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Feed Resources and Seasonal Nutrient Composition of Predominant Forages for Small Ruminant Production in Iwo Local Government Area of Osun state, Nigeria

Funmilayo BAMIGBOYE[*1], Olaniyi Babayemi[2] and Adegboyega Adekoya[3]
[*]1.Department of Animal Science and Animal Technology, Benson Idahosa University, Benin-City
2.Department of Animal Science, University of Ibadan, Ibadan;
3.Department of Agricultural Extension and Rural Development, University of Ibadan, Ibadan
* E-mail of the corresponding author: famílade@yahoo.com or fbamigboye@biu.edu.ng

Abstract
Small ruminant production is largely in the hand of traditional handlers settled in rural areas. Iwo Local Government Area is well noted for small ruminant production. However, there is paucity of information on the feed resources availability in quality and quantity at varying seasons for small ruminant production in the study area. Hence, two studies were conducted in study area to investigate the feed resources utilized by handlers at different seasons and evaluate the nutrient composition of predominant forages available for sheep and goat production in the area. Study I: Information on herd size and composition, feeds, feeding method, water supply and housing for small ruminant production were elicited using structured questionnaire. Study II: Samples of predominant forages in the area were collected once per season and analysed for the nutrient composition using standard procedures.
It was found that the male respondents reared sheep especially ram than goat while the females took to goat particularly doe (female goat). Small ruminants in the area grazed on natural grasslands, most farmers supplied water (87.2%) from well (76.4%) to their small ruminants but provided no housing facilities (92.0%). The occasional feed offered to sheep and goats in wet season was mainly kitchen wastes (46.2%) while in dry season, kitchen wastes (25.7%), cassava and its by-products (25.7%) as well as corn gluten (25.1%).
The predominant grass, legumes and shrubs/forbs that were available in wet season were absent in dry season. However, the browse plants were found to be ever-green and available all year round in the study area. The proximate composition in wet season showed that, dry matter ranged from 57.8% in *Tephrosia bracteolata* to 85.7% in *Ficus thonningii* while the crude protein ranged from 6.20% (*Andropogon gayanus*) to 23.6% (*Ficus vogelli*). The crude fibre contents of the forages ranged from 18.5% in *Ficus polita* to 47.8% in *Tephrosia bracteolata* while ether extract was from 7.50% to 18.4% in *Andropogon gayanus* and *Ficus polita* respectively. Ash content ranged between 7.10% and 17.1% in *Andropogon gayanus* and *Ficus exasperata* respectively. There were significant differences in all the measured parameters among the forages. The observed values for proximate composition of the browses obtained in dry season were similar to the results seen in wet season except for the fact that crude fibre and ash contents increased a little and crude protein and ether extract reduced especially for ficus species under consideration. In conclusion, farmers in the study area should improve on some of their production facilities like housing and feeding. Also, there is need for continual supplementation of feed supplied to small ruminants in dry season to augment the insufficient nutrients.
Keywords: Feed resources, wet season, dry season, proximate composition

1. Introduction

Sheep and goat population is higher than that of cattle in Nigeria connoting great potentials for productivity; sheep was reported to be 33,000,000, goats: 52,000,000 and cattle: 16,000,000 (FMA 2008). Small ruminant rearing is an age long traditional production system where animals are managed under extensive system but in the last decade, they are been reared alongside with cultivation (Ajala *et al* 2008). They are important in supporting the livelihoods of poor resource farmers throughout developing world.
Small ruminants in rural areas often roam around freely and eat a variety of grasses, legumes and kitchen wastes which are available in quality and quantity in wet season (Onwuka *et al* 1999). In Nigeria, rangelands for animals to graze only blossom in the rainy season while in dry season they become standing hay. Thus, animals will have abundant feed in the wet season and a shortage of feed in the dry season. Uneven rainfall distribution leads to wide fluctuations in the quantity and quality of forage available to animals. Natural pastures grow on uncultivated land to which these ruminants have access for grazing. They are found along roadsides and on fallow lands in the coastal forest belt of humid West Africa. They assume more important proportions in the open derived savannah. According to Atta-Krah and Reynolds (1989), natural pastures consist of a mixture of grasses such as *Panicum maximum*, *Imperata cylindrica*, *Andropogon gayanus*, *Pennisetum* spp and *Hyparrhenia* spp. These grasses grow rapidly during the wet season, becoming fibrous and coarse, and are

undergrazed because of the large amounts that become rapidly available. Their quality declines further during the dry season when they become standing hay and are subject to overgrazing.

A review of published nutrient contents of these grasses showed that during the period of rapid growth (wet season) they contain, on average, about 25 % dry matter, made up of 10 % crude protein, 6 % ash and a crude fibre content of 32 % or 43 % acid detergent fibre (ADF). As the dry season advances and conditions become harsh, their nutritional quality declines to the extent that crude protein could fall to as low as 2 %. Ash values decline to about 3-4 % as a result of translocation to the root system, while fibre content increases in response to the process of lignification, sometimes up to 50 % crude fibre or 60 % ADF. In other words, these grasses cannot meet the nutrient requirements of small ruminants for most part of the year. Even during the rains they can only satisfy maintenance requirements (Smith *et al* 1989).

Ademosun *et al* (1988) also affirmed that unless well fertilised and harvested young, tropical grasses alone cannot supply small ruminants with the nutrients required for a reasonable production level. The production of high quality forages requires inputs and management know-how not yet available to the small ruminant producers within the farming system (free range system).

Browses, in the form of fodder trees and shrubs, form an integral part of farming systems in humid West Africa. Apart from utilisation as ruminant feed, browses currently play an important role; fuel wood, shade, food (fruits), poles, etc. Also, their potential to improve soil fertility and conservation are added incentives (Atta-Krah *et al* 1986). These browse plants are evergreen and possessed the ability to maintain a relatively high nutrient value in dry season. Therefore, browses such as *Gliricidia sepium* and *Leucaena leucocephala* had been used either as supplements to tropical forages or as sole feeds and it is a viable feeding system in humid West Africa (Ademosun *et al* 1988).

Iwo Local Government Area is renowned for small ruminant production (Familade *et al* 2011). Since small ruminant production in the area is through extensive system (Bamigboye, 2013), it is therefore expedient to investigate the feed resources available in the area. It is also essential to evaluate predominant pastures in order to ascertain their adequacies or otherwise and make recommendations based on the findings. Hence, the study examined the feed resources used by small ruminant producers and nutrient composition of common grasses, legumes, browses and forbs/shrubs in wet and dry seasons for small ruminant production in Iwo Local Government of Osun State.

1.1 Materials and methods

The experiment is in two (2) parts: data collection through the use of questionnaire and analysis of predominant forages in the area.

Study I: Feed resources offered to small ruminants in Iwo Local Government Area

1.2 Description of the study area

The study was carried out at Iwo Local Government Area, Osun State Nigeria. Iwo Local Government is about 44 Km from Ibadan, 36 Km from Oyo and 48 Km from Osogbo. It lies along latitude 7°37′ to 70°40′ N and longitude 4°9′ to 4°13′ E. The altitude is between 233 m and 300 m above the sea level, temperature range is between 18.5 and 30 °C. It is within the derived savanna zone of Nigeria. It is bounded by Lagelu Local Government in the South, Oyo Local Government in the West, Aiyedire Local Government in the East and Ola-Oluwa Local Government in the North. It has an area of 245 km² land expanse and a population of 191,348 most populous Local Government in Osun State by the 2006 Nigeria National census figures. The population of the area is dominated by Yorubas. The study area is predominantly rural and the people are noted for their involvement in cash and food crop production and processing. They are also well known for their small ruminant keeping activities (Wikipedia the free encyclopedia 2013).

1.3 Sampling procedure and sample size

Three Agricultural Development Cells out of the six existing ones were randomly selected in Iwo Local Government Area. Two locations per cell were thereafter selected and 30 farmers per location were randomly selected, giving a total of 180 respondents. Personal contact and oral interview were the tools employed to elicit information from the respondents.

1.4 Data collection

Data used for this study were obtained through survey, involving the administration of structured questionnaires by personal contacts and discussion. The questionnaire was designed to obtain information on socio-economic background of the respondents production pattern – herd size and composition, feed and water management – feed offered at different seasons, pattern of water supply, sources of water offered and housing pattern of small ruminant in Iwo Local Government Area.

1.5 Data analysis

Data generated from this study were analysed using descriptive statistics such as frequencies, percentages, means, standard deviation etc.

Study II: Nutrient composition of predominant forages in Iwo Local Government Area

1.6 Forage collection

Common forages (grasses, legumes, browses and shrubs) were sampled for both wet and dry seasons in the study area. The collections for wet and dry seasons of browse plants were done on the same plant. There were two samples analysed per plant. The wet season collection was done in June while that of dry season was carried out in February. The sampled forages were identified through the use of weed album. Fresh samples of these forages were weighed, air dried for 48 hours and oven dried to a constant weight (DM analysis) in the laboratory. Oven dried samples were milled (2 mm sieve) and kept for proximate analysis.

1.7 Proximate composition

Crude protein, crude fibre, ether extract and ash contents of the sampled forages were determined according to AOAC (1990). Crude protein analysis was by the process of Kjeldahl. It was effected through the breaking down of 2 g sample in 25 ml concentrated H_2SO_4 acid plus selenium, using Gerhardt Kjeldahltherm (Gerdart GmbH + Co. kg Fabrik fur Laborgerate Postfach 1628 D53006 Bonn) until an opaque colour was obtained. The digested sample was rested for 12 h, diluted with distilled water and made up to the mark in 250 ml volumetric flask. 5 ml of the digest was pipette and distilled with 40 % NaOH solution and the ionised ammonium was trapped by boric acid. The distillate was immediately titrated (n = 3) with 0.01 N hydrogen chloride. The CP was obtained by multiplying the nitrogen with a factor: 6.25.

1.8 Statistical analysis

Descriptive statistics was used to analyse the data generated and data were subjected to analysis of variance (ANOVA) using procedure of SAS (1999).

1.1.1 Result and discussion

Presented in Table 1 is the mean herd size and composition of small ruminants owned by male and female farmers in Iwo Local Government Area. It was noted that male respondents reared more sheep than goats (rams were preferred to ewes). This may be due to the fact that rams command better prices at festive periods especially Idel-Kabri and the study area is Muslim dominated area (Familade *et al* 2011). Females were observed to rear more goats than sheep. However, they reared more does (2.54 ± 1.50) than bucks (2.26 ± 1.55). This might be because goats can survive in a broader ecological zone including harsh environment and can feed on a variety of grasses, herbs shrubs and kitchen wastes than sheep (Oladele and Adenegan 1998). Goats are easier to handle than sheep; this might be the reason why female folks preferred to rear goats than sheep. They reared does more than buck, probably for breeding purpose. In the rural areas, goats are generally more important than sheep for religious reasons (Moll 1989). Nevertheless, goats and sheep do not arouse the same emotions in rural people as cattle (Hunter 1936). Whatever the major objective of keeping sheep and goats, there is always the preponderance of the females in the flock than males (Chukwuka 2010).

Small ruminant farmers in the study area kept small number of animals (not more than 10 animals). This indicated that small ruminants are not kept in commercial sizes by the farmers. This agrees with the findings of Okunlola (2010) who reported that small ruminants are owned by families or individuals in rural areas and the number per group is small. It also confirms the assertion of Ajala and Gefu (2003) that small ruminants are kept as an adjunct to the main business of cropping.

Table 2 shows the feeding method, water and housing supplied to small ruminants by respondents in Iwo Local Government Area. All the small ruminants (100%) in the area freely grazed around the farmers' homestead. This is an indication that the basal diet of small ruminant in Iwo Local Government was based on predominant forages in and around the area. Most of the farmers (87.2 %) offered water to their animals and 12.8 % did not offer water. This might be due to ignorant on the part of the farmers that were not supplying water to their animals for drinking. Animals were then made to drink from ponds and all forms of accessible water whether clean or dirty. Since most of the water may not be hygienic enough high mortality rates of kids and lambs ensued.

Also, 92.0% of the respondents did not provide any form of housing facilities for their animals. This implied that these animals could sleep either on the road, available verandas or space which is grossly inadequate for comfort. This was unethical; the animals are exposed to all forms of inclement weather hazards rainfall or sunshine. Such animals are sometimes maltreated by humans who feel the animals are a nuisance. Inadequate housing might predispose the animals to diseases, theft, accident, discomfort, death and even predators thus hampering their right to freedom from discomfort, pain, injury and diseases. In order to maintain good animal welfare, the animal should be able to cope with its environment and satisfy biological needs (Fraser and Broom, 1990). Ajayi *et al* (2009) recommended that the housing type provided for small ruminants should keep them from harsh weather and theft. This will help reduce high mortality rates amongst kids and lambs.

It is however an accepted fact that for a greater part of the year, grasslands in the tropics do not supply sufficient nutrients to stock for greater productivity. Otchere *et al* (1977) reported that West African Dwarf sheep, on the

Accra Plains of Ghana, which received no supplementary feed during the dry season, lost about 15 % of their body weight. It is noteworthy that the respondent utilised browse plants in dry (15.8 %) season better than in wet (13.3 %). This is probably due to the fact that browse plants are ever green and available around the homesteads of farmers as shade.

Figure 1 is the sources of water supplied to small ruminants in Iwo Local Government Area. The livestock farmers in the study area reported to have been offering water from: bore hole (2.50 %), tap (4.50 %), river (4.50 %), any one (12.1 %) and well (76.4 %) to their animals. Well water was the most common water source utilized for small ruminants in the study area. This implied that well water is the most accessible source of water to the respondents. The water source is paramount when purity of the water is considered. Tap and bore-hole water sources accounted for 7.0 % of the respondents that supplied treated water to their animals. Others could be contaminated by pollutants which may be from land or water bodies. Animals should be accorded the right to hygienic water and freedom from thirst (Duncan 2002; Babayemi and Bamikole 2010).

Presented in Table 3 are the different types of feed supplied to sheep and goats in wet and dry seasons in Iwo Local Government Area. Kitchen wastes (46.2%) and cassava and its by-products (20.8 %) were mainly supplied to small ruminant in the wet season while cassava and its by-products (25.7%), kitchen wastes (25.7%) and corn gluten (25.1 %) in dry season. In dry season, it was observed that varieties of feed resource were used by the farmers to feed their animals. At this time, the crude-protein level in natural grasses is low and lignin levels are high, as happens after flowering in maturing plants, digestibility will fall.

At this stage the provision of additional nitrogen, whether from browse or from urea, will increase rumen microbial growth rates and improve digestibility. This, in turn, will be matched by a higher feed intake because of a faster rate of passage of feed through the gastro-intestinal tract. Thus the nutrient intake of animals on poor-quality forage can be greatly improved by the provision of browse. This may account for the increase in the percentage of animals that ingest browse plants in dry season (15.4 %) as against 14.1 % in wet season of the present study.

Table 5 shows the predominant forages in wet and dry seasons at Iwo Local Government Area. Seasonality was observed to have no effects on the availability of any of the browse tresses. Browse tresses are available throughout the year and ever green even at the critical periods of the year. Bayer *et al* (1987) remarked that browses could provide above 35 % of digestible crude protein requirement for cattle in the semi-arid region of Nigeria and as the dry season progresses, the percentage rises to about 60. He also stated that browse plants provide vitamins and mineral elements which are most limiting in grassland pasture in dry season. The use of browse plants as supplement has greatly increased and as well improved intake, digestibility and general animal performances (Abdulrazak *et al* 2000). They are good reservoir of nutrients such as protein, metabolisable energy, vitamins and minerals.

The annual shrub, legumes and grass that were abundantly growing in wet season were not available in quantity and quality in dry season. Natural pastures grow on uncultivated land to which animals have access for grazing. They are found along roadsides and on fallow lands in the coastal forest belt of humid West Africa. They assume more important proportions in the open derived savannah. According to Atta-Krah and Reynolds (1989), natural pastures consist of a mixture of grasses such as *Imperata cylindrica, Andropogon gayanus, Pennisetum* spp and *Hyparrhenia* spp. These grasses grow rapidly during the wet season, becoming fibrous and coarse, and are undergrazed because of the large amounts that become rapidly available. Their quality declines further during the dry season when they become standing hay and are subject to overgrazing.

The over-riding constraint on feed supply in important tropical ruminant livestock areas is the seasonality in the availability of forages in quality and quantity coinciding with dry and wet seasons. Under-nutrition, especially during the dry season, due to shortage of forage remains the primary limiting factor to ruminant productivity (GFA 1987) in the communal areas.

In wetter areas, where arable cropping is the practice, small stocks are tethered during the cropping season in an attempt to prevent crop damage (Okello and Obwolo 1985; Adu and Ngere 1979). In Northern Nigeria, Adu and Ngere (1979) described a compound system practiced by Hausas who are settled and therefore kept their small stock tethered in their compounds and fed them silage in the rainy season. Otchere *et al* (1985) reported that pastoralist Fulani in Giwa district of northern Nigeria allowed sheep to accompany cattle for grazing but tethered their goats under shelter. These goats were fed cut-and-carry green forage in the rainy season. Similar management systems have been described by Wilson (1985). According to Vlaenderen (1985) adult animals lost 22 % of their body weight while average daily loss in lambs was 30 % during the cropping season which spanned through April to November in northern Togo. This observation is true in most heavily cropped areas with an indication that all is not well with the nutrition of these animals during the rainy season. However, under nutrition during the dry season had often been stressed as a limiting factor in ruminant production in tropical Africa (Otchere *et al* 1977; Meyn 1980). Unimproved pasture will continue to play an important role in small ruminant production in Africa.

Shown in Table 6 is the proximate composition of predominant forages in wet season in Iwo Local Government Area. The dry matter ranged from 57.8% in *Tephrosia bracteolata* to 85.7% in *Ficus thonningii* while the crude protein ranged from 6.20% (*Andropogon gayanus*) to 23.6% in *Ficus vogelli*. The crude fibre contents of the forages ranged from 18.5% in *Ficus polita* to 47.8% in *Tephrosia bracteolata*. Ether extract which connotes crude fat/lipid i.e the main energy storage portion of any feedstuff was from 7.50% to 18.4% in *Andropogon gayanus* and *Ficus polita* respectively. Ash content which is an indication of mineral component was from 7.10% to 17.1% in *Andropogon gayanus* and *Ficus exasperata* respectively. Nitrogen free extract (NFE) ranged from 27.5 to 38.4% in *Ficus vogelli* and *Stylosanthes guianensis* respectively. There were significant differences in all the measured parameters among the forages.

NRC recommended 11 – 14% crude protein to be modest for ruminant production while Devendra and Mc Leroy (1982) reported 11% CP being ideal for normal weight gain in sheep and goats. All the forages analysed fell within this range safe for *Andropogon gayanus* (6.2%) which is a little below the critical level required for ruminal function i.e 7 % (ARC 1980) and 8 % which was suggested by Norton (1994).

The DM (85.7%) noted in the present study for Ficus thoningii was quite comparable with 88.1% reported by Gidado et al (2013). However, the crude protein (16.4%) and ash (9.6%) by the same authors were at variance compared to the observations of the present study. Bawala and Akinsoyinu (2002) observed crude protein (12.25%), crude fibre (18.0%) and ash (11.0%) which was quite comparable to the findings of the present study. Ajayi et al (2005) also reported similar DM, CP and ash with lower level of EE (3.3%).

Abegunde et al (2009) reported crude protein of 9.17% in Ficus exasperata as against 12.45% noted in the present study. The workers however reported higher level of crude fibre and ether extract than reported in the present study. Nevertheless, the dry matter revealed by the authors was similar to the one obtained in this study. Ficus polita and F. vogelli as reported by Abegunde et al (2009) were similar in terms of DM and ash but differed in crude protein and crude fibre compared to the findings of this study.

The values obtained for proximate composition of Gliricidia sepium were higher in terms of ether extract (16.5%) and ash (10.6%) but lower in crude protein (20.8%) compared to what Ajayi et al (2005) reported; EE: 3.30%, ash: 6.67% and CP: 29.31%. However, the result corresponded to the earlier reports of Bawala and Akinsoyinu (2002) in terms of crude fibre and ash.

The proximate composition in terms of DM and CP (29.4% and 20.8% respectively) in the present study was comparable with earlier reports by Babayemi *et al* (2005); DM: 28.0% and CP: 24.7% on gliricidia. The CP (20.1%) and crude fibre (25.2%) of *Tephrosia bracteolata* obtained in this work was similar to the previous work by Babayemi *et al* (2003); CP: 23.4% and CF: 23.2% but at variance in terms of EE, ash and NFE. The values of DM, CP and ash in the present work (42.2, 20.1 and11.3% respectively) were higher than 29.7, 14.3 and 3.00% respectively earlier reported (Babayemi and Bamikole 2006) for *Tephrosia bracteolata.* The reports of Ajayi *et al* (2007) on *Stylosanthes guianensis* was similar in terms of DM (34.2%) and crude protein (18.1%) but at variance as regards crude fibre (9.14), ether extract (7.90%) and ash (2.87%) to the present study.

The nutrient composition of *Andropogon gayanus* as reported in this study corresponds to earlier work by Adewumi *et al* (1999) who revealed that *Andropogon gayanus* hay contained 4.50% CP and 5.40% ash. Also, Odedire and Babayemi (2008) reported CP of 6.72%, ether extract to be 7.0% and ash 10.5% which were comparable to 6.20% CP, 7.50% EE and 7.10% ash obtained in the present study.

In general, the variations that existed among the forages in terms of nutrient compositions could be traced to the fact that the plants differ, time and season of harvest, age of plant, leaf to petiole ratio ecological zone and edaphic (soil) factor also differed (Makkar and Becker 1997; Bamikole, *et al* 2004).

Presented in Table 7 is the proximate composition of predominant forages in dry season in Iwo Local Government. The dry matter ranged from 58.2% in *Imperata cylindrica* to 76.6% in *Ficus thonningii* while the crude protein ranged from 5.90% to 19.8% in *Imperata cylindrical* and *Gliricidia sepium* respectively. Also, crude fibre ranged from 22.9% to 51.0% in *F. polita* and *Imperata cylindrica* respectively with ether extract being from 7.20 – 15.6% (*Imperata cylindrica* and *F. polita* respectively). The analysed forages displayed ash range of 4.25 – 15.3% in *Imperata cylindrica* and *F. exasperata* respectively and NFE ranged between 29.36 and 33.0% in *F. thoningii* and *Imperata cylindrical* respectively. There were significant differences in all the measured parameters among the forages.

The observed values for proximate composition of the browses were similar to the results obtained in wet season except for the fact that crude fibre and ash contents increased a little and crude protein and ether extract reduced especially for ficus species under consideration. Related results were obtained by Abegunde *et al* (2009) who worked on six different ficus species and reported lower crude protein values and corresponding higher crude fibre as compared to wet season values. It was also noted that dry matter of all the forages available in wet and dry seasons was higher in wet season than in dry season. The workers attributed these changes to the fact that the plants were advancing in age (Babayemi and Bamikole 2006) or higher temperatures in dry season. This may also be traced to nutrient depletion in the soil due to weather and continual usage by plant. However, similarities

may be due to inherent anatomical or morphological attributes of forages that are related to cell wall rigidity.

Conclusion and recommendation

The results revealed that small ruminant production in the study area is not gender selective hence; policy makers should take into cognizance the fact that the area is Muslim dominated and send female extension agents to address female small ruminant producers. Also, predominant forages in the area seemed adequate to support growth and production for small ruminant productivity in wet season but grossly inadequate at dry season. It implies that there is need for conservation of forages to improve dry season small ruminant production in the area. On the other hand, supplementation of dry season grazing of small ruminants in the area can be an intervention.

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Table 1: Herd size and composition of small ruminants in Iwo Local Government Area

Type of animal	Sex			
	Male	Total	Female	Total
Ewe	2.55 ± 2.45	213	1.71 ± 0.84	120
Ram	3.11 ± 2.65	227	1.60 ± 1.02	146
Lamb	3.71 ± 2.90	249	1.87 ± 1.08	174
Doe	2.90 ± 1.83	136	2.54 ± 1.50	338
Buck	2.33 ± 1.61	110	2.26 ± 1.55	301
Kid	3.39 ± 3.18	159	2.85 ± 1.98	379

Table 2: Method of feeding, water supply and housing of small ruminants by respondents in Iwo Local Government Area

Method of feeding and water supply	Frequency	Percentage
Grazing	180	100
Water		
Water supplied	157	87.2
Water not supplied	23	12.8
Housing		
Housed	14	8.0
Not housed	166	92.0

Multiple response is possible

Table 3: Occasional feed offered to small ruminants in wet and dry seasons in Iwo Local Government Area

	Wet season		Dry season	
Feed material	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Tree/shrub browse	50	14.1	98	15.4
Cassava and its by-products	74	20.8	164	25.7
Maize residues	0	0.0	15	2.40
Corn gluten	66	18.6	160	25.1
Cowpea haulm	0	0.0	33	5.20
Commercial feed	1	0.30	3	0.50
Kitchen wastes	164	46.2	164	25.7

Multiple response is possible

Table 4: Predominant forages in wet and dry at Iwo Local Government Area

	Seasons	
Forages	Wet	Dry
Browse plants		
Ficus thonningii	+	+
Ficus exasperate	+	+
Ficus polita	+	+
Ficus vogelli	+	+
Gliricidia sepium	+	+
Shrubs/forbs		
Tephrosia bracteolate	+	-
Sida acuta	+	-
Ageratum conyzoides	+	-
Legumes		
Stylosanthes guianensis	+	-
Calopogonium mucunoides	+	-
Grasses		
Andropogon gayanus	+	-
Imperata cylindrical	-	+

Where + means available and - not available

Table 5: Proximate composition (kg/100g DM) of predominant forages in the wet season of Iwo Local Government Area

Forage	DM	CP	CF	EE	Ash	NFE
Ficus thonningii	85.7^{a}	13.3^{c}	22.1^{de}	16.2^{abc}	15.1^{ab}	33.3^{b}
Ficus exasperate	74.2^{c}	12.5^{c}	25.1^{cde}	12.9^{cd}	17.1^{a}	32.4^{bc}
Ficus polita	73.9^{c}	19.5^{b}	18.5^{f}	18.4^{a}	11.2^{cd}	32.4^{bc}
Ficus vogelli	68.9^{d}	23.6^{a}	24.7^{cde}	14.1^{bc}	10.2^{de}	27.5^{d}
Gliricidia sepium	70.6^{d}	20.8^{ab}	23.5^{de}	16.5^{ab}	10.6^{cd}	28.7^{d}
Tephrosia bracteolata	57.8^{a}	20.1^{b}	25.2^{cde}	14.5^{bc}	11.3^{cd}	29.0^{d}
Sida acuta	74.0^{c}	13.3^{c}	28.9^{b}	12.4^{de}	9.80^{de}	35.6^{ab}
Ageratum conyzoides	84.2^{a}	15.2^{c}	26.4^{bc}	9.8^{ef}	13.7^{bc}	34.9^{b}
Stylosanthes guianensis	70.0^{d}	12.8^{c}	28.1^{bc}	13.5^{cd}	10.2^{de}	38.4^{a}
Calopogonium mucunoides	74.3^{c}	23.4^{a}	25.8^{bcd}	12.2^{de}	9.30^{de}	29.3^{d}
Andropogon gayanus	76.3^{b}	6.20^{d}	47.8^{a}	7.50^{f}	7.10^{e}	32.4^{bc}
SEM	0.48	0.46	0.51	0.46	0.47	0.47

^{a,b,c,d,e,f}= Means on the same column with similar superscript letters are not significantly different (P<0.05).
DM= Dry matter, CP= crude protein, CF= crude fibre, EE= ether extract, NFE= nitrogen free extract, SEM – Standard error of means

Table 6: Proximate composition (kg/100g DM) of predominant forages in dry season in Iwo Local Government Area

Forage	DM	CP	CF	EE	Ash	NFE
Ficus thonningii	76.63^{a}	10.24^{b}	28.60^{b}	14.30^{ab}	13.70^{ab}	29.36^{b}
Ficus exasperate	58.57^{c}	10.12^{b}	30.10^{b}	9.55^{cd}	15.25^{a}	31.98^{ab}
Ficus polita	67.20^{b}	16.61^{a}	22.90^{c}	15.35^{a}	12.70^{ab}	32.44^{a}
Ficus vogelli	66.89^{b}	18.20^{a}	27.55^{b}	12.05^{b}	10.40^{b}	30.80^{ab}
Gliricidia sepium	65.06^{b}	19.78^{a}	27.15^{b}	11.65^{bc}	11.90^{ab}	30.40^{ab}
Imperata cylindrical	58.15^{c}	5.90^{c}	51.00^{a}	7.20^{d}	4.25^{c}	33.01^{a}
SEM	0.47	0.47	0.47	0.47	0.47	0.52

^{a,b,c}= Means on the same column with similar superscript letters are not significantly different (P<0.05).

CP= crude protein, CF= crude fibre, EE= ether extract, NFE= nitrogen free extract, SEM – Standard error of means

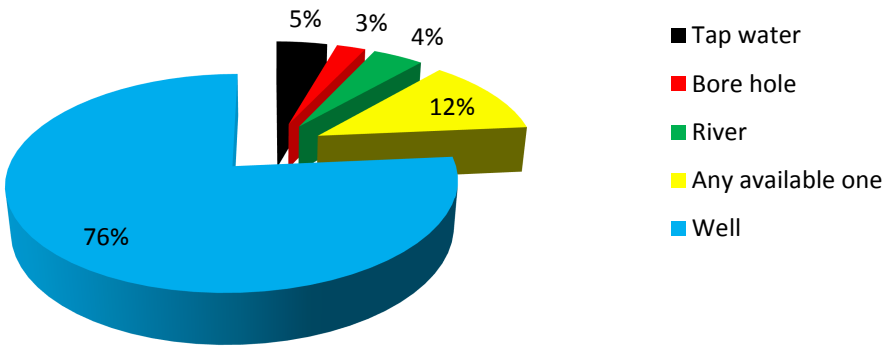

Fig. 1: Sources of water supplied to small ruminants in Iwo LGA