

SURVEY OF THE DIVERSITY OF FORAGE PLANTS USED IN FEEDING PIGS IN SMALLHOLDER FARMS IN SOUTHEASTERN NIGERIA

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ABSTRACT

A survey was conducted with the aid of questionnaires, farm visits and personal interviews in fifty-one (51) smallholder pig farms across three Local Government Areas each in Imo, Abia and Akwa Ibom states, Southeastern Nigeria, to determine the diversity of forage crop species used in pig feeding. The result showed that pigs consumed a diverse array of forage species made up of thirty eight (38) plant species which comprised trees, shrubs, lianas, woody vines, herbs, forbs and grasses belonging to 32 genera and 20 families. Important plant families that contributed to the forage resource base of pigs include legume families, Fabaceae (Papilionaceae) and Mimosoideae comprised 10.5 and 2.6%, respectively. Six (6) plants in the family Asteraceae accounted for 15.79%, the highest proportion of forage plants recorded in a family in the survey. Each of these families, Euphorbiaceae, Anacardiaceae, Musaceae and Poaceae formed 5.26% respectively while Loganiaceae, Amaranthaceae and Convolvulaceae formed 7.89% each of the arrays of plants obtained in the survey. Each of these families, Acanthaceae, Araceae, Caricaceae, Commelinaceae among others formed 2.6% of the identified forage plants respectively. Eleven (11) plants or 28.95% of the identified forage plants were consumed avidly and were classified as most preferred plants by pigs. They included *Asystasia gangetica*, *Amaranthus hybridus*, *Alternanthera bettzickiana*, *Carica papaya*, *Ipomoea batatas*,

Manihot esculenta, *Telfairia occidentalis*, *Asystasia gangetica*, *Syndrella nodiflora*, and *Panicum maximum*. The diversity and preferences of the plants reflects the varied feeding and management systems, sources, availability and utilization of forage plants.

Keywords: Survey, diversity, forage plants, feeding, pigs, southeastern Nigeria

INTRODUCTION

The different agro-ecological zones in Nigeria contain a rich genetic diversity of plant species particularly, shrubs, trees, herbs, woody vines, lianas, grasses and forbs that contribute to the forage resource base of farm animals. Leaves from these plants species have been used as sources of crude protein, minerals and vitamins for rabbits, sheep, goats and cattle but in many tropical countries some of the plant foliage could be processed into leaf meals or fed fresh to poultry and pigs. Forage in form of pasture, as part of complete feed, leaf meals or silage can be fed successfully to pigs. Lindberg and Andersson (1998) reported that pigs perform better on a forage-concentrate diet when forage replaces cereal grain component of the diet.

Forage feeds are commonly used in rural and suburban areas at small farm level or among smallholder pig farmers, but not by the animal feed industry in Nigeria. Pig production in the humid tropics according to Halimani *et al.* (2007) is constrained by seasonal feed deficits and high cost, erratic supply of feed ingredients and competition between humans and pigs for available feed resources. There is a worldwide demand for additional sources of food and the exploitation of forage of low economic importance would be a step towards better resource

utilization (Lindberg and Andersson, 1998). In organic pig production forage have special applications in pigs' diets.

Phuc and Lindberg (2000) suggested that under tropical conditions, forage feeds can be supplied at low levels to increase dietary protein supply for growing pigs. In the tropics, it has been observed that smallholder farmers supplement their pigs' diet with several of these plants. Credence is laid to this practice, as nutritional evaluation of wild sun flower, *Tithonia diversifolia* (Olayeni *et al.*, 2006), sweet potato, *Ipomoea batatas* (Mora *et al.*, 1992; An *et al.*, 2005), *Ipomoea asarifolia* (Ekenyem, 2006), *Manihot* (Iyayi, 2001), *Gmelina arborea* (Bruce, 1998; Nkwocha *et al.*, 2008), *Trichanthera gigantea* and *Morus alba* (Ly *et al.*, 2001), *Centrosema* (Ugwu and Chukwuka, 2001) and *Microdesmis puberula* leaf meals (Obua and Davidson, 2011) indicated that forage (leaf meals) could partly replace cereals and protein supplements in pig diets, without reducing pig performance.

Efforts have been made to identify new plants species that can be tested and exploited in feeding pigs and other monogastric animals (D'Mello, 1995; Halimani *et al.*, 2005; Leterme *et al.*, 2005). Highly palatable forages with high intake potentials could decrease the proportion of concentrates in the diet, thereby minimizing imports of feed and resulting in low nutrient (manure) load on the environment (Cherney and Allen, 1995).

In Asia, leaves of plants such as cassava, sweet potato and water spinach have been shown to be good protein sources for pigs (Phuc and Lindberg, 2000; An *et al.*, 2005; Men *et al.*, 2006). The utilization of browse, herbs and forbs as supplement to pigs' diet can only be maximized by in depth knowledge of the diverse plants that are available for feeding pigs. In Nigeria, information on the diversity of forage plants that could be fed to pigs is lacking. Feeding forage to pigs should increase the sustainability and profitability of the farming system.

Hence, the objective of this study is to determine the diversity of forage crops, important families and preferred forage species used as supplements in pig's diet by smallholder pig farmers in Imo, Abia and Akwa Ibom state, Nigeria. This would help in making appropriate recommendations to smallholder pig farmers who practice forage-concentrate feeding system on the forage plants to use.

MATERIALS AND METHODS

Study area:

The agro-ecological characteristics of study area(s) have been described (Okoli *et al.*, 2003b). Three states were selected for the study, Imo, Abia and Akwa Ibom, all situated within southern Nigeria. Three Local Government Areas (L.G.As) were selected from each of the three states. Abia state lies

between latitude 04° 45' and 06° 17' North and longitude 07° 00' and 08° 10' East. It has an area of 6420 km², a population of 2,845,380 and average population density of 443 persons per square km² (FRN, 2009). Abia state is made up of seventeen L.G.A s. In Abia state Ikwuano, Isiukuwato and Umuahia South L.G.As were selected as the study areas. Ikwuano L.G.A has a population of 137,897 people. Isiukuwato L.G.A has a population of 115,794 people while Umuahia South L.G.A has a population of 139,058 people (FRN, 2009).

Akwa Ibom state lies between longitude 07° 25' and 08° 25' East and latitude 04° 32' and 05° 53' North. It has an area of 8412 km², a population of 3,902,051 people and average population density of 463 persons per square km² (FRN, 2009). Akwa Ibom has thirty-one L.G.As. Ini, Ikono and Ikot Ekpene L.G.As were selected. Ini L.G.A has a population of 99,084 people; Ikono L.G.A has a population of 131,673 people while Ikot Ekpene has a population of 141,408 people (FRN, 2009).

Imo state lies between longitude 05° 12' and 05° 56' North and latitude 06° 38' and 07° 25' East. Imo state has an area of 5,430 km² and a population of 3,927,563 people and average population density of 723 persons per km² (FRN, 2009). In Imo state, there are twenty-seven L.G.As. Ohaji/Egbema, Owerri North and Oguta L.G.As were selected for the study. Ohaji/Egbema L.G.A has a population of 182,891 people; Owerri North L.G.A has a population of 176,334 people while Oguta L.G.As has a population of 142,340 people (FRN, 2009).

The Study:

A survey was conducted with the aid of questionnaires, personal interviews and observations in three L.G.As in each of the three states. Seventeen smallholder pig farmers spread across the three L.G.As selected in each of the three states of Imo, Abia and Akwa Ibom states, Southeastern Nigeria were involved. Communities were selected randomly from the selected L.G. As and seventeen respondents were interviewed in the three L.G.As selected in each state, making up a total of fifty-one (51) respondents. A total sample size of fifty-one (51) spread over the three states was drawn. Selected respondents comprised households, which kept pigs at the time of the study. The study was conducted between the months of July and September, 2010.

The aspects covered by the questionnaires were identification of forage crops used in feeding pigs, local names (in Igbo and Ibibio) and most preferred plant species used in feeding pigs. The forage plants were ranked based on the rating by the farmers on the acceptability and preferences of the plants by pigs. The rating included three categories, least preferred, preferred and most preferred plants.

Each household was visited once during the study period. On each visit, sampling and identification of the plants was undertaken. Subsequently, in company of the farmers, plants were identified with their local names, collected, tagged and preserved for subsequent botanical identification. Plants sampled at the different sites were identified at the Forestry, Department, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. The data

collected from the survey were analyzed using simple descriptive statistics such as averages and percentages.

RESULTS AND DISCUSSION

This study revealed a striking rich diversity of plant species utilized by farmers for feeding pigs in Imo, Abia and Akwa Ibom state Nigeria Thirty-eight (38) plant species which comprised trees, shrubs, lianas, woody vines, herbs, forbs and grasses belonging to 20 families and 32 genera were identified (Table 1).

Table 1: Diversity of plant species used in feeding pigs in Imo, Abia and Akwa Ibom state, Nigeria

Family/Botanical names	Common name	Vernacular name	Rating
Acanthaceae			
<i>Asystasia gangetica</i> (Linn.) T Anders	Bush green	Ekere	***
Amaranthaceae			
<i>Amaranthus hybridus</i> (L)	Green Amaranth	Inine; inyan afia	***
<i>Amaranthus viridis</i> (L)	Slender Amaranth	Inine oji; Uman inyan afia	*
<i>Alternanthera bettzickiana</i> Regel Voss	Red Amaranth	Adad mfang	***
Anarcadiaceae			
<i>Mangifera indica</i> (L)	Mango	Mangolo; Manko	*
<i>Spondias mombin</i> (L)	Hog plum	Ijikara; Nsukakara	*
Arecaceae			
<i>Elaeis guinensis</i> Jacq	Oil palm	Nkwu; Nkon Eyop	*
Asteraceae (=Compositae)			
<i>Agerantum conoizoides</i>	Goat weed	Oranjila; Nnyano	*
<i>Emilia sonchifolia</i> (L). Dc	tassel flower	Nti ele; Utimense	***
<i>Emilia praetermissa</i> Milne	Emilia		***
<i>Syndrella nodiflora</i> Gaertn	Yellow starwort	Mbiet udo inyang	**
<i>Tridax procumbens</i> (L)	Tridax	Ayara utime-nse	**
<i>Vernonia amygdalina</i> Del	Bitter leaf	Olugbu; Etidot	*
Caricaceae			
<i>Carica papaya</i> (L)	Paw paw	Udia edi; Ukod	***
Commelinaceae			
<i>Palisota hirsuta</i> (Thumb) K. Schum		Ikpere aturu	*
Convolvulaceae			
<i>Ipomoea batatas</i> (L)	Sweet potato	Jinwanu; Ediam	***
<i>Ipomoea cairica</i> (L) Sweet	Railway creeper		*
<i>Ipomoea involunrata</i> P. Beauv	Morning glory	Mgbana-ala	*
Costaceae			
<i>Costus afer</i> Ker-Gwal	Ginger lily	Okpete; mbritem	**
Cucurbitaceae			
<i>Telfairia occidentalis</i> Hook.f	Fluted pumpkin	Ugu; Ubon	***
Euphorbiaceae			
<i>Eurphobia heterophylla</i> L	Spurge weed	Ogbara-ohu	**
<i>Manihot esculenta</i> Krantz	Cassava	Akpu; Ikong Iwa	***
Fabaceae			
<i>Arachids hypogea</i> (L)	Groundnut	Opupa; Mban san	**
<i>Calopogonium mucunoides</i> Benth	Calopo	Agbara; Ogbanala	**
<i>Centrosema pubescens</i> Benth	Centro	Iyeri ekpo	**
<i>Pueraria phaseoloides</i>	Tropical Kudzu		**
Laminaceae (Labiatae)			
<i>Persea americana</i> Mill	Avocado pear	Ubebekee; Ebenmbara	**

Loganiaceae			
<i>Anthocleista djalonensis</i> A. Chev	Cabbage tree	Oroghopo; Ibu	*
<i>Anthocleista vogelli</i> Planch	Cabbage tree	Ibu	*
<i>Spigelia anthelmia</i> (L)	Worm bush		***
Mimosaceae			
<i>Pterocarpus santalinoides</i> L'Her ex Dc	Cam wood	Nturukpa	*
Musaceae			
<i>Musa paradisiaca</i> (L)	Plantain	Ipa; Nkon ukom	**
<i>Musa sapientum</i> (L)	Banana	Unere; Nkon Mboro	**
Nyctaginaceae			
<i>Boerhavia diffusa</i> Linn	Hog weed	Okponkoron	**
Pandaceae			
<i>Microdesmis puberula</i> (Hook.f) ex	Little clusters	Mkpiri; Ntanebit	**
Poaceae			
<i>Panicum maximum</i> Jacq.	Guinea grass	Achara; Nyayaha	***
<i>Setaria barbata</i> (Lam.) Kunth	Bristly foxtail	Ele ododo; Nkwono	**
Portulacaceae			
<i>Talinum triangulare</i> Jacq	Water leaf	Gbolongi; Mmon-mon ikon	**

Rating= *** Most preferred, ** Preferred, * Least preferred

Important plant families that contributed to the forage resource base of pigs included, legumes families, Fabaceae (Papilionaceae) and Mimosaceae which comprised 10.53 and 2.63%, respectively (Table 2). Six (6) plant species in the family Asteraceae accounted for 15.79%, the highest proportion of forage plants recorded in the survey. In terms of species diversity within each genus, Asteraceae can be said to be the richest as it was represented by 5 genera (Table 2). Each of these families, Euphorbiaceae, Anarcadiaceae, Musaceae and Poaceae formed 5.26% respectively, Loganiaceae, Amaranthaceae and Convolvulaceae formed 7.89% while each of these other families, Acanthaceae, Arecaceae, Caricaceae, Commelinaceae, Costaceae, Cucurbitaceae, Lauraceae, Nyctaginaceae, Pandaceae and Portulacaceae formed 2.63%, respectively of the arrays of plants identified in the survey (Table 2). These families are therefore important plant families that

contributed to the forage resource base of pigs in the study area. In the present study, the forage plants were ranked based on the rating by the smallholder pig farmers on the acceptability and preferences of the plants. Several plants were commonly well accepted by pigs in the study area (Table 1). The rating included three categories, least preferred, preferred and most preferred plants by pigs. The preferred forage plants constituted the highest proportion (39.47%), followed by the least preferred (31.58%) while the most preferred formed the least proportion (28.95%) (Table 3). The most preferred plants, which the pigs had high preference for included *Asystasia gangetica*, *Amaranthus hybridus*, *Alternanthera bettzickiana*, *Emilia species*, *Carica papaya*, *Ipomoea batatas*, *Manihot esculenta* and *Telfairia occidentalis*. Grass species identified as most preferred was *Panicum maximum*. Among the forage plants, pigs had moderate preference for *Musa species*, *Talinum triangulare*, *Tridax procumbens*,

Table 2: Proportion, number of species and genera of forage species used in feeding Pigs in Imo, Abia and Akwa Ibom state, Nigeria

Family	Number of species	Number of genera	Percentage of plants (%)
Acanthaceae	1	1	2.63
Amaranthaceae	3	2	7.89
Anarcadiaceae	2	2	5.26
Arecaceae	1	1	2.63
Asteraceae	6	5	15.79
Caricaceae	1	1	2.63
Commelinaceae	1	1	2.63
Convolvulaceae	3	1	7.89
Costaceae	1	1	2.63
Cucurbitaceae	1	1	2.63
Euphorbiaceae	2	2	5.26
Fabaceae	4	4	10.53
Lauraceae	1	1	2.63

Loganiaceae	3	2	7.89
Mimosaceae	1	1	2.63
Musaceae	2	1	5.26
Nyctaginaceae	1	1	2.63
Pandaceae	1	1	2.63
Poaceae	2	2	5.26
Portulacaceae	1	1	2.63
Total	38	32	100.00

Arachids hypogea, *Calopogonium mucunoides*, *Centrosema pubescens*, *Pueraria phaseoloides*, *Costus afer*, *Syndrella nodiflora* and *Eurphorbia heterophylla* but they had low preference for others like *Palisota hirsuta* and *Vernonia amygdalina* (bitter leaf) but especially foliage obtained from tree species such as mango, cabbage tree and hog plum (Table 1).

Table 3: Preference ranking and proportion of forage plants according to preferences of the pigs

Preference rating	Number of plants	Percentage (%)
Most preferred	11	28.95
Preferred	15	39.47
Least preferred	12	31.58
Total	38	100.00

In goats, preferences of forage plants have been associated with succulence (Omokanye *et al.*, 2001); high crude protein (Bamikole *et al.*, 2001) and low ether extract content (Louw *et al.*, 1967) but in pigs, reasons for preferences of forage crops have not been fully elucidated. Factors other than nutritional composition should be complimentary to the intake and palatability of forage to pigs. In the present study, high preference of some plants to pigs may be associated with moisture content (succulence), odour, flavour, smell, taste, chemical composition and even physical characteristics of the plants (McLeod, 1974; Pond, 1987). The diversity and preferences by pigs for some plants in the present study reflects availability of the forage species and the effect of different pig feeding and management systems.

Least preferred forage species could have potential as pasture for swine when the primary objective is ground cover maintenance in an outdoor production system rather than nutrient supply. This is because such forage species with low preference should be able to withstand trampling and rooting, resist pig damage and would maintain more ground cover on an outdoor pasture under an outdoor pig production system (Rachuonyo *et al.*, 2005).

Most preferred plants have high intake potential and when fed to pigs, could decrease the proportion of concentrates in the diet, thereby reducing cost of feed and cost of producing pigs. Cherney and Allen (1995) had reported that highly palatable forages with high intake potentials could decrease the proportion of concentrates in the diet, thereby minimizing imports of feed and resulting in low nutrient (manure) load on the environment. Wheaton and Rea (1993) recommended that forage for swine be chosen based on certain traits including succulence, high

productivity, palatability, protein and vitamin content as well as growth viability over reasonably long periods.

Proximate analysis of some of these plants (Mecha and Adegbola, 1980; Okoli *et al.*, 2001; Okoli *et al.*, 2003a; Ahamefule *et al.*, 2006a; Ahamefule *et al.*, 2006b) have yielded promising values thus highlighting the role of these plants as nutrient sources and the importance of indigenous empirical knowledge residing in farmers (Komwihangilo *et al.*, 2001). In several separate studies which involved feeding trials, leaf meals from *Trichanthera gigantea* and *Morus alba* (Ly *et al.*, 2001) and *Centrosema* (Ugwu and Chukwuka, 2001), *Ipomoea batatas* (An *et al.*, 2005), *Manihot* (Iyayi, 2001), *Tithonia* (Olayeni *et al.*, 2006), *Ipomoea asarifolia* (Ekenyem, 2006), *Gmelina arborea* (Nkwocha *et al.*, 2008) and *M. puberula* (Obua and Davidson, 2011) were reported to supply nutrients and improve the performance of pigs.

In the present study, smallholder farmers generally fed forage plants to pigs to complement their nutrient and dry matter needs. This could probably contribute to meeting the high feed needs of some categories of pigs such as boars and pregnant sows.

Leaves of some of these plants fed to pigs have been ascribed to have ethno-veterinary uses. Leaves of hog plum (*Spondias mombin*) were fed to pregnant pigs to alleviate difficult delivery, discharge of retained placenta and improvement of poor milk let down in lactating sows. This claim has been substantiated in a study using sheep (Udeh and Oguike, 2008). In this study, leaves of *Manniophytum fulvum* were also fed to pigs to control diarrhoea. *Euphorbia heterophylla* leaves were fed to pigs presumed over fat which led to mild diarrhoea and subsequent reduction in the size

of the erstwhile oversized fat pigs over a short period of time. *Carica papaya* (paw paw) leaves are relished by pigs and used to reduce worm load in pigs. This is supported by research result which ascribed paw paw leaves with anti-helminthic properties (Satrija *et al.*, 1994). This gives credence to some of the claims by smallholder pigs on the efficacy of some of the treatments administered to pigs to cure some ailments.

It is noteworthy that pigs consumed parts of plant that are not the foliage such as pods of *Arachis hypogea*, fruits and flowers of *Mangifera indica*, *Spondias mombin*, *Elaeis guinensis*, *Carica papaya*, *Persea americana*, *Musa sapientum*, *Musa paradisiaca*, *Irvingia gabonensis*, roots of *Manihot* species and tubers of *Ipomoea batatas*. They also consumed the pseudo stems of *Musa sapientum* and *Musa paradisiaca*.

CONCLUSION

There is a wide variety of plants utilized as forage for pigs in Southeastern Nigeria. This reflects availability of plants and pig management system adopted by the farmers. The major plant families that contributed to the forage resource base of pigs in Imo, Abia and Akwa Ibom State, Nigeria are the family Asteraceae, which accounted for 15.79%, the highest proportion of browse plants while the legume families, Fabaceae and Mimosaceae formed 10.53% and 2.63% of the forage plants respectively. Families such as Amaranthaceae, Loganiaceae and Convolvulaceae formed 7.89% each. Each of these families, Poaceae, Euphorbiaceae, Anarcadiaceae and Musaceae formed 5.26% respectively of the plants identified in the present study. These families are therefore important plant families that contribute to the forage resource base of pigs in the study area.

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