Multipurpose uses of forage species, estimation of availability and distribution of grass species, and effect of location on the crude fibre and ash contents of common browse species in Nsukka, Nigeria.

C. C. Onyeonagu*, J. E. Asiegbu, A. R. Nweke, and C.S. Akagha
Department of Crop Science University of Nigerian, Nsukka.
*Corresponding Author E-mail: onyeonagu@yahoo.com

Abstract

A study of multipurpose browse and grass species from four rural communities of Nsukka Local Government Area of Enugu State was conducted between 2005 and 2006. Structured questionnaires were administered to farmers in the four communities. A total of 38 plant species belonging to 24 plant families were identified as multipurpose browse species. A greater number of the plant species are used for fuel wood (22 species), for fruits and leaves as vegetables (20 species) and for human and veterinary medicine (16 species). Twenty seven species of these browse plants from 2 communities were subjected to nutritional evaluation of their ash and crude fibre contents. The percentage crude fibre content of Icancina trichantha (73. 8%) was highest compared with the other browse species. Browse species from Edemani community gave significantly ($P < 0.05$) higher crude fibre contents than those from Obukpa community. Elaeis guineensis had significantly ($P < 0.05$) the highest ash content (23.5%). Plants from Edemani had higher ash content (11.4%) than those from Obukpa community (8.1%). Location and species interaction significantly ($P < 0.05$) affected the ash contents of the browse plants. A total of 6 plants were identified as multipurpose grass species. A greater number of the grass species are used for soil fertility enrichment (4 species), for lighting (2 species) and as roofing materials (2 species). The most frequently used grass species (with mean usage = 15%) across all sampled communities include: Andropogon gayanus and Anthephora ampulaceae. All the grass species identified are moderately available in the area of study.

Keywords: Multipurpose uses, location, forage species.

Introduction

Browse in the form of trees and shrubs, form an integral part of ruminant production. The use of browse plants in ruminant animal nutrition has become an essential practice, especially in the dry season when herbaceous forages are scarce and of low quality (Bamikole *et al*., 2004; Onyeonagu and Asiegbu, 2006). Browse plants are available all the year round (all season), contributing their succulent leaves and twigs to small ruminant feeding and production (Onyeonagu and Asiegbu, 2006). In Addition to their being used in feeding small ruminant in Nigeria, there are other multipurpose uses of browse which include human and veterinary medicine, fuel wood, shade, poles for building, food for man, soil fertility enrichment etc. (Okafor, 2002; Mtengeti and Mhelela, 2006).

Indigenous browse species have high persistence in their respective areas (Woodward and Coppock, 1995). They are, however, in danger of extinction due to over use (Mtengeti and Mhelela, 2006).

Topographic factors such as slope, aspect, altitude and underlying geology, influence the biomass production and quality of forage species (Mutanga *et al*., 2004). At present, forage species are collected from the wild within the Nsukka rural areas (Onyeonagu and Asiegbu, 2006). There seems a need to focus some research attention on the multipurpose uses of forage species, distribution and utilization of identified forage grass species of rural communities in Nsukka Local Government Area of Enugu State to aid inventorisation. Available information on browse plants of southeastern Nigeria is scanty (Mecha and Adegbola, 1980) and mostly unpublished (Okigbo, 1980; Orok and Duguma, 1987; Okafor and Fernandez, 1987).

The bulk of the feed available to ruminant animals in the tropics is the grass forage, as this can be sourced cheaply (Bamikole, 2003). Smallholder producers of ruminants particularly sheep and goats in Nigeria rely on unimproved natural pasture as the main feed source, backed up with crop residues after harvest (Bamikole *et al.,* 2004). The supply of grass herbage for livestock during the dry months of the year declines substantially (Onyeonagu and Asiegbu, 2006).

An earlier study (Onyeonagu and Asiegbu, 2006) examined the seasonality and preference rating of identified forage species commonly found in the derived savanna zone of Nigeria. However, there is paucity of information on the multipurpose uses of forage species, ease of availability and distribution of forage grass species commonly found in Nsukka, derived savanna zone of Nigeria. Accordingly, research was undertaken within the area to:

Determine the multipurpose uses of forage species commonly found in Nsukka

Determine the effect of location on the ash and crude fibre contents of some common browse species found in Nsukka.

Estimate the ease of availability and distribution of identified forage grass species found in Nsukka.

Materials and methods

Semi structured interview schedule were made in this study. Four communities in Nsukka LGA were randomly selected from the area, with Ehalumona, Edemani, Obukpa and Obimo communities representing the East, West, North and South of Nsukka LGA, respectively. Nsukka is situated in a derived savannah ecological zone on latitude 06^{O} 52'N, longitude 07^{O} 24' E and at an altitude of 447.26 meters above sea level. Five farmers per community were randomly selected and a total of 20 farmers were interviewed.

The information required in the interview schedule was the multipurpose uses of identified forage grass species in Nsukka rural communities (Table 2). The study was carried out between 2005 and 2006. The availability rating of grass species was based on mean scores to the nearest whole number (Key: 1 = scarce; 2 = moderately available; and 3 = easily available). Samples of all the 38 browse species were collected in 2006 for chemical analysis, but only 27 of these were complete at the time of chemical evaluation. The species were identified with the help of a taxonomist in the Department of Crop Science University of Nigeria, Nsukka. The local names were provided by the local farmers.

Chemical Analysis

The laboratory experiment was a 2 x 27 factorial laid out in a completely randomized design (CRD) and was replicated three times. Treatments comprised two locations and 27 browse

species. Leaves from mature plants were randomly collected from three villages in the Obukpa and Edemani communities for chemical analyses. These plant samples were dried to constant weight in a forcedair oven at a tempeature of 80^0C, and ground using Thomas Wiley laboratory Mill (Mode 4). Determinations of crude fibre and ash contents were as described by Pearson (1976).

Soil Analysis

Soil samples were collected from the three (3) villages in each of the two communities (Obukpa and Edemani) sampled for chemical analysis. The soil samples were collected at random by augering 1 20cm below the soil surface. Sampling was done at four points in each village and soil samples from these points were bulked together. A representative sample was taken to determine the chemical and physical characteristics of the sites.

Statistical analysis

All data from chemical analysis of samples were statistically analysed using the procedure outlined by Steel and Torrie (1980) for factorial experiment in a Completely Randomized Design (CRD). Separation of treatment means for statistical significance was done using the standard error of the difference between two means (s.e.d.). The results of the interview were analysed using percentages and arithmetic means as described by Steel and Torrie (1980). percentage of all minerals except Calcium than that from Edemani community which is acidic in reaction (Table 1). Base saturation was also higher in Obukpa soil than Edemani.

Except for *Mucuna urens*, the rest of the browse plants had several other uses besides being browsed by small ruminant animals (Table 2). The family Fabaceae had the greatest numbers of browse plants in the study

Table 1: Soil Physical and Chemical Properties of the Experiment sites

Mechanical Properties	Edemani	Obukpa
Course Sand (%)	36.0	61.2
Fine Sand (%)	46.0	24.5
Clay (%)	15.0	5.0
Silt (%)	3.0	9.3
Textural Class (%)	Sandy loam	Sandy
Chemical Properties		
pH in water	4.7	6.2
pH in KCl	4.1	6.0
Organic Carbon (%)	0.42	0.399
Organic Matter (%)	0.72	0.688
Total nitrogen (%)	0.042	0.07
Total phosphorus (ppm)	15.95	17.11
Base saturation (%)	10.74	85.16
ExchangeableCations (mg/100g soil)		
Potassium	0.12	2.55
Magnesium	0.2	2.4
Calcium	2.2	1.2
Sodium	0.40	4.41
Hydrogen	0.8	2.0
Aluminium	0.4	0.6
CEC	27.2	12.4

Result

The soil from Obukpa is slightly acidic in reaction and had higher

percentage of all minerals except Calcium than that from Edemani community which is acidic in reaction (Table 1). Base saturation was also higher in Obukpa soil than Edemani.

Except for *Mucuna urens*, the rest of the browse plants had several other uses besides being browsed by small ruminant animals (Table 2). The family Fabaceae had the greatest numbers of browse plants in the study

Table 2: Multipurpose uses of identified forage browse plants in four rural communities around NSUKKA.

S/NO	FAMILY AND SPECIES	MULTIPURPOSE USE	CODE FOR USES
	Anarcardiaceae	Stops stomach problems in human; prevents stomach	
1	*Spondias mumbin* (ijikara)[1]	problem when given to pregnant goats after lambing; Fruit taken to improve appetite in humans; Medicinal against inflammation of the throat; Induces milk production in lactating goats.	1, 3, 4
2	*Mangifera indica* (mango)	Fruit edible; leaves used against malarial; fuel wood; shade.	1, 2, 3, 4, 11
	Amaranthaceae	Vegetable	1, 3
3	*Amaranthus spinosus* (Inene-itete)		
	Arecaceae (Palmae)	Palm oil from fruits; palm wine from inflorescence and	
4	***Elaeis guineensis*** (Igunkwu)	tender aerial plant of the stem; palm kernel oil used to make soaps; fronds used for thatching and broom making; fronds are sometimes used as fuel wood when dry, in making baskets; fence.	1,2,3,5,6,13
	Compositae (Asteraceae)		
5	*Aspilia africana* (Aramjila)	Leaf stops bleeding;	1, 4
6	*Chromolaena odorata* (Kitika)	Medicinal in treating minor wounds and stops bleeding; soil fertility restoration.	1,4,9
7	*Vernonia amygdalina* (Onugbu)	Leaf as medicine against malaria, cough, Diabetics; antihelminthic; land demarcation; leaves as vegetable.	1, 3, 5, 9
8	**Bignonaceae** *Newbouldia leavis* (Ejuruoshishi or Ogirisi)	Boundary demarcation; fencing; staking, nectar from flower as juice.	1,3,5,8
	Bombacaceae		
9	*Ceiba pentandra* (Akpu Ogwu)	Timber; Fuel wood	1, 2, 6
	Caesalpinoideae	Fruit edible; fuel wood; leaf against malaria and	
10	*Dialium guineense* (Icheku or Unuagu)	stomach problem:	1, 2, 3, 4
11	*Berlinia grandriflora* (Ububa)	Fuel wood; staking	1, 2, 8
12	**Caricaceae** *Carica papaya Okwurnbekee or opopo)*	Fruit edible; medicinal against malaria	1,3,4
	Chrysobalinaceae	Staking; fuel wood; boundary demarcation; chewing	1,2,5,7,
13	*Acioa bateri* (Ahaba)	stick; yam ban	
14	**Euphorbiaceae** *Manihol esculenta* (Akpu or Ogodo)	Starch; fufu; garri; cassava chips	1, 3, 13
	Fabaceae	Vegetable; fuel wood; medicinal against dysentery and	
15	*Pterocarpus santalinioides* (Uturukpa)	in clearing the system of newborn babies; land demarcation.	1, 2, 3, 4, 5
16	*Baphia nitida* (Aboshi)	Fuel wood; medicinal against skin rashes and malaria; chewing stick; treatment of wounds; boundary demarcation.	1, 2, 4, 5, 7
17	*Cajanus cajan* (Agbugbu)	Seed edible; fuel wood; staking	1, 2, 3, 8
18	*Mucuna urens* (Egbara))		1

Table 2 continued

19	*Calapogonium mucunoids* (Ogbanala)	Soil fertility restoration	1, 9
20	**Icancinaceae** *Icacina trichantha* (Urumbia)	Medicinal against scabies	1,4
21	*Irvingia gabonensis* (Ujuru)	Fruit edible; fuel wood; soup thickener	1, 2, 3
22	**Lauraceae** *Persea americana* (Ube bekee).	Fruit edible; leaf medicinal against malaria; shade; reduces high blood pressure.	1,3,4,11
	Lecythidaceae		
23	*Napoleona imperialis* (Odure or ukpodu)	Green manure; medicinal against stomach problem and dysentery.	1,4,9
	Malvaccae		
24	*Sida acuta* (Ogbogu)	Erosion control	1, 10
	Meliaceae		
25	*Azadirachta indica* (Dogonyaro).	Leaf as medicine against malaria; fuel wood.	1, 2, 4
26	**Mimosaceae** *Pentachlethra macrophylla* (Akpaka)	Fruit edible; fuel wood; medicinal against malaria; making knife handle; mortar and pestle.	1, 2, 3, 4, 12
27	**Moraceae** *Ficus thonningii* (Ogbu)	Tender leaves as vegetables yam ban; as fence;	1,3,5
28	*Treculia africana (*Ukwa)	Fruit edible, fuel wood	1, 2, 3
29	*Milicia excelsa* (Iroko)	Timber; fuel wood	1, 2, 6
30	**Musaceae** *Musa sapientum* (Unene)	Fruit edible; leaf for wrapping; stem for preserving Cocoyam in storage; part of stem used as rope.	1, 3
31	**Myrtaceae** *Psidium guajava* (Gova)	Fruit edible; fuel wood; staking; medicinal against malaria; shade.	1, 2, 3, 4, 8, 11
32	**Rubiaceae** *Nauclea diderrichii* (Uvuru)	Timber; fuel wood.	1, 2, 6
	Sterculiaceae		
33	*Cola acuminata* (Oji Igbo)	Fruit edible; fuel wood; shade	1, 2, 3, 11
34	*Cola gigantica* (Oji enyi)	Stake; fuel wood	1, 2, 8
35	*Triplochiton scleroxylon* (Okpo).	Timber; fuel wood	1, 2, 6
36	**Tiliaceae** *Glyphaea brevis* (Utarioba or ubeh or Anyachu)	Fuel wood; yam ban; boundary demarcation; seed as medicine against cough and dysentery;	1, 2, 4, 5
37	**Verbenaceae** *Gmelina arborea* (Melina)	Fuel wood; leaf as medicine against malaria when in mixture with Dogonyaro; timber; shade	1, 2, 4, 6
38	*Vitex doniana* (Uchakiri).	Timber; vegetable; fuel wood;	1, 2, 3, 6

()[1] = Local name

KEY:

CODE FOR USES	USES	NUMBER OF SPECIES
1	Edible to live stock	All
2	Provide fuel wood	22
3	Edible fruits & leaves as vegetable (food for man)	20
4	Human & Veterinary medicine	16
5	Boundary demarcation and fence	8
6	Provide building poles / roofing materials (Timber)	7
7	Chewing stick	2
8	Staking material	5
9	For soil fertility enrichment	4
10	Soil erosion control	1
11	Provides shade	4
12	Making tool handles	1
13	Raw materials for some industries	2

areas followed by the families Compositae (Asteraceae) and Moraceae with 3 species each. *Icancina trichantha* produced significantly ($P < 0.05$) the highest crude fibre content compared with the other browse species (Table 3). Species from Edemani community had higher crude fibre contents of browse plants than those from Obukpa community. *Gmelina arborea* collected from Obukpa had the least crude fibre content. *Elaeis giuneensis* produced significantly ($P < 0.05$) the highest ash content while *Berlinia grandriflora* had the least ash content among the sampled species (Table 3). Species collected from Edemani community had higher ash content of browse species than those from Obukpa community. *Elaeis guineensis* from Edemani area had significantly ($P < 0.05$) the highest ash content while *Cola gigantica* collected from Obukpa had the least content.

Besides being used in livestock feeding (Table 4), most of the forage grass species are used for other purposes.

Six (6) grass forage species were identified in the 4 communities (Table 5). The most frequently used grass species (with mean usage = 15%) across all sampled communities include: *Andropogon gayanus* and *Anthephora ampulaceae*. *Panicum maximum* was also found to be frequently used while *Setaria barbata* had a moderate usage in small ruminant nutrition in the communities. *Loudetia orundinaceae* and *Hyparrhenia rufa* are poorly used in small ruminant nutrition in the area.

All the grass species identified are moderately available in the area of study (Table 6). The species *Panicum maximum* and *Setaria barbata* are not common in Obimo community. *Setaria barbata* is not common in Edemani area while *Loudetia orundinaceae* and *Hyparrhenia rufa* found usage only in Obukpa community.

Discussion

Besides browsing, greater number of the browse species (22 species) were used for fuel wood and this compares favourably with the results of Mtengeti and Mhelela (2006) who

reported that greater number of browse species (20 species) were used for fuel wood in central semi arid part of Tanzania. The use of *Aspilia africana* and *Vernonia amygdalina* as medicinal plants for human is in agreement with what has been reported in Southeastern Nigeria (Okafor, 2002). bringing about the disappearance of some plant species (Mtengeti and Mhelela, 2006). Therefore, a fast screening method to identify the potential indigenous browse plant species for domestication should be developed. The families Fabaceae, Compositae (Asteraceae) and Moraceae have great number of species used as browse plants.

Table 3: Effects of location on crude fibre and ash contents (%) of browse species.

Species	Crude Fibre (%)			Total Ash (%)		
	Edemani	Obukpa	Mean	Edemani	Obukpa	Mean
Baphia nitida	58.33	23.83	41.08	7.67	3.00	5.33
Acioa bateri	55.83	14.33	35.08	9.33	2.33	5.83
Pentachlethra macrophylla	50.00	45.33	47.67	6.00	7.33	6.67
Manihot esculenta	30.33	27.67	29.00	16.67	14.33	15.50
Azadirachta indica	45.50	40.83	43.17	9.00	12.00	10.50
Newbouldia leavis	67.50	53.67	60.58	11.00	9.67	10.33
Gmelina arborea	41.67	11.67	26.67	8.67	7.67	8.33
Psidium guajava	64.17	29.17	46.67	8.33	4.33	6.33
Dialium guineense	48.83	29.67	39.25	8.67	3.33	6.00
Elaeis guineensis	41.00	45.00	43.00	37.33	9.67	23.50
Milicia excelsa	32.17	27.17	29.67	14.67	6.33	10.50
Spondias mumbin	55.00	31.00	43.00	10.33	9.33	9.83
Mangifera indica	27.83	35.33	31.58	8.33	7.67	8.00
Napoleona imperialis	55.33	30.17	42.75	7.00	2.67	4.83
Ficus thonningii	47.17	33.33	40.25	22.67	17.33	20.00
Cola gigantica	60.17	14.50	37.33	8.00	2.00	5.00
Cola acuminata	49.17	41.83	45.50	7.67	7.00	7.33
Carica papaya	26.00	21.83	23.92	20.00	26.67	23.33
Bambusa vulgaris	54.67	41.33	48.00	13.00	11.67	12.33
Persea americana	43.67	47.00	45.33	8.33	7.00	7.67
Berlinia grandriflora	55.17	14.67	34.92	5.33	2.67	4.00
Irvingia gabonensis	52.00	34.50	43.92	9.33	9.33	9.33
Trœulia africana	39.00	48.83	43.92	11.67	7.67	9.67
Musa sapientum	57.33	28.50	42.92	12.33	4.33	8.33
Icacina trichantha	73.83	52.67	63.25	8.00	6.67	7.33
Glyphaea brevis	34.50	36.33	35.42	11.67	9.00	10.33
Pterocarpus santalinoides	50.17	46.33	48.25	7.00	7.33	7.17
Mean	48.75	33.57	41.16	11.42	8.09	9.75

		Crude Fibre	Total Ash
S.e.d. for 2 location means	(L)	2.42	1.14
S.e.d. for 2 species means (S)		8.90	4.20
S.e.d. for 2 L x S means		12.59	5.94

Table 4: Multipurpose uses of identified forage grass plants in Nsukka rural areas.

/NO	SPECIES	MULTIPURPOSE USES	CODE FOR USES
1	*Andropogon gayanus* (Owa)[i]	Soil fertility restoration (green manure); for lighting	1, 2, 3
2	*Anthephora ampulaceae* (Ejo)	Soil fertility restoration (manure)	1, 2
3	*Panicum maximum* (Icharaku)	Green manure; soil erosion control	1, 2, 5
4	*Setaria barbata* (Ebandu)	Soil fertility restoration (manure)	1, 2
5	*Loudetia orundinaceae* (Ize)	For lighting; roofing material	1, 3, 4
6	*Hyparrhenia rufa* (Ikpo)	Roofing material	1, 4

Table 5. Distribution of forage grass plants in four communities and species usage (% of respondents) in Nsukka rural areas.
()[1] = Local names
- signifies nill

S/No	Species	Obukpa	Obimo	Eha-Alumona	Edemani	Mean
1	*Andropogon gayanus* (Owa) [i]	25.0	25.0	20.0	25.0	23.27
2	*Anthephora ampulaceae* (Ejo)	15.0	25.0	10.0	20.0	17.50
3	*Panicum maximum* (Icharaku)	25.0	-	15.0	15.0	13.75
4	*Setaria barbata* (Ebandu)	20.0	-	5.0	-	6.25
5	*Loudetia orundinaceae* (Ize)	5.0	-	-	-	1.25
6	*Hyparrhenia rufa* (Ikpo)	5.0	-	-	-	1.25

Table 6: Availability and distribution of forage grass plants in the sampled communities (Availability rating is based on mean scores to the nearest whole numbers: figures also indicate distribution areas). Key: 1 = scarce; 2 = moderately available; 3 = easily available

S/No.	Species	Obukpa	Obimo	Eha-Alumona	Edemani	Mean
1	*Andropogon gayanus* (Owa)[i]	2	2	2	3	2
2	*Anthephora ampulaceae* (Ejo)	2	2	2	2	2
3	*Panicum maximum* (Icharaku)	2	-	3	2	2
4	*Setaria barbata* (Ebandu)	3	-	3	-	2
5	*Loudetia orundinaceae* (Ize)	2	-	-	-	1
6	*Hyparrhenia rufa* (Ikpo)	2	-	-	-	1

()[1] = Local names
- signifies nill

Species in these plant families have been shown to have very large number of palatable and very palatable species (Onyeonagu and Asiegbu, 2006).

The slightly acidic nature of the soil from Obukpa community (with higher nitrogen content) compared with the acidic soil from Edemani community (with lower nitrogen content) could be a reason for the lower crude fiber contents of the browse species from Obukpa compared to those from Edemani. Nitrogen application has been shown to reduce pasture crude fiber and ash-contents (Gilmour *et al.,* 1979). Differences in species tolerance to soil conditions and extent of land use for farming activities in the study areas could account for the differences in quality of the species.

The moderate availability of the grass species could be explained by the fact that these species are available only during the months of March to November each year in the study area (Onyeonagu and

Asiegbu, 2006). The presence of most of the identified forage grass species in the derived Savannah Zone of Nigeria was earlier reported by Onifade and Agishi (1988). Most of the identified forage species have been shown to be very palatable to ruminant livestock (Onyeonagu and Asiegbu, 2006). Therefore, a fast screening method to identify the potential indigenous forage grass and browse species for domestication should be developed.

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