14	14.18
34	48.19	2.54	12.21

Table 8: Some Major Elements Concentrations in the Accessions of *P. maximum* Studied

Accession Number	K (%)	Na (%)	Mg (%)	Ca (%)	N (%)	P (%)
1	3.10	0.01	0.007	0.191	1.890	0.008
5	3.30	0.15	0.005	0.147	1.890	0.008
6	3.05	0.12	0.007	0.203	1.890	0.006
7	3.05	0.14	0.008	0.205	1.764	0.006
11	2.55	0.10	0.006	0.197	1.890	0.002
12	3.55	0.10	0.005	0.140	2.205	0.008
14	2.90	0.11	0.003	0.081	2.331	0.006
15	2.63	0.14	0.007	0.173	2.205	0.004
16	2.40	0.13	0.015	0.349	2.016	0.008
18	2.55	0.15	0.006	0.178	2.205	0.006
23	2.35	0.12	0.006	0.177	1.953	0.013
24	2.55	0.09	0.007	0.200	2.079	0.008
25	2.25	0.12	0.007	0.177	2.331	0.010
26	3.70	0.13	0.008	0.182	2.394	0.006
30	3.25	0.13	0.006	0.180	2.331	0.006
31	3.23	0.09	0.003	0.099	2.205	0.006
32	3.20	0.09	0.005	0.157	2.016	0.010
33	2.25	0.14	0.003	0.074	2.268	0.004
34	2.90	0.10	0.005	0.116	1.953	0.010

Dry matter above ground plant correlates highly positively with dry matter culm and dry matter leafy portion because the culms integrate to form the above ground plant dry matter yield and they also bear the leaves. The culms and the leaves are the primary and secondary repositories for the partitioning of photosynthates.

It was observed that the complete linkage cluster grouped the accessions into 5 main clusters. A close look at these clusters show that none of the accessions within a group share comparable forage attributes except accessions 18 and 31. Habitat of collection is also not a key factor in the groupings revealed by the cluster analysis. Distinct genetic entities were recognized on the basis of forage attributes and nutritive value suggesting that there are genetic resources in the population of *P. maximum* surveyed. It would therefore appear that there is sufficient heterogeneity among and within the populations making clusters on the basis of habitats to be improbable.

Nutritive Value (Chemical Composition)

When different genotypes within a species are grown in a common environment and under uniform management, estimations of their chemical composition and feeding value often reveal significant difference (Reid *et. al.*, 1973). The chemical composition of the *Panicum* accessions studied show that they accumulate fibrous material at an early stage of growth.

Ademosun (1970), Olubajo *et. al.* (1974) and Karue (1975) have reported increase in fibre and lignin with increasing maturity. The maximum percentage Acid Detergent Fibre in this study is 53.07%. According to Van Soest and Marcus (1964), above 60% cell wall constituents, there is marked decrease in voluntary intake with increasing content of cell wall. So at this stage of growth of the accessions studied, that is, at sexual maturity, about 6 weeks after initial pruning (early in the rainy season), there is voluntary feed intake of the plant by herbivores.

The level of concentration of the chemical elements in a plant changes as the season progresses from the wet season to dry season. Muoghalu (1984) in his work on some plant tissues showed the seasonal trend in concentrations of Nitrogen, Phosphorus and Potassium. The author concluded that peak concentrations of these elements in the above ground biomass were observed in May and lower values prevailed as the season progressed.

Church (1980), provided a table on mineral requirements of beef cattle, recommended nutrient content of rations for dairy cattle and mineral requirements of sheep. According to these tables, Potassium, Nitrogen, Sodium and Calcium concentrations are within the recommended range in the accessions of *Panicum* studied but Magnesium and Phosphorus are below the recommended range (Table 8). Low Phosphorus levels in grass are generally credited to the low content of this element in most soils (Milligan and Sule, 1982).

The maximum crude protein of grasses occur at the beginning of the wet season. During this period, leaf production is greater than stem production and thus, as the leaf contains a higher percentage of crude protein than the stem (Haggar, 1970), the quality of crude protein is high. As the wet season progresses, stem elongation accounts for the increase in biomass and by the end of the wet season, crude protein content is low (less than 6% Dry Matter).

This nutritive value study was carried out at the beginning of the rainy season, in May, when it was assumed that quality of forage is high. According to Milligan and Sule (1982), differences in crude protein content and mineral content of individual grass species occur or are affected by the season of sampling, the plant part selected and inter-specific differences. According to Bogdan (1977), crude protein content in *Panicum maximum* ranges from 4 to 14%. He reported further that in Brazil, four weeks old grass contained 22.6% crude protein; 12.4 and 8.5% crude protein 12 and 32 weeks after the last cut, respectively. Malaviya (1999) reported crude protein in *P. maximum* to

range from 4.63 to 8.25%. As has been said earlier, all the different values could be due to different sampling periods.

The crude protein content in the accessions of *Panicum maximum* studied range from 11.03 14.96%. From these values, it is obvious that at the time or season of this study, all the accessions of *Panicum maximum* studied can provide sufficient protein to meet the requirements of animals, most especially cattle, since the crude protein values are higher than the minimum value of 6% estimated by Miller, *et al.* (1963) as being necessary to maintain the body weight of Fulani cattle.

According to Milligan and Sule (1982), there is basically an inverse relationship between herbage quality and yield, that is, the higher the forage yield, the lower the nutritive value or herbage quality. Many optimum harvesting times have been proposed by many workers for *P. maximum*. Bogdan (1977) recommended that *P. maximum* should be first grazed after planting through splits 3 4 months after planting. Lazo *et. al.* (1996), recommended 60 days of age during the dry season and 15 days during the rainy season (Lazo *et. al.* 1997). Santos *et. al.* (1999) recommended a grazing frequency of 28 days.

Panicum maximum in South-western Nige poor seeders and propagation is mainly through the rootstocks and roots from the nodes (Adedeji, 2001). Harvesting is recommended before booting because the panicles are sinks as far as food and nutritive values are concerned. Also, since there is an inverse relationship between herbage quality and yield, to get the best forage quality as per herbage quality, the earlier the harvest or grazing time, the better. *Panicum maximum* grows very fast, so it is recommended from this study that the best time to harvest or put animals to graze on *P. maximum* fields should be 15 days interval in support of Lazo *et al.* (1997), or at most, 30 days interval during the rainy season.

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