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ASSESSMENT OF THE POTENTIAL VALUE OF TWELVE BROWSE LEGUME TREES USING *IN VITRO* GAS PRODUCTION AND COEFFICIENT OF PREFERENCE TECHNIQUE

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ABSTRACT

Twelve tropical multipurpose browse plants were evaluated for their chemical composition, metabolizable energy (ME), organic matter digestibility (OMD), in vitro gas production characteristics and preference by the West Africa Dwarf (WAD) goats using cafeteria method.

The crude protein content of the legumes ranged from 9.79 to 29.53 g/100 g DM and varied significantly (P< 0.05). Ether extract varied widely ranging from 6.0-13.1 g/100 g DM. The total gas produced at the end of 24 hrs of fermentation varied between 13.67 to 20.83 ml per 200 mg per DM. In-vitro characteristic parameters also varied significantly amongst the legumes. Initial gas (a) produced ranged from 0.00 to 4.67 ml, insoluble but degradable fraction (b) varied from 14.66 to 23.00 ml while a+b which is the potential degradability varied from 13.67 to 24.00 ml. Methane production ranged between 8.33 and 13.83 ml. Also, metabolizable energy (ME), organic matter digestibility (OMD) and short chain fatty acid of the forages varied from 4.81 to 6.58, 37.20 to 52.09 and 0.27 to 0.57 respectively. Neutral detergent fibre (NDF), acid detergent fibre (ADF), acid detergent lignin (ADL) varied significantly (P< 0.05), ranging from 41.82 to 65.55 g/100 g DM, 26.72 to 49.38 g/100 g DM, and 6.05 to 13.72 g/100 g DM respectively. The ash content of the plant species also varied significantly (P< 0.05), ranging from 5.14 in *Albizia odoratissima* to 8.93 g/100 g DM in *Cassia fistulosa*. A wide range of preference was observed, as *Leucaena leucocephala* was most preferred.

The results showed that these browse species are potential sources of nutrients for ruminants as dry season basal forage.

Keywords: cafeteria method, degradable fraction, dry season, fermentation, WAD goats

INTRODUCTION

Ruminant animals (cattle, goat and sheep) are unique in their ability to utilize native pasture, crop residues and fibrous agro-industrial by products. However, these feeds do not contain the balanced nutrients needed to support both efficient rumen fermentation and high animal productivity. There arise the needs to balance nutrient deficiencies. The supplements needed to balance these feed resources, oil seed cakes and by products of animal processing are the first choice in situation where these are available and underutilized. The amount available is, however, limited and often exported to earn foreign exchange. Hence, there are many advantages from growing protein supplements on the farm (Preston *et al*., 1987).

Leguminous and non- leguminous plants come to bridge this gap. A legume fixes nitrogen which can be used by the subsequent crop and provides a fodder supplement that supplies fermentable nitrogen (N), other nutrients for the rumen microbes, readily fermentable cellulose and by pass-protein. The importance of browse plants have been emphasized over the years (Le Houerou, 1980; Onwuka, 1985) and they form a very important part of goat's diets especially in the rural areas of Nigeria. Meanwhile, Le Houerou (1980) reported that there is still little or no information on some of these browses in their compositional analyses. The present study therefore, determined the chemical composition and the acceptability of some known and relatively unknown legumes by West African dwarf goats.

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MATERIAL AND METHODS

Fodder collection

Twelve legume plants were collected from the humid zone of Nigeria from the field gene bank of National Centre for Genetics Resources and Biotechnology (NACGRAB) Moor Plantation, Ibadan, Nigeria (Latitude $7^{o}15'$ to $7^{o}30'$N and Longitude $3^{o}45'$ to $4^{o}1'$E). The area was tropical with average rainfall of 1415 mm and the average daily temperature between 28^{o}C to 35^{o}C. Dry matter content of the plants was determined immediately at 105°C.

Chemical composition

Fodder samples were ground in a Wiley mill to pass a 1- mm screen and analyzed for crude protein (CP), crude fiber (CF), ether extracts (EE) and ash (AOAC, 1990), neutral detergent fibre (NDF), acid detergent fiber (ADF) and acid detergent (Van Soest *et al* 1991).

In vitro gas production

The forages were ground through 1 mm sieve. Three replicates sample of 200 mg fodder were put into 100 ml calibrated plastic syringes. Rumen

liquor collected from the donor WAD goats using stomach tube (Babayemi 2007) was sieved with four layer cheese cloth and buffered at ratio 1:4 respectively. 30 ml of buffered rumen liquor was introduced into the syringe already contained tested diet according to Menke *et al* (1979) and modified by Babayemi et al (2004) The samples were incubated in an incubator at regulated temperature (39 ± 1^{o}C). The gas volume produced was recorded at interval of 3, 6, 9, 12, 15, 18, 21 and 24. At the end of 24 hour post incubation, the fermentation was terminated by using plastic syringe to introduce 4 ml of 10 M sodium hydroxide through silicon tube into the syringe to determine the amount of methane and carbondioxide produced (Fievez *et al* 2005). At the end of fermentation, incubation parameters including metabolizable energy (ME), organic matter digestibility (OMD %) and short chain fatty acids (SCFA) were calculated using appropriate formulae as;

ME =2.20+0.136GV+0.057CP+0.0029CF

OMD=14.88+0.889GV+0.45CP+0.651XA (Menke and Steingass 1988).

SCFA=0.0239GV-0.061 (Getachew *et al* 1999) where GV, CP, CF and XA are net gas production, crude protein, crude fiber and ash of the incubated samples respectively

Qualitative determination of secondary metabolites

The secondary metabolites in the plant species were determined (Babayemi et al 2004). 2g of each milled sample were weighed in duplicates into extraction bottles, using two extraction solvents, (Methanol and petroleum ether). Methanol-water (MW) was prepared using 9:1(v/v). Equal amount (30ml) of each solvent was added into the sample and mixture was agitated using the mechanical shaker (Gathehamp, Germany) at 2000 rpm for 90 minutes. The agitated solution was immediately filtered and rinsed using separating funnel.

Two layers were distinctly formed; lower (MW) and upper (Petroleum ether) fractions, were separated into 50ml flask each. Out of the MW fraction, 1-67ml of each sample was dispensed into 9ml distilled water. 1ml of it was pipette into calibrated test tube (duplicates). The content was shaken for 30 seconds the agitated test-tube was allowed to stand for 15 minutes, after which the height of the foam (mm) in the test- tube was measured: 5mm or less =Negative; 5-9mm= low saponin; 10-14 mm= Medium saponin; 15 mm or more = High saponin. 1ml of MW fraction was again pipette into two bottles each, after which the prepared solutions of 1% $FeCl_3$ (w/v) at 1ml were dispensed into the two bottles. A characteristic of colour change was used in detecting the presence of hydrolysable or condensed tannins (phenols). No change=No phenols or tannins; Dark blue =Water –soluble or hydrolysable tannin; Dark green = Condensed Tannins. From the petroleum ether fraction 10ml was measured into test –tube (n=2) using a calibrated measuring cylinder. This was later shaken together under warm water, after which 0.5 ml chloroform,0.25ml acetic acid anhydride and 0.125ml concentrated H_2SO.The solution was later shaken together for 30 seconds and the colour reaction was inferred: Blue or green = Steroids; Pink, Red or purple= Triterperoids; Light yellow = Saturated steroids or triterperoids.

Forage acceptability

The study was carried out at the Livestock Unit of NACGRAB, Moor Plantation, Ibadan. Ten adult female West Africa dwarf goats were used in a cafetaria feed preference study which lasted for 14 days. The initial weight of the animals was between 10-12 kg at 18 months old. They were housed in a well ventilated open pen capable of accommodating 80-100 adult goats. The forages were harvested fresh and 10 kg of each was introduced to the animals in different containers. Each plant replicated thrice in order to have access to the plants. The positioning of the plants in the pen was changed daily to remove bias by the animals sticking to the same feed in the particular position. The feeding of the animals was monitored for 6 hours (0800-1400) daily. Average daily intake was calculated by deducting the refusal from the amount served. Coefficient of preference (COP) was determined as the ratio of individual intake of the forage and the average intake. Forage with COP less than unity is considered not accepted, while COP greater than unity is well accepted (Karbo *et al* 1993, Bamikole *et al* 2004)

Design of the experiment and statistical analysis

The design of the study was complete randomized and data obtained were subjected to Analysis of variance procedures of SAS, (1990). Significant differences were separated using the same package.

RESULTS AND DISCUSSION

Proximate composition

Table 1 represents the proximate composition of the leguminous plants. Dry matter varied significantly ($P<0.05$) among the plants. The least (20.27 g/100 g DM) and the highest (41.60 g/ 100g DM) were in *Gliricidia sepium* and *Pentaclethra macrophyllum* respectively. The CP of the browse also followed the same trend. The CP contents were generally moderate except for *Dalbergia sisso* and *Griffonia simpilicifolia* which has CP of 9.8 % and 29.3% respectively. CF contents of the browse trees were significantly different ranging from 23.1% in *Leucaena leucocephala* to 38.1% in *Tamarindus indica*. Significant ($P<0.05$)

differences were likewise observed among the browse plants in respect to ash and EE. The variations observed in DM content of the browse plants were meaningful as it may largely depend on the species of the plant. The DM obtained was similar to those reported elsewhere (Brender *et al* 1997; Bamikole *et al* 2004; Yavuz Gurbuz 2006). The CP levels of the browse species agreed with the report of Le Houerou (1980), Minson (1990), Larbi *et al* (1998), Abdulrazak *et al* 2000 and Omokanye *et al* (2001). This also falls within the minimum and maximum protein requirement for ruminants in the tropics. This suggests that browse legumes can be used as protein supplements for low quality feeds such as crop residues, kitchen wastes, industrial by - products and grasses. The CF content of the plants reported in this study was similar to the report of Pellew (1980). The values were higher than those obtained by Omokanye *et al* (2001). The variation and disparity could be due to the leaves to petiole ratio, age of plant and time of harvest. The ash values were high, suggesting substantial mineral deposited in the plants. In earlier studies, Yavus Gurvuz (2007) obtained similar enhanced ash contents in browse plants

Table 1 also shows the fiber fractions of the browse species and the values obtained were significantly ($p<0.05$) different ranging from 41.8% to 65.6% for NDF, 26.7% to 49.4% ADF and 6.1% to 13.7% for ADL. The result indicated high proportion of ADF, which is an indication of high level of lignin and cellulose and low level of hemicellullose. This was consistent with what was reported elsewhere (Abdulrazak *et al* 2000). Values obtained for NDF, ADF and ADL corroborate those reported for some browse species in Nigeria (Larbi *et al* 1996, Bayer 1990). However, Meissner *et al* (1991) reported that NDF higher than 55-60 % will depress the intake of such browse. Nevertheless, a high level of cell wall and lignin is typical of tropical forages (Van Soest 1982) and is due to the high environmental temperature at which the forage grows in this zone. But forage higher than this NDF level may be cut at early stage to reduce high cell wall content. Since most of the forages fall between this considerable range, the fodders are better alternatives for the ruminants, most especially during the dry season, when the grasses are not available and those standing ones are lignified.

Table 1: Chemical composition (g / 100 g DM) of twelve leguminous browse plants

	Nutrient composition							
Plant spp	DM	CP	CF[1]	Ash	EE	NDF	ADF	ADL
CF[2]	39.55bc	14.81g	30.48c	8.93a	18.58d	60.8b	46.9a	7.7f
PP	33.74d	13.33b	30.17c	6.41ef	7.49g	65.6a	49.4a	13.7a
TI	31.68e	15.48fe	38.11a	6.02fg	9.69e	58.2c	41.6b	11.1cd
PS	31.48e	10.38i	28.82c	9.25a	12.76ab	60.6a	46.6a	12.9ab
DS	40.19b	9.79i	29.55c	6.88ed	11.32cd	44.4f	31.7c	8.9e
GLS	25.27f	19.60c	24.87d	7.89c	11.71c	48.7e	34.3c	7.4f
GFS	39.08c	29.53a	33.64b	8.30bc	13.36a	62.1b	41.1b	12.1bc
TT	33.03d	15.30fg	39.17a	7.02d	5.95b	52.1d	39.3b	10.2d
AO	41.25a	15.99c	23.78ed	5.14f	9.05f	41.8g	26.7d	6.3g
PM	41.60a	15.15fg	33.00b	5.64gh	10.00c	60.0bc	32.5c	8.8f
PB	39,53bc	18.38d	33.48b	7.32d	13.11a	58.2c	41.6b	11.1dc
LL	31.72c	23.85b	23.14e	8.70ab	12.36b	44.5f	32.2c	6.1g
SEM	0,26	0.22	0.54	0.08	0.21	0.11	1.08	0.35

Means on the same column with different letters are significantly different ($p < 0.05$)

CF= *Cassia fistulosa*, PP= *Peltophorum pterocarpum,* TI= *Tamarindus indica,* PS= *Pterocarpus santalinoides,* DS= *Dalbergia sisso,* GLS= *Gliricidia sepium,* GFS= *Griffonia simplicifolia,* TT= *Tetrapleura tetraptera,* AO= *Albizia odoratissima,* PM= *Pentaclethra macrophylla,* PB= *Parkia biglobosa,* LL= *Leucaena leucocephala.*

DM= Dry matter, CP= crude protein, CF[1]=Crude fibre, EE= Ether extract, NDF= Neutral detergent fibre, ADF= Acid detergent fibre, ADL= Acid detergent lignin

Secondary metabolites

Table 2 shows the anti- nutritional factors found in the browse plants. The qualitative assessment of secondary metabolites is applicable as a field test in situ due to its low requirement for laboratory equipment. It is also used to screen a large number of samples within a short time (Babayemi *et al* 2004). The spot test or the qualitative test indicated that the forages contain at least one of the secondary metabolites which are saponins, tannins, steroids etc. Saponins from different sources have been found to be detrimental to protozoa and have been identified as possible defaunating agents in the rumen (Wallace *et a*l 1994, Newbold *et al* 1997).

Table 2: Qualitative assessment of secondary metabolites in leguminous plants

	Saponin		Phenol/ Tannin		Steroid	
Plant spp	Foam length (mm)	Comment	Colour change	comment	Colour change	Comment
CF	2	Negligible	Nil	Negative	Green	Present
PP	2	Negligible	Green	Present	Green	Present
TI	4	Negligible	Green	Present	Green	Present
PS	3	Negligible	Green	Present	Nil	Negative
DS	4	Negligible	Green	Present	Green	Present
GLS	Nil	Negative	Green	Present	Green	Present
GFS	5	Low	Green	Present	Green	Present
TT	5	Low	Green	Present	Nil	Negative
AO	6	Low	Blue	H_20 soluble	Green	Present
PM	Nil	Negative	Nil	Negative	Green	Present
PB	2	Negligible	Green	Present	Green	Present
LL	2	Negligible	Green	Present	Green	Present

Also reported else where was that saponin rich plants have been found to improve growth, feed efficiency and health in ruminants (Mader and Brumm 1987). The presence of metabolites was reported for tropical browse plants (Onwuka 1992, Larbi *et al* 1998). Min *et al* (2003) reported that the action of condensed tannins in forages markedly reduced rumen proteolytic bacterial growth and some proteolytic bacterial populations measured *in vivo*. Bloat is caused by high solubility of forage proteins leading to the development of stable foam in the rumen and is prevalent in cattle fed on legumes (Jones and Lyttleton 1971). Jones *et al* (1996) reported that the presence of condensed tannin (CT) in legumes fed to ruminants markedly reduced rumen gas production by precipitating the stable forage protein foam and prevent bloat due to action of condensed tannin. Li *et al* (1996) proposed minimum plant CT concentration needed to make forage bloat free to be 5 g CT/ kg DM or greater while another author reported that 2-4 % tannins in the diet protects protein from rumen degradation and increase the absorption of essential amino acids whereas 4- 10 % depresses voluntary intake (Terrill *et al* 1992, Barry and McNabb 1999). Hence, the presence of CT in these legumes may be beneficial.

Table 3: Free choice intake of twelve tropical legume plants by WAD goats

	Acceptability parameters	
Browse species	Ave. daily intake (kg DM)	Coefficient of preference (COP)
Cassia fistulosa	0.16	0.14
Peltophorum pterocarpum	0.96	0.82
Tamarindus indica	1.62	1.38
Pterocarpus santalinoides	0.88	0.75
Dalbergia sisso	1.80	1.53
Gliricidia sepium	2.00	1.70
Griffonia simplicifolia	0.30	0.26
Tetrapleura tetraptera	1.38	1.17
Albizia odoratissima	1.14	0.97
Pentaclethra macrophylla	1.35	1.15
Parkia biglobosa	1.44	1.22
Leuceana leucocephala	2.64	2.24

Forage acceptability

The forage preference of the animals fed on browse species is shown in Table 4. The animals exhibited their choice of preference. The coefficient of preference (COP) showed that seven legumes were accepted while five were rejected. The order of preference being *Leuceana leucocephala.> Gliricidia sepium> Dalbergia sisso > Tamarindus indica > Parkia biglobosa > Tetrapleura tetraptera >Pentaclethra macrophylla.* The acceptability and refusal of some browse species could be due to many factors such as presence of one or more secondary metabolites such as saponins and tannins found in most tropical browse plants, and this may inhibit their intake and palatability. Another reason could be as a result of high NDF level of some of the refused forage species which may inhibit the feed intake (Meissner *et al* 1991). Bamikole *et al* 2004 reported that goat can accept or refuse certain feed based on their preference. This was observed when different Ficus species were introduced to WAD goats. Another author also reported that WAD goats preferred Guinea grass to elephant

grass because of its coarse and tough nature (Babayemi 2007). Likewise, the observation was in line with reported study of Omokanye *et al* (2001) when some forages were offered to Yankasa sheep in different post- harvest treatments (fresh, wilted or dried state).

***In vitro* gas production**

Table 5 shows the gas production of legumes. The gas production varied significantly (P<0.05) amongst the plant species after 24 hours of fermentation. The highest being 24.83 in *Dalbergia sisso* and the least (13.67) in *Peltophorum pterocarpum*. The variation is expected since the plants differ, and it may also be due to the contents of fermentable carbohydrates and available nitrogen found in them (Aregheore (2000). The high gas production found in *Dalbergia sisso* may be due to a high organic matter digestibility (OMD) exhibited by this plant. Nonetheless, the values recorded here was lower than the values reported for acacia species (Abdulrazak *et al* 2000).The difference might be as a result of leaf to petiole ratio, soil, climate, stage of maturity and even season at the time of collection (Le Houerou 1980, Topps 1992, Spears 1994). The variation indicated amongst the plant species in total gas production may be due to many factors such as the content of fermentable carbohydrate and available nitrogen in them (Aregheore 2000), natures and fibre level, the presence of anti-nutritional factors (Babayemi 2007), the potency of the rumen liquor used during incubation. Babayemi (2007) observed that high crude protein in the feed/fodders enhanced microbial multiplication in the rumen, which invariably may affect the extent of fermentation.

The present study revealed that nearly all the forages in the study have one of the secondary metabolites in them. This may be responsible for their low gas production. It was reported that condensed tannins have suppressive effect on rumen degradation and on the interference of condensed tannins with microbial attachment to feed (Aharoni *et al* 1998).

Methane production of these fodders was represented in Fig 1, and ranged between 8.33 and 15.17 ml/200 mg DM. Significant differences (P<0.05) occurred among the fodders. The highest value was exhibited by *Cassia fistulosa* while the lowest was found in *Peltophorum pterocarpum*. Methane production as a result of fermentation of feed in the rumen of the ruminants is a waste nutritionally (Mauricco *et al* 1999). Hess *et al* (2003) observed that insufficient quality of ruminant diets, as is prevalent in tropical agriculture, in conjunction with low feed conversion efficiency, leads to high methane emission per kg of feed of ruminant origin produced. It constitutes a loss of about 10-11 % of gross energy intake (McCrabb and Hunter 1999). Methane provides a useful basis for metabolizable energy, organic matter digestibility (OMD) and even short causing fatty acid (SCFA) of the fodders. So, high production of methane in this study may indicate that the fodders could be a good source of feed to the ruminants.

Table 4 : *In vitro* gas production (ml / 200 mg / DM) of leguminous plants in Southwestern Nigeria

Plant spp	3 hr	6 hr	9 hr	12 hr	15 hr	18hr	21 hr	24hr
CF	3.33	7.67	12.33a	15.67ab	19.17a	21.33ab	23.17ab	24.83ab
PP	0.33	4.83	7.67bc	9.17bc	10.50b	11.50c	12.50c	13.67c
TI	0.33	5.67	9.17abc	10.17bc	13.00ab	14.67abc	16.50abc	17.83abc
PS	1.17	4.00	7.56c	8.87c	10..33b	12.83abc	13.67bc	14.83bc
DS	2.17	6.67	22.67ab	17.17a	19.17a	21.83a	24.33a	26.17a
GLS	1.65	5.50	9.5abc	11.83abc	12.69ab	16.50abc	16.50abc	19.17abc
GFS	3.17	4.33	9.33abc	12.33abc	15.50ab	16.83abc	18.83abc	20.83abc
TT	2.00	3.67	7.00c	9.55c	11.67ab	12.67c	14.67abc	16.00abc
AO	1.50	2.67	7.50bc	8.83	10.33b	11.83c	13.50bc	15.00bc
PM	1.00	4.83	6.83c	9.17c	11.83ab	13.83abc	15.67abc	16.83abc
PB	0.33	2.67	5.50c	7.33c	9.83b	11.33c	13.17bc	14.00bc
LL	1.33	5.33	8.83abc	11.17bc	13.50ab	16.00abc	18.17abc	19.83abc
SEM	1.06	1.63	1.36	1.82	2.31	2.72	3.01	3.26

abc. Means within the column with the same letters are not significantly different (P>0.05).
CF= *Cassia fistulosa,* PP= *Peltophorum pterocarpum,* TI= *Tamarindus indica,* PS= *Pterocarpus santalinoides,* DS= *Dalbergia sisso,* GLS= *Gliricidia sepium,* GFS= *Griffonia simplicifolia,* TT= *Tetrapleura tetraptera,* AO= *Albizia odoratissima,* PM= *Pentaclethra macrophylla,* PB= *Parkia biglobosa,* LL= *Leucaena leucocephala*

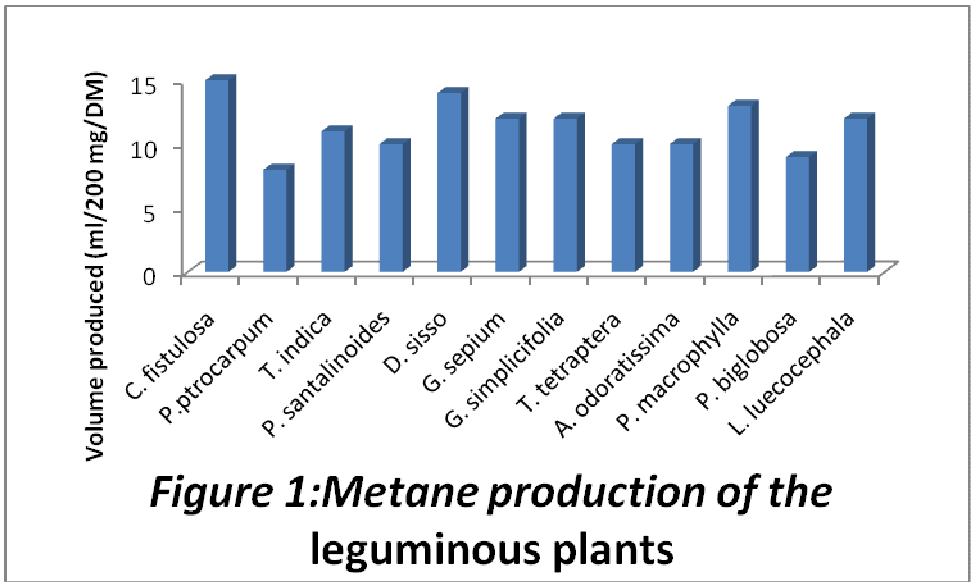


Figure 1:Metane production of the leguminous plants

Table 5 : In vitro characteristic parameters of leguminous plants

Plant spp	a ml	b ml	a+b	c ml h^{-1}	t / h	Y
CF	3.00c	20.00b	23.00b	0.07ab	15.00a	15.00b
PP	0.00f	15.33f	15.33g	0.08a	12.00b	9.67f
TI	1.33d	18.00de	19.33c	0.05c	15.00a	11.33e
PS	1.33d	15.34f	16.67f	0.08a	15.00a	12.33d
DS	3.67b	23.00a	26.67a	0.06abc	12.33b	15.98a
GLS	4.67a	19.33bc	24.00b	0.06abc	12.00b	14.65b
GFS	1.67d	17.00e	18.67cd	0.07ab	15.00a	12.45d
TT	2.67c	14.66fg	17.33ef	0.08a	15.00a	12.67d
AO	1.33d	15.33f	16.99ef	0.07ab	12.00b	11.00e
PM	0.00f	18.00de	18.00de	0.02d	15.00a	13.11cd
PB	0.00f	13.67fg	13.67h	0.01d	15.00a	11.33e
LL	0.66e	18.65cd	19.31c	0.08a	15.00a	13.67c
SEM	0.28	0.47	0.49	0.06	0.57	0.40

Means within the column with the same letters are not significantly different (p>0.05)

Initial gas produced (a) ranged from 0.00 in *Parkia biglobosa* (PB), *Pentaclethra macrophylla* (PM) and *Peltophorum pterocarpum* (PP) to 3.00 in Cassia fistulosa. These three legumes could not degrade as others. This may be due to factors like level of lignin, crude fiber, fermentable carbohydrate and even presence of secondary metabolites inherent in these legumes. The highest value of gas produced from insoluble but degradable fraction was recorded with *Dalbergia sisso* (DS, 23.00) and lowest in *Parkia biglobosa* (PB, 13.67).The potential gas production (a+b) ranged from 13.67 to 26.67 ml in PB and DS respectively. The highest gas production rate was also observed in PP, PS, TT and LL (0.08 h^{-1}) and lowest in PB (0.01 h^{-1}). The values obtained in this study were similar to the report on multipurpose trees (Larbi *et al* 1998 and Abdulrazak *et al* 2000) but a little higher. Apori *et al* (1998) recorded higher rate of gas production with Ghanaian leaves containing a relatively low condensed tannins level. The higher values could be as a result of a relatively low level of cell- wall contents. . The high values of potential extent of fermentation exhibited by these samples are an indication that more degradation could take palace if period of incubation is extended (Babayemi 2007). Generally, the values of the in vitro fermentation characteristics were higher than those reported elsewhere (Babayemi *et al* 2006, Babayemi, 2007).

Table 6: Metabolizable energy (ME, MJ / Kg DM), organic matter digestibility (OMD, %) and short chain fatty acid (SCFA, µmol) of the tropical legume plants

Plant specie	ME	OMD	SCFA
Cassia fistulosa	6.41a	49.47ab	0.53ab
Peltophorum pterocarpum	4.61b	37.20d	0.27c
Tamarindus indica	5.51ab	41.62bcd	0.37abc
Pterocarpus santalinoides	4.81b	38.75dc	0.30bc
Dalbergia sisso	6.33a	46.94abc	0.57a
Gliricidia sepium	5.87ab	45.98abcd	0.40abc
Griffonia simplicifolia	6.58a	52.09a	0.44abc
Tetrapleura tetraptera	5.2ab	40.55bc	0.32abc
Albizia odoratissima	5.12ab	38.75cd	0.32abc
Pentaclethra macrophylla	5.34ab	40.34bcd	0.34abc
Parkia biglobosa	5.12ab	40.35bcd	0.28ba
Leucaena leucocephala	6.09ab	48.48ab	0.46abc
SEM	0.44	2.88	0.08

Means with the same letters are not significantly different (P>0.05)
ME= Metabolizable energy, OMD= Organic matter digestibility, SCFA= Short chain fatty acid

Table 6 shows the values of metabolizable energy (ME) organic matter digestibility (OMD) and short chain fatty acid (SCFA). Values were significantly different ($p<0.05$) ranging from 4.81 and 6.58, 37.20 and 52.09, 0.27 and 0.57 respectively. High production of methane from these fodders could indicate an increased proportion of acetate and Butyrate but decrease in propionate production (Babayemi *et al* 2004) but relatively lower gas production in this present study could be associated with propionic production which is carbohydrate in nature. Again, the high gas production of forages is a reflection of its high metabolizable energy (ME) and organic matter digestibility (OMD) since gas production increases energy density and organic matter digestibility increase up to a certain level. Fievez *et al* (2005) observed that short chain fatty acid (SCFA) is an indication of energy content. SCFA as end products of carbohydrate fermentation contributes to the energy supply for the host animal (Hoffmann *et al* 2003). Abdulrazak *et al* (2000) recorded similar values for the calculated OMD obtained in this study for Acacia spp but the ME was higher than the values obtained in this present study. The reason for these differences may not be far from the factors afore mentioned.

CONCLUSION

The results revealed that almost all the fodder trees studied were nutritionally good for WAD goats. The browse plants had moderate gas production level which indicates good digestibility. Also, at least seven of the browse plants studied was well accepted by WAD goats. This suggests that some of these browse plants are important forage for ruminants and could also play an important role in the nutrition of WAD goats most especially during the period of dry season to improve production.

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USE OF NATIVE HERBS IN HEALTH MANAGEMENT IN NIGERIA

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ABSTRACT

In recent times there has been an increased awareness of the importance of traditional/alternative medicine in health care of human and animal populations in developing countries. It is an indisputable fact that farmers, civil servants, market women and men utilized indigenous knowledge systems in treating health problems before the advent of modern medicine. Increasing cost of modern orthodox drugs and services have further alienated the resource poor farmers, civil servant, market women and men from having access to modern orthodox drugs and services thus compelling them to resort to traditional medicine. Traditional medicine has become an issue mainly because it is cost saving and easily appreciated, adopted, applied and use by farmers, civil servant, market women and men. Traditional medicine extension delivery have in recent times become issues in the way forward for the development of the poor and least Developed Countries. Research is tilting towards traditional medicine, which is the springboard for rural development. Extension work in Nigeria is one of the means available to impart advance knowledge in traditional medicine, vocational skills and create awareness among farmers that encourages farmers' adoption, application and continuous use of new innovations in traditional medicine, which is instrumental in sustaining good health of farmers that enhance them to promote increase in agricultural productivity and generate income to alleviate poverty in Nigeria. Traditional medicine extension delivery in human and animal diseases, health problems experienced by farmers, civil servant, market women and men and methods of control are highlighted. Random sampling procedure was used in the study to draw up a representative sample for the study. At first stage, 4 states were taken from 36 states. then one local government area was randomly selected from each of the 4 states namely: Dindima Local Govermemt Area of Bauchi State, Bekwarra

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INTRODUCTION

Forestry is described as the scientific management of forest resources for continual production of essential goods and services for mankind(Olajide, 1997). Nigeria has a total land area of 983, 213km^2 . Forest occupies 360,000 km^2 or 36.6 percent of the total land area (King and Ubom, 1997). Food and Agricultural Organization (FAO, 1993) maintained that the role of forest in traditional medicine production cannot be over stressed. Okafor(1979) revealed that rural people exploit the potentials of forest resources towards ensuring sustainability in traditional medicine production. Indigenous Knowledge (IK), experts say, refers to a "Complete body of Knowledge, know-how and practices maintained and developed by rural peoples, who have extended histories of interaction with the natural environment" (Boven and Morohashi, 2002).

Obinne (1994) revealed that Indigenous or Local Knowledge comprises of complete body of knowledge, practices and skills developed and maintained by people in specific areas who have long history of interaction with the natural environment. Much of indigenous knowledge (IK) have not been written down and is, thus, held in people's memoryand passed down from one generation to the next by word of mouth.

Okigbo (1998) stated that indigenous technology involved in development does not only consist of elements of indigenous knowledge systems, it also consists of an indispensable element which entails the development of human resources and building of institutional capabilities that facilitate nurturing of endogenous African Science and technology capacities for locally generating technologies and resource management in all sectors.. Kofi Annan (2002) Stressed that what the world needed was not so much new knowledge, but the creation of new forms of partnerships that can help leverage the knowledge that exists and turn it into organized action. Areas of crucial importance worldwide are water, energy, health, agricultural production and biodiversity. Indigenous knowledge could and should play an important role in all these sectors.

Adinya et al (2007) revealed that in rural areas in Nigeria, access to modern health care is often unaffordable by resource – poor farmers due to high cost of Western medicine so farmers have resorted to use of traditional medicine that is cheaper and readily available. However, there are several factors that constitute impediments to

traditional medicine development in Cross River State, Nigeria and the world at large. Udo and King(1997) maintained that some people prefer traditional medicine to orthodox medication, while some cannot afford orthodox medication because of high cost.

Traditional medicine extension delivery have in recent times become issues in the way forward for the development of the poor and Least Developed Countries. Research is tilling towards traditional medicine, which is the springboard for rural development. Extension is one of the means available to impart advance knowledge in traditional medicine, vocational skills and create awareness in a way that encourages farmers' adoption, application and continuous use of new innovations in traditional medicine, which is instrumental in sustaining good health of farmers that enhance them to increase agricultural productivity and generate income to alleviate poverty (Arshad et al, 2007; Adinya et al, 2007).

Now, more than ever, research and extension is tilting towards providing scientific basis for existing well-known practices in almost all spheres of life with a view to improving them. Science as we understand is the systematic study of nature, which is the springboard for all forms of development. Indigenous knowledge in traditional medicine has become an issue mainly because it is cost saving and easily appreciated and applied. Traditional medicine extension delivery system offer us the advantage of enhancing technological transfer with its attendant benefits, makes cost-effective technologies available and can certainly affect the present status of poverty that is real and widespread in Nigeria.. They have traditional ways of solving their problems. Modern Scientists need to build upon this (Ayatse, 2004). Research and extension thoughts are being directed to indigenous knowledge in traditional medicine, agriculture, and other key areas of human endeavour (Kucha, 2004).

Adinya et al (2007) observed that in recent times there has been an increased awareness of the importance of traditional medicine in healthcare of human and animal populations in developing countries. Efforts had been made in different countries to carry out researches into traditional medicine and to integrate it with western medicine. It is a fact that before the advent of western medicine, in Nigeria people were managing human and animal diseases through traditional medicine. It is an indisputable fact that small-scale farmers utilized indigenous knowledge in treating health problems before the birth of modern medicine. The traditional medicine enjoys a wider acceptability among the farmers and rural dwellers than modern medicine in Northern and Southwest Nigeria. The major contributory factor, however, is the fact that traditional medicine blends readily with the socio-cultural life of the people in whose culture it is deeply rooted (Makinde, 2000). Traditional medicine care among the rural people of Nigeria constitute the first tier of healthcare delivery because most of the rural areas lack clinic or medical centers and veterinary clinic. Secondly, the same herbs used in treating human diseases were also used in treating corresponding animal diseases, but there are some herbs that are used mainly for veterinary purposes and some diseases are peculiar to animals that had to be treated with herbs (Nwude, 1997). Extension is one of the means available to impart advance knowledge in traditional medicine, vocational skills and stimulate farmers' adoption, application and continuous use of new innovations in traditional medicine, which is instrumental in sustaining good health of farmers that enhance increased agricultural productivity and generate income to alleviate poverty (Arshad et al, 2007). Traditional medicine extension has contributed in one way or the other to community, rural and agricultural development in Nigeria. Though some researches have been conducted concerning medicinal plant and traditional medicine but none involved traditional medicine extension for enhancement of resource poor farmers' health in Nigeria, therefore the need for this study. The purpose of this paper is to review traditional medicine extension delivery as the way forward for the development of poor resource farmers' health and its role in small-scale farming in Nigeria. This will include the reasons for revival of traditional medicine, the current knowledge of the material used for traditional medicine practices and their potential usefulness are highlighted. The constraints of traditional practices are discussed and the way forward for research, extension and development proffered for improved traditional health care services in Nigeria.

METHODOLOGY

The research study was carried out in Nigeria. Nigeria is located between latitude 10^0.00'N and longitude 8^0 00'E(Menakaya and Floyd,1978) Farming and other agro-based activities dominate the economic life of the people in Nigeria. However, some are involved in Civil service while others are involved in marketing and processing of agricultural products and other forms of non-farming activities or business.

Study population and samples size

A sample of 160 respondents was randomly selected for the study. This served as the sample size for the study. Random sampling procedure was used in the study to draw up a representative sample for the study. At first stage 4 states were taken from 36 states. Random samples of 10 villages were selected from the 4 local government areas in each state However the number of local governments in state varies. Forty respondents

were randomly selected from each of the selected states. In all, 160 respondents were drawn from study area.

Data collection and analysis

The instrument used for data collection was questionnaire that contained structured and semi-structured questions. Questions bordered on extension delivery methods used in traditional medicine and parts of plant used was investigated. Simple percentage and mean was used in explaining usage of plant parts by farmers for health problems or healthcare.

Data obtained from the study were analyzed using descriptive statistic analysis. The descriptive statistics include tables, means, percentage and frequency analysis.

The model specification used in calculation is as follows:-

$$\text{Percentage } \% = \frac{Z}{N} \times \frac{100}{1}$$

Where Z = Number of respondents that answer a particular question.

N = Total number of respondents

RESULTS AND DISCUSSION

Table 1**:** *Socio-economic characteristics of respondents*

Socio-economic characteristics	*Dindima Local Government Area of Bauchi State,*	*Bekwarra Local Government Area of Cross River State*	*Awka Local Government Area of Enugu State*	*Ilorin Local Government Area of Kwara*	Total frequency	Percentage (%)
Age (years)						
20-30	12	16	10	15	53	33.13
31-40	10	12	10	11	43	26.87
Above 41	18	12	20	14	64	40.00
Occupation						
Farming	18	12	10	11	51	31.88
Civil servant	12	16	20	15	63	39.38
Trading	10	12	10	14	46	28.75
Educational level						
Primary education	8	10	9	8	35	21.87
Secondary education	6	12	10	12	40	25.00
College/polytechnic/University	2	7	5	19	33	20.63
No formal education	24	11	16	1	52	32.50

Table 1 reveals that 33.13% of the respondents are within the age of 20-30 years. Also, 26.87% of the respondents are within the age of 31-40 years. While, 40% of them are above 41years. Further analysis of Table 1 reveals that 31.88% of the respondents are actively engaged in farming. Table 1 indicated that 25% of them that had West African Examination Certificates (WAEC). This is followed by 21.87% of them that had First School Leaving Certificates (FSLC). Only, 20.63% of them attended tertiary institution. While, 32.50% of the respondents had no formal educational training.

Table 2: Distribution of respondents according to traditional medicine(different plants parts) used for treatment of different type of human diseases by resource poor farmers in Nigeria and their mode of preparation, dosage and natural neutralizer if dosage is exceeded.

Type of Human disease	Scientific Name of Plant	Plant part use fo treatment	Method of preparation of herb	Dosage	Natural neutralizer if dosage is exceeded	*Dindima*	*Bekwarra*	*Awka*	*Ilorin*	Total Frequency	Percentage %
Malaria	Dogoyaro or neem plant (*Azadiracta indica)*	Leaves	Get some leaves of*Azadiracta indica* mix with lemon grass, and grape and lime and boil with clean water for 3-4 hours.	Take half glass 2 times daily for 3 days	1 glass of palm oil	4	3	7	3	17	10.63
Hypertension	Mistletoe plant (*viscum album)*	Leaves	Make an infusio of dried mistletoe herb using one tablespoon to cup of boiling water	One glass (1.2cl) daily until symptom various	1 glass of coconut juice	3	4	4	2	13	8.13
Typhhoid fever	Aloe vera *(Aloe spp*)	Leaves	Boil some aloe vera with unripe pineapple 1gramme of garlic	Take half glass 2 times daily for 3 days	1 glass of palm oil	3	6	4	5	18	11.25
Wound/cut	Air plant *Bryophyllum pinatum*	Leaves	Squeeze some leave of Bryophyllum pinatum	Rub extracted juice on Wound or cut	Wash affected with clean water	2	3	5	5	15	9.38
Total						12	16	20	15	63	39.38
Whooping cough	Mango (*Magnifera indica)*	Fruit	Roast ripe mango in hot clean sand and allow to cool	Suck the roasted mango for 3 days	1 glass palm oil	4	3	4	3	14	8.75
Diarrhoea	Tomato (*Lycopersium esculentum)*	Fruit juice	Mix the spoon of garlic powder with half tea spoon full crest powder with a cup of tomato juice	One glass (1.2cl) 2 times daily till symptoms varnish	1 glass of palm oil	3	4	3	2	12	7..50
Rheumatism	Avocado pear seed(Persea gratissima)	Seed	Grind dry Persea gratissima seed to powder form ,mix pure honey	2 tea spoon full every morning for 3 days	1 glass of coconut juice	6	3	1	2	12	7.50
Asthma	Mango seed(*Magnifera indica)*	Seed	Grind seed to powder form ,add 5grammes of this to1 liter of clean water	One glass (1.2cl) 3 times daily till symptoms varnish	1 glass of palm oil	5	2	2	4	13	8.13
Total						18	12	10	11	51	31.88

Continuation of Table 2

Bacteria/fungal infection	Ginger (*Zingiber officinale*)	Root /rhizomes	Grind ginger ,add 2 spoonfull of lemon/lime plus 5 spoonfull of honey	1 teaspoon daily till symptoms varnish	1 glass of palm oil	3	2	4	3	12	7.50
Urinary tract infection	Water leaf(*Talinum triagulare)*	Root	Grind root of water leaf (Talinum triagulare) and filter extract	one glass (1.2cl) 2 times daily for 15 days	1 glass of palm oil	2	4	1	4	11	6.89
ToTal						5	6	5	7	23	14.38
Fever	Dogoyaro or neem plant (*Azadiracta indica)*	Bark	Azadiracta indica bark mix in clean water plus lemon grass	one glass (1.2cl) 2 times daily for 3 days	1 glass of palm oil	4	3	2	4	13	8.13
Eczema	Mango (*Magnifera indica*)	Bark	Grind mango bark mix with rock salt	Apply the mixture on affected part of body	Wash with clean water	1	3	3	3	10	6.25
Total						5	6	5	7	23	14.38
Aggregate Frequency						40	40	40	40	160	100

Table 2 also reveals that 10.63% of them suffered from malaria, and were treated with traditional herbal remedies using Azadirachta indica (Dogoyaro leave/neem tree leaves), the deloction of some of the leaves of lemon (citrus), mango leaves (mangifera indica) and guava leaves (psidium) were used as a remedy for malaria or fever in recommended dose of one glass two times daily for three days. The result of findings agrees with Okojie et al (1996) mango (Mangifera) and guava (Psidium) were used as a remedy for fever and malaria (in recommended doses).

Further analysis of table 2 disclose that 9.38% of the respondents had wound /cut , they were treated with traditional herbal remedies using *Bryophyllum pinatum*. This findings agree with Gill (1992) farm accidents also occurred when cut were mistakenly made on the body with traditional tools like machetes, hoes, processing machinery during and after the farm operations. The women used the fresh leaves of air-plant (a weed and ornamental) called Bryophyllium pinatum, slightly warmed under flame, and the extracted juice was mixed with ash and common salt. The concoction was applied to wounds once daily. This species (Bryophyllium pinatum) has been reported by Gill (1992) to have astringent and antiseptic properties.

Table 3 also reveals that 39.37% of cattle, goats and sheep suffered from Ticks and other ectoparasites and were treated with traditional herbal remedies using Eupharibа daightonii . *This is followed by* 31.88% of suffered poultry birds suffered from Coccidiosis and diarrhea and were treated with traditional herbal remedies using Khaya senegalensis. While, 28.75% of cattle, sheep, goat and poultry suffered from Helmin thiasis and were treated with traditional herbal remedies using Helmin thiasis . Research work has been done in this country on medicinal plants used in animals treatment but not much has been done on those used in human. Stephen (2005) compiled information on plants used in traditional medicine. While Nwude and Ibrahim (1980) compiled information on plants used in traditional veterinary medicine.

Table 3 : Distribution of respondents according to traditional medicine (different plants) used for treatment of different type of animal diseases by resource poor farmers in Nigeria

Animal disease	Plant **(Scientific Name of Plant)**	*Dindima Local Govermemt Area of Bauchi State,*	*Bekwarra Local Govermemt Area of Cross River State*	*Awka Local Govermemt Area of Enugu State*	*Ilorin Local Govermemt Area of Kwara*	Total frequency	Percentage (%)
Coccidiosis and diarrhea in poultry	Khaya senegalensis	18	12	10	11	51	31.88
Ticks and other ectoparasites if cattle tick, effective control in ruminants (cattle, goats and sheep)	Euphariba daightonii	12	16	20	15	63	39.37
Helminthiasis in cattle, sheep, goat and poultry	Moringa oleifera	10	12	10	14	46	28.75
Total		40	40	40	40	160	100

.

Table 4: Distribution of sampled Extension agents in study area

Location	Frequency of Interviewed Extension agents	Percentage (%)
Dindima Local Government Area of Bauchi State	16	25
Bekwarra Local Government Area of Cross River State	16	25
Awka Local Govermemt Area of Enugu State	16	25
Ilorin Local Government Area of Kwara	16	25
Total	64	100

Table 4 revealed that 25 % of the Extension agents were purposely sampled and used for this study in study area . The result of the findings agrees with findings of Nwude and Ibrahim ,1980; Gill ,1992).

Table 5: Distribution of respondents according to extension visits to demonstrate how to prepare and use traditional medicine for treatment of human /animal diseases in the study area

Extension visits	*Dindima Local Govermemt Area of Bauchi State,*	*Bekwarra Local Govermemt Area of Cross River State*	*Awka Local Govermemt Area of Enugu State*	*Ilorin Local Govermemt Area of Kwara*	Total frequency	Percentage (%)
Too much	17	11	9	28	65	40.63
Much	23	29	31	12	95	59.37
Total	40	40	40	40	160	100

Table 5, 59.37% of respondents revealed that much increased in frequency of extension visit to demonstrate on how to prepare and use traditional medicine for treatment of human /animal diseases in the study area . The result of the findings agrees with findings of Nwude and Ibrahim ,1980; Gill ,1992).

Constraints of traditional medicine and the way forward

There is the need for collaborative research and development involving all farmers, pastoralist, veterinary, national agricultural research institutes, University, International agencies, non-governmental organizations and others in the area of traditional medicine. Points required for charting future direction for traditional medicine in Nigeria should include the need to establish a National

Institute for Traditional Medical Research and Development and another Institute for Traditional Veterinary Medical Research and Development, Also Institute for medical plants as well as the establishments of a co-operative biodiversity agency.

The prospects of trado-medical practices in the control of human and animals diseases through the documentation of herbal and other local preparations used by farmers in Nigeria have been highlighted (Stephen, 2005, Egharevba and Iweze, 2004; Akubue, 1986; Asogwa, 1986; Okojie et al 1996; Okoh, 2004; Atawodi, 2000a; Atawodi, 2000b; Abdu et al 2000a; Abdu et al 2000b; Zachariya et al 2000; Adinya et al, 2007. In all these studies the need to validate the efficacies of the plants and products claimed by the farmers is emphasized. Also there is the need to establish standard (dose rate) and frequencies as well as establish toxic level of these traditional medicine remedies.

The future direction for development and advancement on traditional medicine and research in Nigeria needs to take into consideration, the following:

all stake: holders should: -

(a) encourage close interaction between farmers and research as a way of disseminating indigenous knowledge system in traditional medicine.
(b) Identify and collate information of proven useful medicine plants.
(c) Carry out research into ways of standardizing the methodology for herbal medical preparation to ensure specificity of action, dosage regime and clinical efficacy of preparations from medicinal plants.

CONCLUSION

For centuries, and ever before the advent of orthodox medicine practice in Nigeria, our ancestors, who keep animals, have gained experience in diagnosing and treating animal and human diseases. Their indigenous knowledge; now referred to as alternative medicine or ethnoveterinary medicine, was based on time-tested observations of adverse and beneficial effects of plants (herbs) on human and animals hence, rather ignoring traditional medical practice, we should try to learn more from the past to move forward in our endeavour to provide cheaper, locally available and at times more effective treatment from these natural resources that God has provided. There is urgent need for further research for the development of traditional medicine practice in Nigeria and African in general. Such research and collaborative work is not only on pharmaceutical activities of local plants and herbs but also on sociological and economics studies for their acceptability, cost-benefit analysis and wide usage. It is important that experiences of our people in the traditional treatment of human and animal diseases be recorded and that studies be carried out to establish the efficacy of herbs used. A research into the efficacy off herbs used in traditional medicine practice in Nigeria would therefore be worthwhile. Traditional medicine are available and local herbs prove more effective or cheaper or safer.

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ECONOMIC EVALUATION OF SMALL SCALE FISH FARMERS IN EPE LOCAL GOVERNMENT AREA OF LAGOS

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ABSTRACT

The study was conducted to assess the profitability and socioeconomic factors influencing small scale fish farming activities in Epe Local Government Area of Lagos State. Primary data was generated from 100 fish farmers purposively selected. Data collected were analyzed using descriptive statistics, cost-returns analysis and regression analysis. Findings revealed that fish farming was profitable with gross margin estimated at N610, 727.12 (USD $4071.51) and mean net income was N71, 742.58 (USD $478.28). Level of education, farm size, household size, fish farming experience, fish species culture, feed used, and number of labour used are significant and positive in the determination of the level of fish output. The study recommends that government should be committed to the funding of fish farming through the grant of loans and subsidization of fish farming inputs to produce multiplier effects on fish production.

KEY WORDS – Fish Farmers, Socio-economic factors, Profitability, Small scale, Epe.

INTRODUCTION

Over the last three decades, aquaculture has been expanded, diversified, intensified and advance technologically (Pillay, 2001) with an average compounded growth rate of 11% per annually since 1994 (Tacon 20010. Nigeria has not mirrored this global tend. Despite its long history in Nigeria, aquaculture has not yet become an industrial enterprise and continues to be a subsistence activity. Nigeria's annual aquaculture production during the year 2005 was about 56,300 tones metric tones (Adamu, 2005) about 6% of domestic fish production. This might not commensurate with the potential resources available in the country. According to Tobor (1990), there is about 1.8 million hectares of suitable land for aquaculture, out of which less than 20% has been put into use.

Although there is a scope to produce about 2.5 million tones fishes through aquaculture (FISON, 2005), certain problems decelerate the growth of this industry. The lack of convincing data on the cost-effectiveness of aquaculture has perhaps been one of serious constraint in its development. It is, however, quite obvious that aquaculture would not be profitable under all conditions because profitability would depend on a large number of factors like land value, capital and operating costs, productivity, processing, marketing etc (Prasad, 1976).

It is also possible that socio-economic factors could play a part in hindering development of aquaculture. The socio economic context within which aquaculture is introduced is often times the last consideration in many development activities (Siar, 1998). This is a serious oversight because one of the common objectives for introducing aquaculture is the alleviation of poverty among fishers and fish farmers. Gupta and Gupta (2006) reported that aquaculture development programmes have to be designed on the basis of social, economic and behavioral patterns of the community involved.

Despite all the problems, the scientific and technical advancements in aquaculture together with the persisting demand for fish locally and in international market urge the farmers to opt for aquaculture as a profit making enterprise. Aquaculture resembles any other business-oriented activity and the fundamental goal is to make as much profit as possible and without profits the business is unsustainable.

Therefore any prospective fish farmer need to evaluate and determine the viability of such an enterprise (Beem, 1992) and one way of achieving this is by carrying out an evaluation of existing farms to determine their levels of performance economically. It is against this background that this study therefore attempts to determine the economic viability of small-scale fish farmers in Epe Local Government Area of Lagos State.

METHODOLOGY

The study area, Epe Local Government Area (LGA) of Lagos State is located at approximately $6^{o}35^{1}$N and $3^{o}59^{1}$E. It is situated in the riverine area of the State bounded by Ikorodu and Ibeju-Lekki LGAs of Lagos State. Epe LGA is located between two major rivers in Lagos State (i.e River Owa and Oshun) and it is known for its famous Epe lagoon that is freshwater where fishing activities thrive. It is also connected with many tributaries of the Atlantic Ocean and has an ecological condition conductive for both artisanal fisheries and aquaculture.

A combination of purposive and convenience sampling procedures were adopted in selecting 100 fish farmers for the study. The main instrument for data collection was a well structured questionnaire which was administered to the fish farmers by trained enumerators under the supervision of the researcher. Data were collected

on the socio-economic characteristics of the respondents, cultured fish species, system of management adopted, input and output prices etc.

The data were analyzed using descriptive statistics like frequency distribution and percentages. Gross margin analysis was used to measure performance while multiple regression analysis was run to determine the impact of some factors on the profitability of small scale fish farming in the study area.

GM = TR – TVC
Where
GM = Gross Margin
TR = Total Revenue
TVC = Total Variable Cost
The implicit specification of the regression equation run is
$Y = F(X_1,X_2,X_3,X_4,X_5,X_6,X_7,X_8,X_9,X_{10}, X_{11})$
$Y = F(X_1$---------- Xiv,e)

Where
Y = Gross Margin
X_1 = Age
X_2 = Education (years)
X_3 = Household size (Number of people living and feeding in the house)
X_4 = Farm size (m2)
X_5 = Fish farming experience (years)
X_6 = Type of fish culture
X_7 = Type of feed used
X_8 = Type of labour used
X_9 = Uses of the loan
X_{10} = Total loan obtained five years ago (N)
X_{11} = Number of labour (If any)
Ei = Error term.

The coefficient of determination (R^2) was used to explain the independent variables.

RESULTS AND DISCUSSION

Socio-economic characteristics of fish farmers

Data presented in Table 1 indicated that 90% of the fish farmers were male and 10% were female. The low proportion of females should not come as a surprise as one would expect males to be more prominent because of the nature of the work expected of professional fish farmers. Majority of the fish farmers (68%) were between the ages of 41-50 years while 32% of the respondents fell within the age bracket of 31-40 years. The implication of the result is that most of the respondents were within the economically active age. Larger proportion of the respondents (88%) of the respondents had secondary education, 8% had primary education while only 4% of the fish farmers had no formal education. This shows that some level of education is required to function effectively as a fish farmer. It is stated that education will induce economic motivation widens farmers' social and economic horizon and predispose them to a greater receptivity of new ideas (Olayide et al, 1975) and enhances farmer's efficiently use of resources. Most of the respondents (74%) were married, 20% were single while the remaining 6% of the respondents were widow (Table1). This could be as a result of the responsibilities, the married respondents have to shoulder .This is in line with the findings of Akinbile and Alabi (2008) that most of the fish farmers are married.

Half of the fish farmers had long years of experience in the job while 30% of the respondents had between 6-10 years of experienced and the rest 20% had between 1-5years experiences. This result indicates that fish farming is still at its development stage which requires support services. The result of the survey indicated that 61% of the respondents had between 6-10 family sizes while 39% of the fish farmers had between 1-5 household sizes (Table1). This indicates that the farmers have more hands to insist in their farms. Most of the respondents (64%) were Muslims while the remaining 36% were Christian. Result in Table 1 indicated that about half of the respondents (52%) obtained loans from co-operative societies, 16% of the farmers obtained loans from micro finance banks while only 26% of the respondents obtained capital from personal savings. This implies that majority of the fish farmers are yet to adopt formal credit as sources of credit for their fish farming activities. Also commercial banks, being naturally risk averse, would be hesitant in their lending to relatively small holder farmers who usually do not have adequate security to cover such loans (Ijere, 1998). The socio-economic analysis carried out further revealed that. Most of the respondents (64%) used family labour on their farms while 27% used hired labour. Large household size is important sources of labour to the farm since farming is highy labour intensive.

Culture practices and management Technique

Table 2 reveals that majority of the respondents (63%) cultured *Clarias gariepinus*, 20% of the fish farmers cultured *Tilapia sp* and 10% of the respondents cultured both *Tilapia s*p and *C gariepinus* in their farms. Only 7% of the respondents cultured *Chrysichthys sp.* The three fish species cultured in the study area have a significant agricultural potential in Nigeria because of tremendous consumer appeal. The study also revealed that 93% of the respondents used both farm compounded feeds and commercial feeds while 5% used compounded feeds alone and another 2% of the farmers used commercial feeds alone. The major item recurrent cost in fish production is feed. This alone has progressively taken the larger shares of the cost of production so that the total feed cost account for over 60 percent of total production cost (Balogun et al, 1992) and

can sometimes negate the economic viability of a farm if suitable feeds are not used (NRC, 1993).

Costs – returns and profit ability Analysis

The profitability of any business can be deduced from the relationship between cost incurred in running the farm business and the returns accruing to it, Adegeye and Dittoh, (1985). The costs and returns associated with fish production in the survey area are presented in Table3. From the table, the mean total variable cost was estimated at the sum of N193, 029.39 (USD $1286.86), while the mean total cost was put at N663, 984.95 (USD $4426.57) and total cost was put at N777,474.45 (USD $5183.16). The total revenue was N849, 217.03 (USD $5661.45) and mean total margin was N610, 727.12 (USD $4071.51). While return on every naira invested of N0.08 (USD $0.001) is positive indicating a profit from the vocation. The relative low value in profitability could be due to high cost of feeds. However farmers can make more profit if there is increase in the efficiency of use of variable inputs especially the feeds.

Socio-economic factors influencing output of fish farmers.

Table4 shows the results of socio economic factors influencing output of fish farmers in the study area. From the results, the co-efficient of the variables year of education, household size, farm size, year of fish farming experience, type of fish culture, type of feed used and number of labour used are significant and positive in the determination of level of fish output. This shows a direct relationship between all these variables and the output level, which implies that increase in the level of education, household size, farm size, year of fish farming experience, type of fish culture, type of feed used and number of labour used will increase the level of fish out in the study area. Result of the analysis also gave an R-value of 0.952 which point to the fact that there exists a strong positive correlation between output of fish farmers and the variables considered by the model used. The R^2 value was found to be 0.906 which means that 90.6% of the variation in Y can be explained by the regression equation. This is an indication that parameters featured in the model are relevant and gives the model a good fit.

CONCLUSION AND RECOMMENDATIONS.

This analysis indicated sufficient incentive for further pursuit of fish farming in Epe Local GA of Lagos State. The cost-return analysis indicated that the fish farming activities were economically viable. However, results obtain from the regression analysis indicated that output from vocation is determined by the level of education, farm size, fish farming experience, household size, type of feed used, fish species culture and number of labour used.

Based on the results the following recommendations are made:

1. Government should provide credit facilities and necessary inputs at subsidize rates for fish farmers to improve their productivity
2. Fish farmers should increase their yield and income by expansion of their farms

Table 1: Socio-Economic Characteristics of Small-scale fish farmers (n=100)

Description	Freq.	Percent
Sex		
Male	90	90.0
Female	10	10.0
Age (Years)		
Below 30	0	0.0
31 – 40	32	32.0
41 – 50	68	68.0
51 – 60	0	0.0
Level of Education		
No formal education	4	4.0
Primary	8	8.0
Secondary	88	88.0
Tertiary	0	0.0
Marital Status		
Single	20	20.0
Married	74	74.0
Widow	6	6.0
Religion		
Christianity	36	36.0
Islam	64	64.0
Household size		
1-5	39	39.0
6-10	61	61.0
Experience (Years)		
1-5	20	20.0
6-10	30	30.0
11-15	50	50.0
Membership of Cooperative		
Co-operator	56	56.0
Mon-cooperator	46	44.0

Table 2: Culture Practices and Management Techniques

Description	Freq.	Percent
Water Source		
Underground water	72	72.0
Lagoon	28	28.0
Type of fish cultured		
Clarias gariepinus	63	63.0
Tilapia spp	20	20.0
Tilapia spp. And clarias spp.	10	10.0
Chrysichthys spp.	7	7.0
Type of feed used		
Compounded feed	5	5.0
Commercial feed	2	2.0
Both	93	93.0
Type of labour used		
Family labour	64	64.0
Hired labour	27	27.0
Both	9	9.0

Table 3: Cost-returned and profitability analysis of the respondents on output of fish in Epe LGA

Variable	Minimum (₦)	Maximum (₦)	Mean (₦)	St.d deviation (₦)
TOTAL REVENUE (TR)	397, 821.00	2, 025, 000.00	849, 217.03	227.47
TOTAL VARIABLE COST (TVC)	50, 113.21	490, 000.00	193, 029.39	45.15
TOTAL FIXED COST (TFC)	161, 839.63	1, 750, 000.00	663, 984.95	253.60
TOTAL COST = (TVC + TFC)	231, 221.11	2, 240, 000.00	77, 474.45	198.02
NET INCOME (NI) (TR – TC)	260, 000.00	782, 800.00	71, 742.58	129.65
TOTAL GROSS MARGIN (TGM)	411, 239.61	1, 535, 000.00	610, 727.12	168.52

Profitability Index PI = NI/TR = N0.08
Rate of Returns on Investment (RRI) = NI/TC x 100 = 92.60%
Rate of Returns on variable Cost (RRVC) = TR – TFC/ TVC = 96%
Operating Ratio (O.R) = TVC/TR = 0.23

Table 4: Regression Analysis showing the Determinant of Output of Fish Farmers Activities among the respondents in the study area.

Variables	Coefficient B	Std. Error	Beta	T-Value	Sig
Age	-1182771.518	2018795.388	-864	-.586	.560
Education	-370952.381	711140.213	.269	2.569	.603
Household size	-57151.344	267456.533	-.044	1.737	.831
Fishing experience	-437970.855	516819.037	-.791	2.847	.399
Type of fish culture	-677177.613	721905.477	-.828	1.938	.351
Type of feed used	3440.986	7087.127	.017	2.486	.629
Type of labour used	-916.501	8803.365	-.004	1.904	.917
Uses of the loan	-83.134	7296.569	.000	-.011	.991
Total loan obtained five years ago	7378.439	9910.985	.037	.744	.459
Number of labour	-3.811	2.979	-.504	-1.279	.204
	103402.709	42171.846	.119	2.452	.016 .520

R=0.952
R^2= 0.906
Adj. R^2= 0.889

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ASSESSMENT OF THE TRAINING NEEDS OF POULTRY FARMERS IN OVIA & OREDO LOCAL GOVERNMENT AREAS OF EDO STATE, NIGERIA.

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ABSTRACT

This study assessed the training needs of poultry farmers in Ovia and Oredo Local Government Areas of Edo State, Nigeria. Snowball technique was used in locating the 70 small scale poultry farmers from Nifor, Oko-ADP, Oluku and Isihor communitites in the two Local Government Areas. Data were analysed using descriptive and inferential statistics. Findings indicated that poultry farmers in these communities felt they need more training mostly in the area of disease management practices like drug usage ($\bar{x}$ = 2.43 ± 0.714); vaccination ($\bar{x}$ = 2.37 ± 0.726); health management practices like debeaking ($\bar{x}$ = 2.01 ± 0.712) and other management variables like poultry house construction techniques and floor spacing. The findings of this study depict that there are insufficient training exposure of the farmers to the management activities considered in the study. Drug usage as a disease management practice recorded close zero level training exposure among the poultry farmers. For effective poultry production, farmers in these LGAs need to be exposed to good, modern training in appropriate usage of drugs before, during and after disease outbreak on their farms. There was a positive and significant association between the respondents' farm size and their training needs (Chi ^{2} = 12.572, $p < 0.01$).

The panacea suggested is efficient extension services rendered by competent extension agents who are also versatile subject matter specialists (SMS), NGO and university researchers all of who should be backed by good government policy and assistance to these stakeholders.

Key words: Assessment, Training needs, Poultry Farmers.

INTRODUCTION

Training in relation to agriculture, and extension in particular entails the acquisition of knowledge, skills and modifies the behavioural attitude of an average farmer so that he/she can effectively and efficiently carry out farm practices for improved productivity and sustainable agriculture. Ajayi (2008) and Bernadin (2003) posited that training is the acquisition of specific and necessary skills which will assist in performing a job better (proficiency), and improving a farmers performance on a current job and related activities, through changes in specific knowledge, skill, attitudes or behaviours. Training is an arranged effort at behavioural change and could be through short courses, conferences, workshops, seminars, field trips (Agbamu, 2004). The trainer thus employs a training method or strategy to deliver the content of the curriculum in such a way that the trainees will achieve the objectives of the training (Wentling, 1992). Training is far beyond cognitive skill acquisition of facts, methods and information. Rather, it includes the interaction with real farm situations where such knowledge and attitudinal changes are applied in getting the desired results and outputs. Training by extension agents must take care of the felt-training needs of the practicing farmers. Oloruntoba (2001) opined that the primary requirement of a cost-effective and apt training is that it must meet an identified ''felt need'' rather than an imagined or assumed need or problem. Ajayi and Laogun (1999) suggested that the prioritization of training needs should commence with the categorization of needs into felt and unfelt needs with the felt needs ranking highest on the priority scale. The unfelt but important training needs and those expressed by only a small proportion of the trainees should be included in the training exercise only after meeting the highly ranked ones. Prioritizing training needs would not be difficult if the planning is participatory from the onset (i. e. from the planning phase). Wentling (1992) is of the opinion that after successfully assessing the training needs, the trainer has to choose the appropriate method to use having being guided by the learning objectives, the content, the trainee and the practical requirements . He further noted that the choice of the method is guided by the extent to which the method does any of the following:

(a) allows the learners to actively participate;
(b) motivates the learner to make their own personal improvement efforts;
(c) provides a feedback to the learners;
(d) giving a form of reinforcement to the learners for any form of appropriate behaviour they exhibit as learners;
(e) helping the learners to increase their willingness to change;

(f) providing the learners with enabling environment (e. g. opportunity) to practice and repeat what they have learnt if need be;
(g) helping the trainees or learners to effectively transfer their learning from training to the job situation.

Chicken has dominated the poultry industry more than other breeds of poultry (like turkey, geese, duck etc) because of the ease of rearing, highly prolific and high turn-over rate at a shorter maturity period. Poultry birds like chickens have better protein conversion rate than other farm animals hence they are more highly rated than other livestock. Poultry eggs rank second to cow milk in terms of nutritive values and rich protein content and its white meat has low cholesterol content. Large scale investment in poultry bird production could therefore assist the Nigerian government in increasing its animal protein sources so as to attain the desired protein output and thereby be able to meet the FAO recommended protein intake of greater than 44grams /person/day.

Protagonists of human welfare approach have always argued that the behaviour of people at a particular moment is usually determined by their strongest needs. These needs are usually significant to the policy makers who have to understand the common needs of the people they are serving (their clientele). Most people need a positive evaluation of themselves that is based on reality of recognition and respect from others. The satisfaction of these needs produces feelings of self-confidence, prestige, power and control. At this level, people usually feel that they are useful and have some effects on their environment. Once esteem needs are adequately satisfied, self-actualization needs become more important. Self-actualization is the need to maximise one's potential, whatever this may be. Self-actualization is the desire to become what one is capable of becoming. According to Greiner and Cummings (2005), the need for self-actualization or fulfillment is an inherent potential of individuals to pursue what he or she is likely to achieve under conditions of openness and personal recognition. Todaro and Smith (2003) also had similar discussion on the hierarchy of needs as related to development. While this framework may not apply universally, it may to an appreciable extent, reflect in reality the common welfare needs of people in most developing countries. However, in most developing countries, attention tends to be devoted to satisfying physiological and safety needs. Maslow's framework therefore plays a useful role in predicting that the majority of people in developing countries will likely be having unfulfilled needs. Also, Maslow's hierarchy of human needs contribute to the new ideas and concepts about a bottom-up development model; which among others is predicated on the use of local resources, agricultural production in creating rural diversified employment for large number of people. These can strongly be enhanced by meeting the needs of rural farmers, particularly in their specific fields or areas of production.

The most relevant lesson for Nigeria and indeed developing countries to learn from the new development strategy is the understanding that development should start from below (from the majority). As stressed in Uzoigwe (2009) resources should be channeled into those areas or those things that will benefit the majority, those areas that employ more of the majority, and those areas that have potentials of employing the majority without necessarily neglecting other important sectors. Development is for man and should start from man for the provision of his basic needs, food, shelter, clothing, health and education. Development should also include the promotion of gender equality and the empowerment of women, environmental sustainability and pursuing policy programmes that would reverse the loss of environmental resources.

George (2006) identified three different types of rural settlements, namely; (i) isolated or dispersed type of settlement (ii) nucleated rural settlement, which encourages effective cooperation in the development process and abound in the South-Eastern and Western Nigeria. According to him the arrangement of this type of settlement helps to facilitate the provision of roads, electrification, education & other modern infrastructures among the settlers (iii) colonial type of settlement which are mirror copy of settlements of the colonial masters (i.e. of developing countries). Such settlements are dictated and motivated by the socio-cultural and traditional ways of life of the colonialists. A developing country like Nigeria is in dire need to catch up fast with the rest of the developed world in poultry production hence the importance of training in poultry production in the rural Nigeria which constitute majority of the farming population is enormous. Such moves will provide better sanitation, improved hygiene and provide technology across in such a way that, as a whole it would improve the longevity and quality of life of rural dwellers, and allow them to participate and contribute to the rural economies. Therefore, the training of rural agricultural poultry farmers and other livestock farmers is a measurable input factor which can influence the potent Nigeria's rural economy and lead to increased economic development in Nigeria.

The spate of joblessness in Nigerian has led so many unskilled people to join the poultry business at either the medium and small scale level (specializing in poultry products like eggs, chickens, turkeys, geese, ducks for poultry meat; breeders chicken or layers etc). However, their

lack of the working experience and valuable training needed for successful poultry management is reflected by the persistently low productivity over the years and the inability to still meet the recommended protein intake per day per person as advocated by the FAO. Thus there is the need to ascertain the abilities of the poultry farmers, diagnose their training needs with a view to exposing them to efficient techniques and cost effective management practices.

The study therefore aimed at assessing the training needs of poultry farmers in Ovia and Oredo Local Government Areas (LGA) of Edo State, Nigeria and specific objectives were to:

- examine selected socio-economic characteristics of the poultry farmers;
- ascertain the type of training the poultry farmers were exposed to;
- determine the areas of training needs by the poultry farmers and;
- identify constraints associated with having training by the poultry farmers.
- to test the null hypothesis that there is no significant relationship between some selected respondents' socio-economic or professional characteristics and their perceived areas of training needs.

METHODOLOGY

The study was conducted in Ovia and Oredo Local Government Areas of Edo state, Nigeria due to the preponderance of poultry farmers in the Local Government Areas. The areas have bimodal rainfall pattern with peak rainfalls around July and September and a break in August. The population studied comprises small scale poultry farmers in the two local government areas. Snowball technique was used to generate the population from which seventy (70) small scale poultry farmers from Oluku, NIFOR, Oko-ADP and Isihor were randomly selected. A structured questionnaire which was content and construct validated was used by the researchers to elicit information from the respondents (by either giving respondents). The questionnaire had sections on socio-economic characteristics, training exposure and training needs of the respondents. In ascertaining the training needs of the poultry farmers, the items covered aspects of disease management practices like drug administration and health management practices cleanliness. Borich's Need Assessment Model (1980) was adopted in ranking the perceived training needs of the poultry farmers in not less than fourteen (14) competencies or activities related to poultry management. The researchers and two trained assistants administered the questionnaire or interview guide to the respondents and retrieved them immediately. Mean, standard deviation, frequencies and percentages were the descriptive statistics used, while correlation coefficient and Chi-square analysis were used in testing the generated hypothesis.

RESULTS AND DISCUSSION

Socio-economic characteristics of respondents:

The socio-economic characteristics of poultry farmers used in this study are depicted in Table 1.

Table 1: Socio-economic characteristics of poultry farmers in the study area

Socio – economic variables	Freq.	Percent
Age		
50 years and above	11	15.71
40 – 49 years	23	32.86
30 – 39 years	26	37.14
20 – 29 years	10	14.29
Gender		
Male	35	50.00
Female	35	50.00
Marital Status		
Single	10	14.29
Married	59	84.29
Divorced	01	1.42
Educational level		
Primary	04	5.71
Secondary	08	11.42
NCE / OND	19	27.14 c
B.Sc and above	39	55.71 b
Years engaged in production		
21 years and above	04	5.71
11 – 20 years	17	24.29 e
6 – 10 years	30	42.86 e
Less than 5 years	19	27.14
Poultry size		
2,001 and above	09	12.86
1,001 – 2,000	12	17.14 }d
501 – 1,000	25	35.71 }d
Less than 500	24	34.29
Occupation		
Farming	18	25.71
Trading	16	22.86
Civil Service & others	36	51.43 a
Source of labour		
Hired labour	25	35.71
Family labour	27	38.58
Personal labour	18	25.71

Findings indicate that 82.85% of the poultry farmers in these areas are highly educated with 55.71 % [b] having B.Sc degree and above, 27.14 % [c] being NCE/OND degree holders, 11.42 % of them having at least secondary school education. A very small proportion of them (5.71%) have as low as primary education which is almost like being illiterates. A majority of fifty one point four three percent (51.43% [a]) of the poultry farmers in the study areas are civil servants or government workers while the others such as 25.71 % and 22.86 % are engaged in other aspects of farming and trading (respectively) in addition to poultry keeping. This indicates that poultry business in these areas is dominated by educated people. Also, 52.85% of the respondents are medium scale poultry farmers with a poultry size of 501 –

2,000 birds with 42.86% having between 6 – 10 years experience in poultry keeping. This records a slight improvement over what obtained at the inception of poultry production in Nigeria as recorded by Adejoro (2000), who posited that a mean value of 45% of the poultry farmers were medium scale (MS) and small scale (SS) holders with bird population of 1,001 – 2,000 birds. Results further revealed that 70 % of the poultry farmers in these areas fall within the age range of 30 – 49 years while only 15.71% are of the ages 50 years and above. The ages 30 – 49 years constitute the active phase of an individual when he/she can conveniently accommodate and tolerate adding extra activities to compliment the normal source of income. This is agreement with UNAIDS (2001) where it was postulated that ages 25 – 45 years is the economically productive age for humans when (s)he is expected to play the role of a care-giver, and nurturer in families and communities. This implies that poultry production in the study areas is dominated mostly by individuals in their active production age of 30 – 49 years.

Types of training poultry farmers were previously exposed to

Findings in Table 2 indicate that the poultry farmers ($\bar{x}$ = 2.23 ± 0.714) and ($\bar{x}$ = 1.94 ± 0.84) had at one time or the other received training on vaccination of birds and feeding of birds respectively. This finding may be adduced for the fact that issues relating to feeding and vaccination of birds are germane in any poultry business. This is so because feeding cost contributes a lot to the running cost of any poultry enterprise as corroborated by Adejoro (2000) who posited that feed cost represents the major or largest cost of input into poultry operation in that it accounts for more than 70 % of the production cost.. Also, the poultry farmer might have availed themselves of the rudiments of vaccination in order to prevent disease outbreak that is a major contributor to the failure of poultry business. However, these poultry farmers had close to no previous training on drug usage, floor spacing and construction of poultry pens.

Table 2: Training exposures of poultry farmers

Categories of Activities	Mean	Standard Deviation
Routine Management Practices:		
a) Provision of Warmth	1.81	0.82
b) Provision of Water	1.91	0.86
c) Feeding of Birds	1.94**	0.84
Production Management Practices:		
a) Culling of Birds	1.64	0.78
b) Egg Collection	1.81	0.89
Public/Health Practices:		
a) Cleaning of poultry house	1.70	0.78
b) Washing of Drinkers	1.80	0.86
c) Use of footbath	1.76	0.85
d) Debeaking	1.79	0.77
Disease Management Practices:		
a) Vaccination	2.23**	0.74
b) Deworming	1.81	0.74
c) Drug Usage	1.01	0.32
Others:		
a) Floor spacing	1.21	0.62
b) Construction of Poultry Pen	1.51	0.40

Scale: Strongly Needed =3, Needed = 2, Partially Needed =1 and Not Needed = 0

Training needs of poultry farmers

In spite of the previous training exposures the poultry farmers in Ovia & Oredo have had in vaccination etc (as shown in Table 2), the farmers still perceive or see themselves as deficient in some areas as depicted in Table 3 and would therefore need more training in them, to be effective in their production activities. Borich's model (1980) was adopted in ranking the perceived training needs of the poultry farmers using fourteen competencies associated with poultry management (Table 3). A higher mean indicates a greater training need. The ranks, mean & standard deviation of the fourteen competencies or activities as found with the Ovia & Oredo poultry farmers are tabulated below in Table 3.

Table 3: Categories of activities the poultry farmers require more training (Training Needs).

Competencies or activities	Rank	Mean	Standard Deviation
Drug Usage	1	2.43	0.71
Vaccination of birds	2	2.37	0.72
Floor spacing	3	2.03	0.74
Construction of P.Pen	4	2.01	0.78
Debeaking	5	2.01	0.71
Deworming	6	1.96	0.73
Feeding of birds	7	1.93	0.82
Provision of water	8	1.91	0.86
Provision of warmth	9	1.79	0.75
Culling of birds	10	1.69	0.73
Use of foot-bath	11	1.64	0.76
Washing of drinkers	12	1.58	0.78
Cleaning of P. House	13	1.55	0.68
Egg Collection	14	1.47	0.82

The highest training needs being in (i) drug usage ($\bar{x}$ = 2.43 ± 0.71), followed by (ii) vaccination in terms of technological details, requirement, dosage etc ($\bar{x}$ = 2.374 ± 0.72) and floor spacing management ($\bar{x}$ = 2.03 ± 0.74). The topmost six in their ranking are related to disease management and housing problems or needs. The high ranking given to these variables indicate that the poultry farmers in these areas recognize the inadequate training they possess in these important activities (which had been neglected in their earlier training exposures as discussed under Table 2) and felt they still needed training or re-training in them. In order words, these are the farmers' areas of felt needs with regards to poultry production. This implies that any extension service programmes packaged for the respondents must be planned along these areas in order to stimulate the cooperation or participation of the farmers. Results further revealed that the farmers have minimal needs for training in culling of birds ($\bar{x}$ = 1.69 ± 0.73), the use of footbath ($\bar{x}$ = 1.64 ± 0.76), with the least training needs in egg collection ($\bar{x}$ = 1.47± 0.82) procedure. These findings may be adduced to as the evidence of the importance the poultry farmers in Ovia and Oredo LGA attach to these management practices.

Constraints to poultry production in the study area

Table 4 below provides the ranks, mean and standard deviation of the perceived constraints to poultry production by the poultry farmers in the study areas. The barriers to the production scores range from a mean of 1.68 t0 a mean of 4.39. The highest were from (i) Finance, in terms of ease of accessibility to credit facilities ($\bar{x}$ = 4.39 ± 1.14), (ii) high cost and quality of feed with concomitant reduction in feed quality ($\bar{x}$ = 4.34± 1.16) and (iii) vaccination issues in terms of cost, type, programming etc ($\bar{x}$ = 3.71± 1.37) as indicated in table. Other areas in which the farmers need training and which is note-worthy is in the area of waste disposal ranking 5th on the list with ($\bar{x}$ = 3.49 ± 1.53). Poultry farming requires a huge capital outlay especially when modern equipment is deployed in the production activities. The cost and quality of feeding materials are also major constraints to poultry production not only in the study area but the nation in general.

Table 4: Constraints faced by poultry farmers

Activities	Rank	Mean	Standard Deviation
Finance (e g Ease of access to Credit)	1	4.39	1.14
High Cost & Poor Quality of Feeds	2	4.34	1.16
Vaccination	3	3.71	1.37
Lack of equipment	4	3.60	1.24
*Waste disposal	5	3.49	1.53
Inadequate storage method/ strategy	6	3.33	1.43
Stocking density(Breeding space)	7	3.11	1.22
Transport problems	8	3.06	1.37
Purchase of birds	9	2.93	1.49
Lack of Information about livestock extension activities	10	2.91	1.44
Farness of extension training site from farmers location	11	1.86	1.17
Marketing	12	2.64	1.37
Difficulty in getting land to use.	13	1.68	1.08

Scale range (1-4):4=Strongly Agree;3=Agree;2=Disagree1=Strongly Disagree

Test of hypothesis:

The 5th objective of the study was to determine the relationship between three selected characteristics of the poultry farmers and their perceived area of training needs. An overall training need score was computed for each of the identified domains of training needs (--- they are five in number serving as the composite need areas in this survey). The obtained mean scores were treated as interval data and used to calculate the correlation coefficient (r) values of each of the composite need areas in relationship with (i) farm size, (ii) cognate experience (in years) in poultry farming and (iii) type of labour/quantity of labour in use (in Table 5).

Extremely high association/ correlation exist between the farm size and demands for training in vaccination(r = 0.67) and drug usage (r = 0.90) as shown in Table 5 respectively, although there is negligible association between farm size and training needs in waste disposal (r = 0.40). This indicates that the larger the farm size, the more willing or desirous the farmer would be in demanding for training himself or herself and his/her workers in disease control measures like drug usage, vaccinations etc which are all curative measures. The result also reveals that there is the

neglect of the prophylactic approach to disease control by the poultry farmers in Ovia & Oredo because there is poor recognition given to biosecurity issues like waste disposal management (r = 0.40) which are preventive measures that could greatly reduce disease outbreaks if taken serious and properly addressed. This portends a great and latent danger for the poultry industry in future.

Table 5: Correlation coefficient (r) of three selected independent variables of the poultry farmers and five domains / areas of training needs.

	Correl ation Coefficient (r)		
Areas of Training Needs as perceived by the farmer	**Farm Size**	**Cognate experience in poultry farming**	**Labour type/ Quantity in use**
Vaccination programming	0.67	0.42	-0.80
Drug Usage	0.90	-0.60	-0.60
Waste Disposal	0.40	0.15	-0.12
Ease of Accessibility to credit facilities	0.11	0.59	0.10
Exposure to extension services	-0.80	- 0.70	0.60

Table 6: Relationship between these Poultry Farmer's Characteristics and Training Needs.

Variables	**Chi – square (χ^2)**	**P – level**	**Decision**
Farm Size: Number of Birds	12.572	0.01	Significant
Professional Profiles:			
(a)No of years of involvement in poultry farming.	2.192	0.53	N. S
(b)Source of labour (type / quantity)	3.595	0.57	N. S
Educational profiles: Educational Level	1.738	0.62	N. S

However, when all the composite training need domains considered are taken together and related to farm size as in Table 6, a significant relationship (Chi ^{2} = 12.57, $p < 0.05$) was obtained. This still corroborate the fact stated earlier that the the size of the poultry farm influences the training need requirement or the farmer. The larger the farm size, the more the need for the regular training of the staff.

Again, Table 5 shows that when the domains are taken in isolation or singly, the association is different. For instance, the higher the cognate experience (in terms years of management experience) there is the tendency to experience less demand for training in drug usage and demand for extension services as found with r = - 0.60 and r = - 0.70 respectively (in this study) among the Oredo & Ovia farmers, although when all the training need domains were compositely correlated with the years of experience in poultry farming, there was found to be a non significant relationship. The reason for the former finding could perhaps be attributed to the " self – medication syndrome" peculiar to Africans/ Nigerians where knowledge or use of previous medication to current ailment is done on the basis of similarity of events. Because of the many years on the poultry farm practice, the farmer could be tempted to transfer the knowledge of previous livestock disease treatment to current disease outbreak without consulting any veterinarian.

When exposure to extension service was associated with farm size and cognate years of experience, correlation values of r = -0.80 and – 0.70 were obtained respectively. This suggests that poultry farmers in the study area feel that the larger their farm size & the more the number of years they have spent in poultry production, the less their need for extension services. Such notions, and challenges as this, are what the poultry industry and stakeholders must endeavour to address and correct.

The implication of all the findings in this study therefore is that the growth of the poultry farms in Oredo & Ovia LGA (in terms of increased productivity & sustainability) and by extrapolation, to Nigeria, is only visible when supported with regular exposure of the farmers, poultry attendants, associated stakeholders etc to adequate training in all the facets treated in this survey.

CONCLUSION AND RECOMMENDATIONS

Results from this study have established that training and retraining is essential in poultry industry as new challenges come up from time to time. The major areas where the poultry farmers in Ovia and Oredo require training are in management practices such as drug usage, vaccination and floor spacing management. The study also established that these farmers face financial and barriers of high cost of feeds and quality of feeding materials. Based on the finding of this study the following recommendations are made:

(1) the extension agents should organize regular training for the poultry farmers in the management practices areas. The extension

programmes so organized will be effective if focused on the training needs indentified by the farmers themselves.

(2) even farmers with many years of experience in the poultry business still need retraining in some management practices. For example, exposure of these poultry farmers to a cost effective strategy on good hygiene programme which will disallow or minimise diseases in the poultry flock should be a constant feature or programme from agricultural institution, competent animal scientists and extension agents in the state. The ADP in this state must be motivated to improve on their services particularly in the area of livestock extension services. For instance, a well designed vaccination programme by veterinarians; nutritional and hygiene programme such as the use of highly effective disinfectants, foot – dips etc orchestrated and propagated by competent extension agents, animal scientists and veterinarians at the cell levels are necessary. It is only a healthy chick managed under conducive environment, balanced diets and proper management that will produce optimally. Since health is of paramount importance to productivity in birds, good hygiene standard will result in low dependence on drug, hence enabling the birds to achieve the desired management goals in terms of feed conversion, live weight, livability and productivity. A livability of 0.96 – 0.99 is ideal.

(3) The exposure (through training, workshops etc) of these poultry farmers to some essential bio - security issues like dead bird carcass disposition through the use of modern incinerators should be encouraged. In fact, it is more advisable and profitable for medium and small scale poultry farmer to seek for more training in preventive disease control measures like these which would forestall disease outbreak than curative disease measures which can only be applied when the 'did' would have been done. That is most of the animals must have suffered mortality.

(4) Training on how to source for financial assistance either as bank loans, cooperative efforts or groups, agricultural credit schemes or funds with minimal loan interest is also essential for poultry farmers.

(5) Poultry farmers need to be trained in modern feed formulation technologies at reduced costs, using locally available materials.

(6) They also need to be exposed to strategies on reduction of cost of production such as integrated farming that advocates '' zero tolerance to wastages in farming''.

(7) Extension departments of the Ministry of Agriculture in Edo state will find this research information useful as to how to prioritize the services to be rendered to these poultry farmers and perhaps to the nation at large.

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DISTRIBUTION AND CHEMICAL COMPOSITION OF BROWSE PLANTS OF EGBADO NORTH RANGELAND

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ABSTRACT

Four herds of cattle were used to investigate the distribution and chemical composition of browse plants in Egbado North of Ogun State. The results showed that a wide variety of browse plants abound-trees and shrubs. *Glyricidia sepium* and *Ficus exasperata* were the most frequent trees while *Manihot utilissima* was the most frequent shrub. They all had high dry matter (%DM), crude protein (%CP), calcium (Ca) and phosphorus (P) but low crude fibre (%CF). Since they are available all year round they present a good source of dry season feeds.

Keywords: Cattle, browse plants, distribution, chemical composition.

INTRODUCTION

Most forage species in Nigeria are annuals and their productive lives terminate with the end of wet season. The perennials particularly the grasses support livestock adequately until they become stemmy and highly fibrous. Hence by the end of the wet season and during dry season, animals shift from grasses to browse plants (Adu et. al. 1990). Browse plants constitute an abundant biomass in farmland, bush fallow and forest in the tropical environment in South West Nigeria. Their year round evergreen presentation and nutritional abundance provide for year round fodder (Oji and Isilebo, 2002). Also, browse have been reported to provide high level of crude protein, vitamin and mineral elements which are mostly lacking in grassland pastures (Fadiyimu and Alokan, 2007).

Their nature also enables standing feed reserve to be built so that herds can survive critical period of drought without remarkable losses (Udoh and Adamu- Nona, 2002).

The Egbado division of Ogun State comprises of Egbado-North and South local government areas. In this division, the vegetation is mostly derived savannah type with relics of forest particularly in Egbado North local government area (Oyenuga, 1967). Yet the area supports about 85% of ruminant animals in Ogun State. During dry season, the productivity of these animals is severely limited by poor feeding which is accentuated by feed scarcity, fluctuation in quantity and quality inspite of abundant shrubs and multipurpose trees that abound in the wild whose nutritional values are unknown, hence this study.

MATERIALS AND METHODS

Study Area

The study was carried out in Ayetoro, Olodo, Igan-Okoto and Imasai areas of Egbado North local government of Ogun State. Egbado North is in the South West Nigeria in a derived savanna ecological zone. These locations were purposely chosen based on availability of large herds of cattle and abundance of relatively high varieties of browse plants that can possibly be used as fodder. The study was conducted between November 2008 and March 2009- a period between the end of wet and dry seasons in Ogun State.

Experimental Animals

The experimental animals consisted of large herds of cattle in the study areas. In Ayetoro, the University herd which consisted of fifty eight heads of cattle was used for sample collection. At Olodo and Igan-Okoto, two separate herds each consisting of forty eight heads of cattle was used while at Imasai, fifty eight heads of cattle were used for sampling.

Sample Collection

Browse samples were collected at various locations by following the animals while browsing. Samples of browse plants eaten by the cattle were obtained by cutting fresh leaves from the apical portions of branches of such plants using a knife. The collected samples were preserved by placing them in between newspapers and weighed down under a flat surface to prevent shattering of the leaves. The samples were dried in situ under room temperature. Identification and classification of the samples were done at the Department of Pasture and Range Management, University of Agriculture, Abeokuta.

Data Collection

A total of twenty three samples of browse plants were collected and classified into trees and shrubs. Frequency of occurrence of each browse sample in the study areas was determined by partitioning the study areas into sub-units each of $1000m^2$. Ayetoro and Imasai were partitioned into four sub-units each while Olodo and Igan-Okoto each had three sub-units. The frequency of each sample collected was calculated by determining the occurrence of such samples relative to others in the different sub-units of the study area.

Analytical Procedure

Browse plants dried at room temperature were oven dried at 65^0c for 48 hours. Thereafter, they were weighed. The oven dried samples were milled with a hammer mill to pass through 1mm sized screen before analyzing in duplicates. Analysis of the proximate fractions (crude protein, either extract, crude fibre, ash) and gross energy of the samples collected were done using the procedures outlined by the Association of Official Chemists (AOAC, 2000). But Acid Detergent Fibre (ADF) and Neutral Detergent Fibre (ADF) were determined by Van Soest et al (2000) procedures. The minerals were determined by the Atomic Absorption spectroscopy using Atomic Absorption spectrophotometer model 490.

Statistical Analysis

Data were analyzed to determine the frequency of occurrence of the browse plants (trees and shrubs) collected.

RESULTS AND DISCUSSION

Table 1 shows marked variation in the frequency of browse trees in Ayetoro, Olodo, Igan-Okoto and Imasai areas of Egbado North. In the study areas, *Leucaena leucocephala, Glyricidia sepium, Mangifera indica, Terminalia catapa, Anacardium occidentale, Chlophora excelsa, Eleais guinensis, Psidium guajava, Citrus spp, Ficus exasperata, Parkia biglobosa, Acacia spp, Adansonia digitata, Musa sapientum, Bambosa vulgaris* and *Persia Americana* had the highest frequency of 1.0 while *Gmelina arborea* was sparsely distributed in the study areas.

Table 2 shows the frequency distribution of browse shrubs sampled in the study areas. *Manihot utilissima* was the most frequent though not evenly distributed followed by *Sesbania sesban* while *Afzelia africana* was the least evenly distributed. The above findings agreed with Onifade and Agishi (1988) and Aregheore (1996) reports on similar ecological zones in Nigeria. The dry matter (DM) varied from 88.38% in *Citrus spp* to 89.87% in *Adansonia digitata.*

Table 3. This is slightly higher than 88.28-89.79% reported for grasses in this ecological zone, (Babatunde et. al. 2011). All the browse frees had high dry matter indicative of high nutrient that could be available when fed to ruminant animals. The crude protein (%CP) varied from 10.80% in *Ficus exasperata* to 25.61% in *Leucaena leucocephala* which compared with 14-25% reported by Simbaya (2002) for fodder trees in Zambia. The highest crude fibre (%CF) was in *Musa sapientum* while *Leucaena leucocephala* had the least. There seemed to be an inverse relation between (%CP) and (%CF) in the samples. In this study, *Gmelina arborea* had the lowest ether extract (%EE), 3.44% and it was still lower than 4.05% reported for this specie, Abdu et al, (2011) while *Ficus exasperata* had the highest (%EE) which was much higher than 3.46-5.57% reported for this species in the sub-humid agro-climatic zone of Nigeria (Abdul et al, 2011). However, there is marked variation in the ash content of the browse trees, 3.5-16.0% compared with 11.88-14.50% reported for grasses in this zone, Babatunde et al 2011. Also, both the acid detergent fibre (%ADF) and the Neutral Detergent fibre (%NDF) varied markedly and were high.

Table 4 shows the chemical composition of browse shrubs. The DM was generally high, above 88%. The (%CP) was high and it varied from 13.60% in *Gossypium barbadense* and 22.92% in *Afzelina Africana.* In general, the (%CP) was higher than 12-15% reported for shrubs (Simbaya, 2002). Similarly, the (%CF) were uniformly high except *Sesbania sesban*, 21.8% and Cajans cajan, 29.0%. This variation may be due to species differences besides the time of sampling. Expectedly, the (%EE) were uniformly low, all around 4-5% save *Vernonia amygdalina* that was 11%. The shrubs were slightly higher in minerals, ash (4.0-18.9%) than the trees, (3.5-16.0%). The ADF of the samples did not vary markedly, and most shrubs NDF were in a close range save *Sesbania sesban* and *Gossypium barbadense.* Norton (1994) noted that forages with low NDF content were usually of high digestibility.

Table 5 shows the mineral content of the trees sampled in the study areas. Minerals are essential elements that are needed for the normal functioning of the body system. The appropriate ratio of 2:1 Ca and P recommended by ARC (1984) was relatively satisfied in most trees sampled. While the levels of Na, K, Mg, Zn, Cu, Fe, Mn and Bo observed in this study were within the range reported for trees in the dry season (Kearl, 1982).

Similarly, the shrubs in the study areas satisfied ARC (1984) Ca and P ratio of 2:1 while the levels of Na, K, Mg, Zn, Cu, Fe, Mn and Bo were within the range reported for these species.

In both browse trees and shrubs in this study, Ca and K were generally higher than other minerals which agreed with FAO, (1994). Similarly, Osuji (1985) reported that tree forages are potential sources of supplement that could provide an array of minerals and soluble nitrogen for rumen micro-organism; while Le Houerou (1980) concluded from his study that browse contains double amount of energy of dry grass owing to its lower content of fibre.

CONCLUSION

A total of twenty three well distributed browse species were identified in Egbado North. They were mostly tree plants with few shrubs. They all had high dry matter (%DM), crude protein (%CP), calcium (Ca) phosphorus (P) but low crude fibre (%CF). Since they are available all year

round, they present a ready source of supplementary nutrients for ruminants during dry season.

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Table 1: The frequency of browse plants (trees) sampled in Ayetoro, Olodo, Igan-Okoto and Imasai of Egbado North Local Government Area.

	Frequency				
Samples	**Ayetoro**	**Olodo**	**Igan-Okoto**	**Imasai**	**Overall Frequency**
Leucaena leucocephala (Ipil-Ipil)	1.00	----	1.00	0.50	2.50
Glyricidia sepium (Marde De Cacao)	1.00	1.00	1.00	1.00	4.00
Gmelina arborea (Pulp Wood)	0.50	0.33	0.67	0.50	2.10
Mangifera indica (Mango tree)	1.00	1.00	1.00	-----	3.00
Terminalia catapa (Indian Almond)	1.00	----	1.00	1.00	3.00
Parkia biglobosa (African Locust Bean)	----	1.00	1.00	0.75	2.75
Anacardium occidentale (Cashew Tree)	1.00	----	0.67	0.50	2.17
Chlophora excelsa (Iroko)	1.00	1.00	1.00	-----	3.00
Musa sapientum (Plantain Tree)	0.50	0.33	1.00	-----	1.83
Eleais guinensis (Oil Palm Tree)	1.00	----	1.00	1.00	3.00
Acacia spp. (Acacia Tree)	----	1.00	1.00	1.00	3.00
Persia americana (Pear Tree)	----	----	----	1.00	1.00
Psidium guajava (Guava Tree)	1.00	----	1.00	0.50	2.50
Adansonia digitata (Baobab Tree)	----	1.00	----	1.00	2.00
Citrus spp. (Orange)	1.00	1.00	0.67	1.00	3.67
Bambosa vulgaris (Bamboo)	0.75	0.33	1.00	0.25	2.33
Ficus exasperata (Sand Paper Leaf Tree)	1.00	1.00	1.00	1.00	4.00

Table 2: The frequency of browse plants (shrubs) sampled in Ayetoro, Olodo, Igan-Okoto and Imasai of Egbado North Local Government Area.

	Frequency				
Samples	**Ayetoro**	**Olodo**	**Igan-Okoto**	**Imasai**	**Overall Frequency**
Manihot utilissima (Cassava Leaf)	0.25	1.00	0.67	0.25	2.17
Cajanus cajan (Pigeon Pea Tree)	1.00	----	0.33	0.50	1.83
Vernonia amygdalina (Bitter Leaf Tree)	0.25	----	0.67	1.0	1.92
Sesbania sesban (Sesban)	1.00	----	1.00	----	2.00
Gossypium barbadense (Cotton Plant)	----	0.67	----	0.75	1.42
Afzelia Africana (Heamorrhage Plant)	0.25	0.67	----	----	0.92

Table 3: Proximate composition, acid detergent fibre and neutral detergent fibre analysis of sampled trees

Samples	**%DM**	**%CP**	**%CF**	**%EE**	**%Ash**	**%NFE**	**%ADF**	**%NDF**
Leucaena leucocephala	88.70±0.30	25.61±0.28	12.40±0.27	8.20±0.16	4.00±0.65	38.47±0.13	22.04±0.67	62.21±0.12
Glyricidia sepium	88.50±0.55	21.05±0.05	25.00±0.32	6.00±0.18	8.00±0.57	28.45±0.23	24.02±0.32	62.00±0.11
Gmelina arborea	88.68±0.32	20.39±0.66	15.00±0.05	3.44±0.03	16.00±0.20	33.83±0.18	42.72±0.11	64.11±0.44
Mangifera indica	89.13±0.17	17.44±0.43	22.58±0.01	5.84±0.28	11.29±0.27	31.98±0.02	29.62±0.29	63.02±0.66
Terminalia catapa	88.70±0.30	13.00±0.32	22.30±0.32	6.20±0.02	9.50±0.40	37.70±0.26	20.50±0.06	66.72±0.42
Parkia biglobosa	88.95±0.05	2.40±0.16	26.50±0.29	4.30±0.17	7.90±0.28	27.85±0.29	32.80±0.33	62.04±0.31
Anacardium occidentale	88.68±0.32	15.54±0.32	24.80±0.08	6.00±0.01	6.50±0.21	35.83±0.36	25.21±0.11	51.10±0.29
Chlophora excelsa	88.50±0.64	17.73±0.32	12.74±0.29	4.80±0.20	6.54±0.50	46.69±0.33	24.00±0.18	47.12±0.11
Musa sapientum	88.47±0.66	12.50±0.57	31.50±0.26	4.00±0.10	10.50±0.66	29.78±0.40	22.36±0.26	58.42±0.03
Eleais guinensis	89.28±0.02	11.60±0.18	24.20±0.02	3.80±0.18	7.90±0.02	41.78±0.02	23.00±0.52	61.14±0.19
Acacia spp.	89.68±0.04	19.16±0.34	23.80±0.26	6.00±0.26	7.00±0.34	33.72±0.05	36.05±0.17	54.28±0.32
Persia americana	89.03±0.07	20.58±0.02	23.60±0.17	10.00±0.56	8.30±0.01	26.55±0.21	18.04±0.33	43.44±0.01
Psidium guajava	88.72±0.01	18.40±0.60	17.60±0.08	8.50±0.33	3.50±0.36	40.71±0.26	21.16±0.02	50.16±0.01
Adansonia digitata	89.87±0.16	18.00±0.38	21.19±0.23	6.00±0.11	4.80±0.22	39.88±0.04	23.20±0.57	49.00±0.02
Citrus spp.	88.38±0.02	20.14±0.26	29.78±0.12	4.90±0.38	10.00±0.29	23.46±0.32	41.06±0.10	68.17±0.38
Bambosa vulgaris	89.46±0.11	14.70±0.30	16.40±0.10	9.00±0.04	5.60±0.02	43.76±0.14	30.04±0.22	69.11±0.42
Ficus exasperata	89.17±0.03	10.80±0.36	22.40±0.10	14.00±019	12.00±0.11	29.97±0.33	20.57±0.66	72.53±0.32
Range:	88.38-89.87	10.80-25.61	12.40-31.50	3.44-14.00	3.50-16.00	23.46-46.96	18.04-41.06	43.44-72.53

Note: %DM is not on fresh basis but as wilted/air-dried basis

Table 4: Proximate composition, acid detergent fibre and neutral detergent fibre analysis of sampled shrubs

Samples	%DM	%CP	%CF	%EE	%Ash	%NFE	%ADF	%NDF
Manihot utilissima	88.78±0.62	21.80±0.22	15.60±0.66	4.00±0.28	18.40±0.10	29.07±0.47	29.05±0.36	48.36±0.66
Cajanus cajan	89.05±0.45	15.75±0.15	29.00±0.35	5.37±0.03	5.87±0.29	33.06±0.50	37.04±0.06	49.70±0.38
Gossypium barbadense	89.03±0.34	13.60±0.08	15.80±0.67	11.00±0.18	4.00±0.36	44.63±0.29	23.04±0.01	47.11±0.11
Sesbania sesban	89.36±0.04	19.74±0.14	21.80±0.32	5.00±0.32	6.90±0.33	35.92±0.40	32.45±0.43	57.90±0.12
Vernonia amygdalina	88.23±0.16	17.92±0.16	15.40±0.14	5.20±.0.42	12.80±0.08	36.91±0.13	28.98±0.22	63.47±0.80
Afzelia Africana	89.11±0.61	22.92±0.01	16.40±0.27	4.00±0.67	5.90±0.12	39.89±0.20	34.79±0.03	51.10±0.02
Range:	88.23-89.36	13.60-22.92	15.40-21.80	4.00-11.00	4.00-18.40	29.07-44.63	23.04-37.04	47.11-63.47

Note: %DM is not on fresh basis but as wilted/air-dried basis

Table 5: Mineral content (ppm), % (g/1000dm) of browse plant (trees) sampled in Egbado North

Samples	Ca %DM	P %DM	Na %DM	K %DM	Mg %DM	Zn mg/Kg	Cu mg/Kg	Fe mg/Kg	Mn mg/Kg	Bo mg/Kg
Leucaena leucocephala	0.30	0.59	0.38	2.15	0.28	61.45	21.00	130.14	25.62	3.62
Glyricidia sepium	0.31	0.60	0.40	2.14	0.25	60.44	20.18	128.11	26.05	4.01
Gmelina arborea	1.12	0.41	0.03	3.60	0.48	56.11	14.12	300.04	19.98	2.85
Mangifera indica	0.96	0.32	0.03	2.04	0.32	49.95	11.11	300.26	17.96	1.97
Terminalia catapa	2.02	0.51	0.10	3.62	0.49	40.16	12.17	309.11	26.14	4.02
Parkia biglobosa	1.38	0.48	0.25	1.89	0.28	38.99	19.85	289.55	24.84	3.50
Anacardium occidentale	1.96	0.36	0.03	2.65	0.56	57.96	13.04	134.11	21.11	2.04
Chlophora excelsa	0.21	0.40	0.04	2.17	0.52	49.16	14.10	272.05	16.12	2.61
Musa sapientum	1.13	0.40	0.04	2.04	0.41	65.72	14.56	289.75	19.21	2.05
Eleais guinensis	1.12	0.35	0.03	2.11	0.46	57.14	14.62	295.62	20.01	3.96
Acacia spp.	1.20	0.47	0.19	2.87	0.30	52.11	12.17	290.68	19.48	2.59
Persia americana	1.04	0.34	0.03	2.10	0.39	66.21	15.01	291.16	18.93	2.55
Psidium guajava	1.15	0.48	0.03	2.16	0.52	51.19	16.02	300.92	21.11	3.00
Adansonia digitata	1.88	0.38	0.02	1.67	0.48	40.88	13.00	150.77	23.19	2.85
Citrus spp.	2.04	0.15	0.01	0.62	0.24	41.12	14.11	301.11	19.72	2.96
Bambosa vulgaris	1.17	0.50	0.40	3.52	0.46	64.11	15.04	299.16	14.17	2.86
Ficus exasperata	1.10	0.42	0.03	1.97	0.48	57.02	15.41	290.10	19.92	3.98

Table 6: Mineral content (ppm), % (g/1000dm) of browse plant (shrubs) sampled in Egbado North

Samples	Ca %DM	P %DM	Na %DM	K %DM	Mg %DM	Zn mg/Kg	Cu mg/Kg	Fe mg/Kg	Mn mg/Kg	Bo mg/Kg
Manihot utilissima	1.05	0.29	0.04	2.19	0.51	58.99	16.01	130.05	18.62	1.96
Cajanus cajan	0.75	0.36	0.08	2.74	0.48	41.25	16.86	170.17	21.22	4.20
Gossypium barbadense	0.92	0.75	0.20	2.06	0.48	62.11	14.87	287.60	15.00	2.25
Sesbania sesban	1.15	0.48	----	3.04	0.25	51.12	18.04	301.12	23.94	1.96
Vernonia amygdalina	1.98	0.62	0.08	2.91	0.52	41.86	14.11	301.42	21.12	4.96
Afzelia Africana	1.18	0.40	0.05	2.74	0.41	48.96	21.63	304.11	26.16	2.95

FARMERS' CONSTRAINTS TO INCREASED POULTRY PRODUCTION IN OGUN STATE

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ABSTRACT

This study investigated constraints to the increased poultry production in Ogun State.A multistage sampling technique was used to select 120 poultry farmers for the study. Data was collected through the use of interview schedule and analyzed using frequency counts, percentages, means, chi-square and correlation analysis. The results showed that majority (76.67%) of the poultry farmers were male, with a mean age of 37years. Over half (61.66%) of the farmers were Christian. A large proportion (98.33%) had completed one form of formal education or the other. The mean farming experience and household size were 5years and 7persons respectively. The study revealed that over half (52.60%) of the respondents depended solely on personal savings as source of capital. Majority (65.63%) of the poultry farmers were operating at small scale. The respondents indicated high cost of equipment (89.00%), inaccessibility to credit (66.67%) and high cost of feeds (63.33%) as serious constraints to poultry production practices. Significant relationship existed between constraints to increased poultry production and sex (χ^2 = 9.64, p =0.02), educational level (χ^2=7.53; p = 0.03),management system(χ^2 = 9.37; p = 0.04) (age (r=0.81; p = 0.03), farming experience (r=0.74, p = 0.02)and household size(r=0.69,p=0.04) This study recommends that effort must be made to subsidize poultry feed ingredients and poultry equipment to reduce their cost.

Keywords: Constraints, farmers, poultry production

INTRODUCTION

Poultry is a subset of animal production which includes the raising of domesticated birds such as fowls, turkeys, duck, geese and guinea fowl by man purposely as sources of meat, egg and income (Fakoya, 2004). There are two major aspects of poultry production namely the commercial table egg production and meat production otherwise known as broiler production. Poultry production can be grouped into three main categories; they are small scale, medium scale and large scale poultry production (Akeeb, 1997). The rate of growth in poultry is affected by the proportions of the various types of poultry and level of investment in modern poultry production (Likkita, 1999). The development of the poultry industry in Nigeria started in early 1960s with the establishment of modern poultry unit in different areas of the country. Ikpi (1997) observed that in the early 1960s the Nigerian economy witnessed a considerable growth in the poultry industry. Salako (2003) pointed out that; poultry is the only aspect of the livestock industry which has been fully commercialised, contributing both eggs and meat in addition to the immense potentials towards alleviating the protein problem in the diet of most Nigerians.

About 95 percent of the development and expansion in poultry production were concentrated in places such as Lagos and other south-west states. In other states however, local inconveniences or civil unrest were stumbling blocks to the development of the poultry industry. After the civil war (1967-1970) the south-east states were making effort to revive poultry back to pre-war level. The establishment of these poultry units was accompanied by returns to farmers. Recently with the outbreak of avian influenza (bird flu), the poultry industry started declining in profit and a looming unattractiveness of the business.

The importance of poultry to both social and economic development of a nation, particularly in Nigeria cannot be over stressed. Poultry products are highly nutritional and are of enormous economic benefit to man both at home and in the industry. Apart from the meat, poultry egg serves as a good and rich source of animal protein, lipid and vitamin of high biological value to man. Infact, protein from egg are well balanced in amino acid and are used as international standard in nutritional assessment (Likkita, 1999; Olofisanye, 1997; Longe, 1998 and Kekeocha, 2004).

Poultry production can indeed be relied upon in ameliorating the deficit in protein supply of the diet of most Nigerians (Gillman, 2006; Eruvbetine, 1998). In addition, poultry eggs form a major ingredient in the baking industry. Egg yolks are used in manufacturing soaps, paints and shampoo (Salako, 2003). The albumen is used in leather, tanning, textile dying, photography, shampoo and the book binding industry. The egg shells as well as their bone serve as good sources of calcium and phosphorus for livestock feeds; while poultry droppings and maggots are valuable sources of organic manure and good source of feed in fish farming (Hodgkson, 2004). The poultry industry now provides additional income to both the farmer and the government in the supply of raw materials to industry and provides employment to a significant pool of the labour force. Very recently,

though in little quantity, eggs are being exported to neighbouring countries, thus serving as a foreign exchange earner. This important uses and contributions are clear indications of the significance of poultry industry.

Furthermore, the poultry industry is also being faced with a number of problems within the last two decades. Many poultry farms established by both government and individuals have collapsed due to some factors such as the rising cost of feed, high cost of day old chicks, poultry diseases (bird flu) and lack of proper implementation of agricultural policy by government (Ibe, 1999). It is on this background that this research was conducted to look into the farmers' constraints to increased poultry production in Ogun State. In achieving this aim, the following specific objectives were examined to:

1. describe the socio-economic characteristics of poultry farmers in the study area.,
2. identify sources of capital for the poultry farmers,
3. examine the scale of operation and identify major constraints to the increased poultry production in the study area,.
4. assess the poultry management systems of the poultry farmers and
5. determine the significant relationship between the farmers socio-economic characteristics and constraints to poultry production.

METHODOLOGY

The study was conducted in Abeokuta South Local Government Area of Ogun State. The choice of this area is based on the fact that it is one of the six zones of large concentration of poultry production in the State (OGADEP, 2004). The local government has a land area of about 1256km^2 and a population of 374,843 people (NPC, 2006).

A multistage random sampling technique was used for the study. The first stage involved random selection of eight areas (25%) out of thirty-two areas in the study area while the second stage also involved random selection of fifteen poultry farmers (20%) out of seventy farmers from each of the selected areas in the local government area. In all 120 poultry farmers were selected as the sample for the study. These farmers included those who engaged in the production of broilers, cockerels and egg (layers).

Measurement of Variables

The dependent variable is constraints to increased poultry production. These were measured by asking the respondents to indicate as many constraints as they experienced in poultry production and rank them as (1= most serious constraints, 2= more serious constraints, 3 = least serious constraints).

Data Analysis

Descriptive statistics such as frequencies percentages and means were used for presenting data on socio economic characteristics while inferential statistics such as chi-square and Pearson product moment correlation were used to ascertain whether any significant relationships exist between socio-economic characteristics and constraints to increase poultry production.

RESULTS AND DISCUSSION

Table 1 revealed that majority (76.67%) of the respondents were male while (23.33%) were female. It is also evident from Table 1 that (41.67%) of the respondents were less than 30 years while (45.00%) fell within the age range of 31-40 years. Their mean age was 37 years. Majority of the poultry farmers (75.83%) were married which will enhance the use of family labour to help on the farm due to the small scale nature of their poultry business implying that their reception of innovation and idea in poultry business will be easily embraced. Over half of the respondents (61.66%) were Christians. The mean household size was 7 persons. This indicated that more family labour will be readily available for the poultry farmers (Sule et.al, 2002 and Ajayi & Ogba, 2007). The findings revealed that majority (76.67%) of the poultry farmers have been into business for about 6 years with an average poultry farming experience of 5 years. This implies that they have relatively stabilised in the business.

Table 2 revealed the sources of capital for the respondents which refers to the means through which they obtained credit/funds needed to carry out their poultry production. The table also showed that over half of the respondents (52.60%) depended solely on personal savings while 18.33 percent obtained their capital from cooperative societies. Only (6.67%) obtained their capital from banks. Since over half of the respondents depended on their personal savings, the fund they got from their own savings will not be adequate for them to expand their production activities beyond the small scale level that most of them were operating. However very low percentage (6.67%) of farmers had obtained loan from bank this implied that the high interest rate alongside the lack of collateral security would have prevented most farmers from having access to bank loan facilities.

Table 1: Distribution of respondents by their socio-economic characteristics

Variables Categories	Freq.	Percent
Age (years) (mean=37)		
<30	50	41.67
31-40	54	45.00
41-50	10	8.33
51-60	2	1.67
Above 61	4	3.33
Sex		
Male	92	76.67
Female	28	23.33
Marital status	81	75.83
Married	24	20.00
Single	3	2.50
Widowed	2	1.67
Divorced		
Educational level		
No formal education Adult	2	1.67
literacy	6	5.00
Primary education	19	15.83
Secondary education	49	40.33
Tertiary education	44	36.67
Religion		
Christianity	74	61.66
Islam	32	26.67
Traditional	14	11.67
Household size (mean=7persons)		
1-4	51	42.50
5-8	61	50.83
9-12	5	9.17
13-16	2	1.67
Farming experience (mean=5years		
Above 17	1	0.83
1-3	42	35.00
4-6	50	41.67
7-9	12	10.00
Above 10	16	13.33

Table 2: Percentage distribution of respondents by the sources of capital

Sources of capital	Freq	Percent
Family/friends	17	14.17
Bank loans	8	6.67
Cooperative societies	22	18.33
Personal savings	63	52.60
Bank loan and Family/Friends	1	0.83
Family/Friends and Personal savings	4	3.33
Cooperative and Personal Savings	5	4.17

Table 3 revealed the scale of operation of the respondents which was determined by the number of birds they have in their farms. Akeeb (1997) postulated that one can distinguish three types of poultry farming. The small scale farmers are those keeping less than 2000 birds while medium scale are those keeping 2001-5000 birds and large scale farmers are those keeping above 5000 birds. As shown also from the table, majority of the farmers (65.83%) were small scale farmers while over one third (32.50%) were medium scale farmers and only (1.67%) fell within the large scale farmers. This could be due to the fact that most of the farmers had no access to credit facilities from banks and other lending institutions to operate on a large scale operation.

Table 3: Percentage distribution of respondents by scale of operation

Scale of operation (number of birds)	Freq.	Percent
100-500	29	24.17
501-1000	22	18.33
1001-2000	28	23.33
2001-3000	21	17.50
3001-4000	12	10.00
4001-5000	6	5.00
Above 5000	2	1.67

Table 4 indicated that respondents noted as many items as they considered being constraints. When asked to rank their constraints they face in poultry production. Majority of the poultry farmers (80%) ranked high cost of equipment, inaccessibility to credit (66.67%), high cost of feeds (63.33%) and high cost of labour (61.67%) as serious constraints limiting increased poultry production in the study area .These constraints give a picture of the resources needed to embark on poultry production

Table 4: Percentage distribution of constraints to poultry production

Constraints	Freq.	Percent	Rank
High cost of equipment	96	89.00	1st
Inaccessibility to credit	90	66.67	2nd
High cost of feeds	76	63.33	3rd
High cost of labour	74	61.67	4th
Low productivity of birds	72	60.00	5th
Disease and pest problems	69	57.50	6th
Lack of veterinary services	66	55.00	7th
Marketing problem	58	48.33	8th
Poor infrastructure	56	46.67	9th

The chi-square analysis results in Table 5a revealed that there exist a significant relationship between farmers' constraints to increased poultry production and sex (χ^2 = 9.64, p= 0.02), educational level (χ^2 = 7.53, p= 0.03) and management system (χ^2 = 9.37, p= 0.04). The implication is that the respondents who are male with high educational level and more than one management systems are favourably disposed towards poultry production than those that are female with no formal education and engaged in one management system such as battery cage.

Pearson product moment correlation analysis in Table 5b showed that there was a significant relationship between constraints to increased poultry production and household size (r=0.69, P=0.04), age (r=0.82, P=0.03) and farming experience (r=0.74, P=0.02). The implication is that as age, household size and farming experience increased, level of poultry production also increases.

Table 5a: Chi-square analysis of farmers' constraints to increased poultry production

Variables	χ^2 cal	df	P	CC	Decision
Sex	9.64	1	0.02	0.68	S
Marital status	8.42	3	0.17	0.19	NS
Educational level	7.53	4	0.03	0.73	S
Religion	10.46	2	0.24	0.24	NS
Membership in social organization	11.47	2	0.11	0.28	NS
Management system	9.37	2	0.04	0.57	S

Table 5b: Correlation coefficient between some independent variables and constraints to increased poultry production

Variables	r	P	Decision
Age	0.82	0.03	S
Farming experience	0.74	0.02	S
Household size	0.69	0.04	S

CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study it was concluded that majority (65.83%) of poultry farmers in the study area are operating on a small scale as a result of lack of adequate fund to expand their scale of operation. The farmers identified constraints such as high cost of equipment, high cost of feed, inaccessibility to credit, low productivity of bird and high cost of labour as major constraints affecting increased production of their poultry business. Furthermore the relatively high percentage of battery cage users in the study area could be due to the fact that there were more farmers who had the layers type of poultry.

Recommendations

In order to attain the goal of boosting poultry production in the study area, so as to improve the nutritional status of the people, the following recommendations are therefore proffered:

1. Farmers should form themselves into cooperatives. This will facilitate exchange of idea and information necessary to boost their production as well as raising fund to expand their business.
2. Government assistance to poultry farmers should lay emphasis on the regulation and control of loan requirement by banks and other lending institutions.
3. Government should subsidize poultry feed ingredients and poultry equipment to reduce their cost of production. Also local feed ingredients should be encouraged and use of locally available raw material for poultry equipments should be encouraged and boosted.
4. Feed mill should be sited in strategic locations of the study area to cut down feed cost.

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ASSESSMENT OF MINI-LIVESTOCK FARMING IN PERI-URBAN AREAS OF SOUTHWESTERN NIGERIA: IMPLICATION FOR POLICY FORMULATION, FOOD SECURITY AND POVERTY ALLEVIATION.

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ABSTRACT

This study investigated farmers' involvement in mini-livestock farming such as grasscutter rearing, snailry, beekeeping and rabbit-keeping in the peri-urban areas of southwestern Nigeria. The study was conducted in Osun, Ondo and Ekiti States. Multistage sampling procedure was used to select 270 farmers from the three States using snowball sampling technique. Descriptive and inferential statistics were used to analyze the data collected. The results showed that mean age of mini-livestock farmers of Southwestern Nigeria was 52.0 years with high level of awareness but low level of involvement in all the selected mini-livestock rearing. Positive and significant correlation exist between level of involvement of farmers in mini-livestock farming and years of schooling ($r = 0.285$, $p \leq 0.01$); participation in social organization ($r = 0.158$; $p \leq 0.01$); number of information sources ($r = 0.227$; $p \leq 0.05$) and extension contact ($r = 0.225$; $p \leq 0.05$). Also, positive and significant correlation exists between level of involvement and institutional variables such as roles of agricultural research institutes ($r = 0.188$; $p \leq 0.05$), government policy ($r = 0.177$; $p \leq 0.01$) and roles of Agricultural Development Programme ($r = 0.120$; $p \leq 0.05$). Community related variable such as infrastructural facilities ($r = 0.117$; $p \leq 0.05$) had positive and significant relationship with level of involvement. In conclusion, low level of involvement in mini-livestock farming was due to inadequate training of farmers in management practices. The future implication for food security and poverty alleviation is that if farmers are well trained by extension agents, there will be sustainable increase in production.

KEY WORDS: Awareness, extension agent, food security, involvement, management practices, poverty alleviation.

INTRODUCTION

Mini-livestock (micro-livestock) production refers to species of animal that are associated with small body size, moderate nutrition and management (Akinnusi1998). Rearing these types of animals in captivities helps to protect the animals while providing meat and income for peri-urban farmers. Mini-livestock production can be practiced in rural and urban settlements considering its small size, low-cost management requirement and low capital investment. Mini-livestock production is sustainable and can be handled conveniently by women and children. The attributes of mini-livestock gives it the potential of contributing significantly to food security and meeting up the recommended dietary animal protein intake {Barwa, 2009). Furthermore, Akinnusi (1998), Farinde, Soyebo and Oyedokun.(2005), Centre for Biodiversity Utilization and Development 2004, Soyebo and Jibowo (2004), Larry (2006) and Jori (2006) stressed the important of mini-livestock production such as grasscutter, snail, beekeeping and rabbit as sources of livelihood coping strategies among rural, peri-urban and urban farmers . It is a known fact that most of these mini livestock benefits include better household food security, additional income and improved well-being of farmers. For example Snail meat contains 12-16 percent protein, 45-50 mg/kg of Iron, low fat and amino acid which are needed by man. Grasscutter contains about 15 percent of the animal protein. Likewise honey contains carbohydrate, protein, minerals and vitamins. Unfortunately collecting these mini-livestock from the wild is attended by destruction of the environment through the setting of bush fires by hunters (Opara, 2010, NRC, 1991; yeboah and Adamu, 1995; Ntiamo-baidu,1998).

In a bid to increase the income available to peri urban farmers, diversify into other income generating activities which are critical for poverty reduction and to prevent mini-livestock from going into extinction, Agricultural Development Programme of Osun Ondo and Ekiti States introduced mini-livestock to farmers in the peri-urban areas. Even though, the mini livestock and their management practices were claimed to have been introduced to farmers in the peri-urban communities of southwestern Nigeria their level of involvement have not been empirically investigated. The study therefore assessed the level of involvement of peri urban farmers in the

mini-livestock with a view to enhancing ways to sustain the farmer's livelihood.

The main objective of the study was to assess the level of involvement of farmers in the selected mini livestock and their management practices in Peri-Urban areas of southwestern Nigeria.

The specific objectives are to

(a) assess the level of awareness of farmers in the rearing of the mini livestock in the study area,
(b) examine farmers socio-economic characteristics in the study areas
(c) examine the constraint associated with their involvement.

RESEARCH METHODOLOGY

Three states namely Osun, Ondo and Ekiti were purposively sampled in Southwestern Nigeria because extension agents claimed to have disseminated technologies on the mini livestock to peri urban farmers of the states. Multistage sampling procedure was employed to select respondents from the three states. At the first stage, two Local Government Areas (LGAs) were randomly selected from each state making a total of 6 LGAs. These LGAs include Ife East and Ife Central in Osun State, Ondo West and Idanre in Ondo State and Ise/ Orun and Gbonyi in Ekiti State. At the second stage, three peri-urban communities were randomly selected from each of the LGAs based on the list of prevalent communities that are raising mini-livestock collected from the agricultural officers in the state ministry of agriculture, giving a total of 18 communities At the third stage, all the 21 grass cutter farmers in the sampled communities and 10 percent of other selected mini-livestock farmers in each of the 24 communities were purposively selected using snowball sampling technique. A total of 270 respondents were selected and interviewed for the study.

Questionnaire was used to collect relevant quantitative data. Descriptive statistics was used to summarize the data, while mean and standard deviation were used to rank respondents into high and low level of involvement. Pearson Moment Correlation was used to measure relationship between dependent and independent variables.

In order to determine the level of involvement, respondents involvement in mini-livestock farming were rated on three point scale as fully involved (2), partially involved (1) and never (0). Management practices which include production, processing, packaging, storage and marketing were also rated on 3 point scale as fully involved (2), partially involved (1) and never (0). The minimum involvement index was 0 and the maximum score was 72. The grand mean involvement score of each of mini-livestock were calculated from where the level of involvement of peri urban farmers in mini-livestock was determined through categorization as follows: less than grand mean score signifies low level of involvement and scores above grand mean signifies high level of involvement in selected mini-livestock.

RESULTS AND DISCUSSION

The results in Table 1 show that majority (65.7%) of the respondents were between the ages of 31 and 60 years which indicated that majority of the peri-urban farmers in the three states were in their active years of life. The results of this study is in line with the study of Annor and Kusi (2006), which showed that most of the farmers who adopted grasscutter farming in Ghana were adults, followed by the youth and then the aged. Also majority (79.3%) were male, while 20.7 percent were female. The implication of this finding is that low involvement of women mini-livestock may be due to laborious nature of its production. Most of these farmers (93.67%) were married in the three states. However, above average (53.7%) were monogamists while 46.3 percent were Polygynist. The mean number of household size was 8.0 with a standard deviation of 5.4. Almost average (45.3%) had between 6 and 10 household sizes. The small size of household shown by farmers may be due to the fact that majority of them were monogamist because of their education and religious affiliation. The findings buttresses Soyebo's (2005) assertion that the traditional orientation of marrying more than one wife at a time and bearing as many children as possible as a sign of wealth or prestige is constantly fading away among the rural household in the study areas. The results is in variance with (Adesoji, 2009, Teklewold , Dadi , Yami and Dana 2006 and Ogunjimi 2002) claimed that households with more family size are more likely to be adopters than families with lower family size because family members usually serves as a good source of labour for animal production management. The sizes of household shown by farmers may be due to the fact that majority of them did not marry many wives because of their education and religious affiliation.

Table 1:Distribution of respondents according to personal characteristics

Personal characteristics	F	%
Age		
≥30	18	67
31-60	177	65.7
61-and above	75	27.6
Sex		
Male	214	79.3
Female	56	20.7
Marital Status		
Single	7	2.7
Married	253	93.7
Divorced	1	0.3
Widowed	9	3.3
Types of marriage		
Monogamy	145	53.7
Polygyny	125	46.3
Household size		
None	6	2.3
1-5	85	31.3
6-10	122	45.3
11-15	42	15.7
16 and above	15	5.6

Results in Table 2 indicated that majority (61.7%) of the farmers were Christian while 35.0 percent were Muslim. This finding is an indication that Christianity and Islam were the common denominations practiced in the study area. Religion is a predisposing factor since some of the activities mentioned were been used by religion faithful. For example honey was specially used for naming of a new born baby and legitimization of marriage contract during engagement ceremonies. Majority (76.6%) were literate, while 23.3 percent had never been to school. This indicates that farmers can easily comprehend whatsoever they learnt and can read instructions and manuals about feeding, breeding materials and other management practices.

Majority (67.3%) of the respondents indicated they had between 1 and 4 contacts with extension agents in a year to discuss issues concerning mini-livestock and their management practices. The implication of this low extension contact in the study area was that farmers were not well exposed to training on the management practices of the livestock, which may subsequently affect production of the mini-livestock in the study area. The results also show that majority (63.8%) sourced for loan from farmers' cooperative society, which shows the importance of this organization as a good source of financial empowerment to farmers in their various economic lives.

Good percentage (59.7%) of the respondents claimed sourcing information from other farmers, while 48.9 percent got information from radio and 31.8 percent from extension agents. Other farmers were the most reliable source of information due to familiarities among the farmers. The implication of this is that research and extension staff in the institutions may not be enough to ensure that the technologies are continuously been in use.

Table 2: Distribution of respondents according to socio-economic characteristics

Socio-economic characteristics	F	%
Religious Affiliation		
Christianity	166	61.7
Muslim faithful	95	35.0
Traditional religion	9	3.3
Years of schooling		
1-6	86	31.7
7-12	80	29.7
13 years and above	41	15.3
None (never)	63	23.3
Extension contact		
1-4	182	67.3
5-8	18	6.7
9-12	6	2.3
13-16	1	0.3
Not contact	63	23.3
Participation in social organization		
Religious organization	206	476.3
Cooperative association	184	68.3
Thrift society	74	27.4
Fraternal organization	7	2.6
Occupational organization	197	7.3
***Source of information**		
Other farmers	161	59.7
Radio and television	132	48.9
Newspaper	56	20.8
Extension agents	86	31.8
Sale agents	36	13.3
Research institution	42	15.6

*Multiple responses

Results in Table 3 shows that the mean income realized by grasscutter farmers was ₦45, 000 with standard deviation of ₦15,610, whereas the mean annual income of the snail farmers was ₦36, 335 with standard deviation of ₦12,452. Mean annual income of beekeeper was ₦41, 435 with standard deviation of ₦14, 065 and mean annual income realized from sales of rabbits was ₦30, 174 with standard deviation of ₦9, 699. This is an indication that peri-urban farmers realized little money from their involvement in these activities. This might be as a result of the fact that most peri-urban farmers were partially involved in the raising of these mini-livestock and also low level of adoption of technology despite the training received from FRIN and ADP.

Table 3: Mean income realized from selected mini-livestock

Mean income realized from selected mini-livestock	Mean	Standard deviation
Grasscutter	45,000	15.61
Snail farming	36,335	12,452
Beekeeping	41,435	14,062
Rabbit keeping	30,174	9.699

Level of Awareness about the mini livestock:

Mean was used to categorize level of awareness into high and low. Results in Figure 1 show that majority (85.6%) of respondents were aware of grasscutter farming at low level, while 14.4 percent were aware of grasscutter rearing at high level. The level of awareness about snail farming was high (52.9%), while 47.1 percent of farmers had low level of awareness.

Results in Figure 1 also show that average (57.7%) of respondents had high awareness level, while 42.3 percent of respondents' level of awareness was low in beekeeping. Also, about 55 percent of peri-urban farmers had high level of awareness about rabbit keeping, whereas 44.2 percent had low level of awareness.

It could be deduced that most of the peri-urban farmers in Southwestern Nigeria had high awareness level about snail farming, beekeeping and rabbit keeping, while they had low level of awareness about grasscutter farming. This may be due to the inadequate information about the management practices of grasscutter rearing in the study area. The result of the finding is in line with Soyebo (2005) and Imran, Kehinde, Samuel, Adesope, and Akinyemi (2007) who reported that few numbers of respondents were aware that grasscutter could be domesticated. This is an indication that farmers in southwestern Nigeria were aware of domestication of all the mini-livestock.

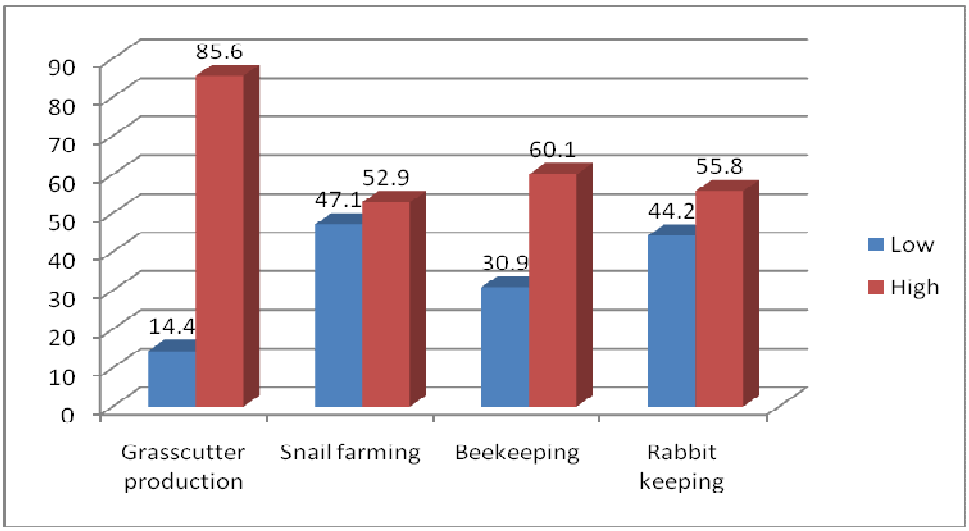


Fig 1: Bar chart showing the distribution of level of awareness of peri-urban farmers in mini-livestock farming

Involvement in mini-livestock : Results in Table 4 show that sizeable percentage (37.8%, 29.6%, 25.2%) were involved in beekeeping, snail rearing and rabbit keeping, respectively. Few (7.4%) of respondents were involved in grasscutter rearing. The findings from this study showed that number of peri-urban farmers that were involved in beekeeping; snail farming and rabbit keeping were more than those farmers rearing grassctters. Low number of farmers rearing grasscutter might be due to inadequate technical–know-how on the management practices.

Table 4: Distribution of peri-urban farmers by their involvement in selected mini-livestock

Selected mini-livestock	F	%
Grasscutter rearing	20	7.4
Snail farming	80	29.6
Beekeeping	102	37.8
Rabbitkeeping	42	25.2

Categorization of level of involvement of peri-urban farmers in mini-livestock

Mean was used to categorize level of involvement into high and low. Data in Figure 2 show that majority (75.0%) who claimed to be involved in grasscutter rearing were involved at low level. About 52 per cent had low level of involvement in snail rearing, while about 48 percent were highly involved**.** Also majority (64.5%) of peri-urban farmers were highly involved in beekeeping. Results in Figure 1 also show that about 57.0 percent of the respondents claimed low level of involvement in rabbit keeping, whereas 43.0 percent were highly involved in rabbit keeping. The findings shows that beekeeping had high patronage of the respondents in the study area and majority of the framers were fully involved in it a major source of income, where as only few of the peri-urban snail farmers were fully involved in the production of snail, rabbit and grasscutter. This could be as a result of the fact that, the said resources were gifts of nature that were available in the wild with little or no cost in an effort to acquire them. This practice, if continue without proper control might lead to total extinction of these valuable resources.

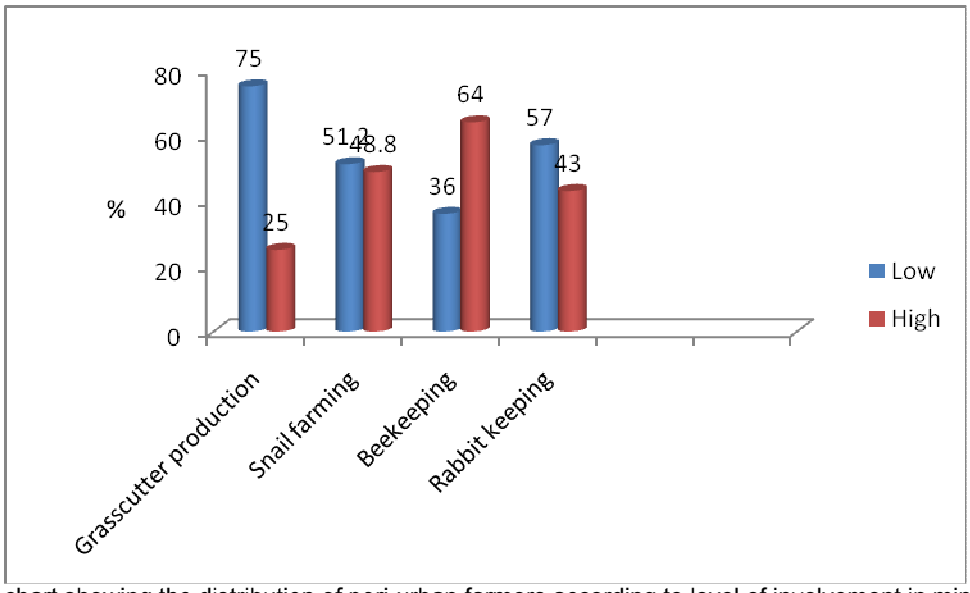


Figure 2: Bar chart showing the distribution of peri-urban farmers according to level of involvement in mini-livestock

Challenges of peri urban farmers

Results in Table 5 show the ranked mean scores of problems confronting peri- urban farmers in descending order of severity. Inadequate credit facilities with means score 3.79 was ranked as the most critical problem. This was followed by untimely release of credit facilities to farmers (3.74), while untimely supply of inputs by government 3.46 was ranked third. Also, inadequate supply of agricultural inputs (3.38) was ranked fourth. The next on the rank was inadequate information on production (3.32), followed by high cost of production material (3.19) and lack of proper management skill (technology know-how) (2.83), inadequate infrastructural facilities (2.78) was ranked next in the 9th position, this was followed by inadequate processing technology (2.67), inadequate labour supply (2.50).

The findings indicate that the first ten problems encountered by the farmers were the major problems, which was above average mean score of 2.50. It could be interpreted that most of the peri-farmers who were involved in most of the mini-livestock production encountered a lot of problems ranging from inadequate credit facilities, credit facilities not timely released, inadequate and untimely supply of inputs, inadequate information on the production and improper management skill, high cost of production materials, inadequate processing technology and labour supply. Provision of credit facilities and subsidy would assist the farmers to be more involved in the production of all the mentioned activities. The findings is in line with Yeboah (2009) that grasscutter were confronted with problems ranging from high cost of housing, lack of access to credit and dry season feeding placing.

Table 5: Distribution of respondents according to the problems encountered on involvement in mini livestock

Problems	Mean	Rank
Inadequate credit facilities	3.79	1st
Credit facilities are not timely	3.74	2nd
Untimely supply of inputs by government	3.46	3rd
Inadequate supply of agricultural inputs	3.38	4th
Inadequate information on production	3.19	5th
High cost of production material	3.19	5th
Lack of proper management skill method	2.83	7th
Inadequate processing technology	2.67	9th
Inadequate labour supply	2.78	8th
Unavailability of market	2.50	10th
Inadequate storage facilities	2.23	11th
Inadequate farmland	2.04	12th
Bad weather	1.94	13th
Inadequate infrastructural facilities	1.89	14th

Hypothesis testing

There exist positive and significant correlation between level of involvement in selected mini-livestock and the following variables; years of schooling ($r = 0.285$; $p \leq 0.01$), residency in community ($r = 0.158$, $p \leq 0.01$), livestock size ($r = 0.276$; $p \leq 0.05$) income realized from mini-livestock ($r = 0.361$; $p \leq 0.05$), participation in social organization ($r=0.158$; $p \leq 0.05$), and sources of information ($r = 0.227$ $p \leq 0.05$), boundary maintenance ($r = 0.177$; $p \leq$), infrastructural facilities in the community ($r= 0.117$; $p \leq 0.05$); compatibility ($r = 0.239$; $p \leq 0.01$) complexity (r 0.224 P 0.01), divisibility ($r = 0.224$; $p \leq 0.01$),

openness (r = 0.179; P≤ 0.01) availability (r = 0.153; P≤ 0.01) and economic desirability (r = 0.139; p ≤ 0.01).

There are also positive and significant relationship between institutional variables such as roles of religious institution (r = 0.297, P ≤ 0.01) role of Agricultural Development Programme (r = 0.120, P≤ 0.05), role of Government policy in encouraging small and medium scale farmers(r = 0.177; P ≤ 0.01), roles of research institutions (r = 0.188; P ≤ 0.05) and level of involvement of farmers on mini –livestock production.

Table 6: Correlation analysis between peri-urban farmers' involvement in mini-livestock and personal, socio-economic characteristics, community, activities and institutional variables.

Variables Variables	Correlation r	Co-efficient of determination r^2
Year of schooling	0.285**	0.081
Residency in community	0.158*	0.025
Livestock size	0.276**	0.076
Income realized form mini-livestock	0.361	0.130
Participation in social organization	0.158*	0.025
Source of information	0.227*	0.052
Boundary maintenance	0.177**	0.031
Infrastructural facilities	0.117*	0.014
Compartibility	0.239*	0.057
Divisibility	0.224*	0.05
Openness	0.179*	0.032
Availability	0.153*	0.023
Economic desirability	0.139*	0.019
Roles of religious institutions	0.297**	0.088
Roles of ADPs	0.120*	0.014
Roles of research institutions	0.188*	0.025
NGOs	0.147	0.022
Government policy	0.177	0.031
Perception	0.181	0.203

** Significant at 10 per cent level

* Significant at 5 per cent level

CONCLUSION

Based on the findings from the study, the following conclusions were made: That peri-urban farmers had low extension contact in the study area, which resulted in farmers not well exposed to training on the management practices of the livestock, which may subsequently affect production of the mini-livestock in the study area. Moreso the major source of loan to farmer was cooperative society, which shows the importance of this organization as a good source of financial empowerment to farmers in their various economic lives. Major source of information about mini-livestock was other farmers. Another source of information was radio which might be because most rural farmers listened to radio even when they were on their farms. It might be so, because of wide radio coverage. Farmers in the three states had low level of involvement in all the mini livestock activities and their management practices. In ranking, beekeeping ranked best than other activities, while grasscutter rearing had the lowest level of involvement. Most of the problems confronting peri - urban farmers that were involved in selected activities include inadequate credit facilities, untimely supply of inputs, inadequate information, low extension contact and inadequate processing technology.

RECOMMENDATION

- Most of the farmers have low knowledge of management practices of the selected mini - livestock therefore; adequate training on management practices such as production, housing, feeding, processing, storage, packaging and marketing of these mini livestock should be organized by extension agents. There should be follow-up visits to ensure the desired result among peri - urban farmers.
- Peri - urban farmers should be encouraged to join a functional cooperative society in order to access information on the management practices and to source for credit /loan facilities on the selected mini livestock.
- Government policy should tend toward encouraging farmers to be more involved in the mini-livestock in order to reduce their poverty level and for livelihood sustainability.
- Government and Non–Governmental Organizations should commit more resources to agricultural programmes especially on domestication of selected mini-livestock on radio and television. This will serve as a medium of communication to peri - urban farmers and other farmers on these activities.

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EVALUATION OF LIVESTOCK IDENTIFICATION AND TRACE-BACK SYSTEM (LITS) IN THREE VILLAGES OF KWENENG DISTRICT, BOTSWANA

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ABSTRACT

A study was conducted in Gamodubu, Lentsweletau and Kopong in Kweneng District to evaluate the performance of LITS and to ascertain whether it has enabled Botswana beef sector to meet traceability standards to secure EU market. Data were collected using a verbally guided questionnaire which was administered to 50 individual livestock keepers (Gamodubu - 10, Kopong – 15 and Lentsweletau - 25) and key informants (traditional leaders, police officers and extension agents). In addition, secondary sources of data were reviewed. Data on socio-economic characteristics (age, sex, educational level and marital status) of the respondents, factors affecting LITS implementation and role of extension services in LITS implementation were collected. Data were analysed using Statistical Package for Social Sciences (SPSS). The current results showed that cattle breeds reared in the study area in order of preference are Brahman /*Tswana* cross (48%), *Tswana* (17%), Simmental/Brahman (14%) Simmental/*Tswana* cross (6%), Simmental (6%), Brahman (6%), Bonsmara (1.5%) and Afrikaner (1.5%). Seventy percent of the respondents were males, only 48% of the cattle population in the study area was inserted with bolus, extension service is inadequate and that LITS system is experiencing implementation challenges. These challenges are attributable mainly to frequent breakdown of equipment in the field resulting in backlogs in bolus insertions, Also, the present results showed that LITS did not contribute to the decline in stock theft cases. Based on the low number of cattle inserted with bolus (48%), these results suggest that LITS in the current form is not enabling Botswana to export beef to the EU market.

Key words: Beef, EU market, LITS, Kweneng, socio-economic characteristics, stock theft

INTRODUCTION

About 70% of rural households in Botswana derive their livelihoods from agriculture. The agricultural share of the Gross Domestic Product (GDP) has declined from 40% at independence in 1966 to about 1.7% currently (National Development Plan (NDP) 10, 2008). Beef provides 80% of the sector's contribution to GDP. Although livestock, particularly beef cattle, play a dominant role in the sector, beef exports have not reached the annual European Union (EU) Cotonou Agreement quota that offers Preferential Trade Agreement for Botswana beef of 18,916 tonnes per annum to the EU market. The average fulfillment in the last 10 years is about 63%.

In 1997, the Council of the European Union (EU) introduced regulations concerning the identification and registration of bovine animals and labeling of beef products due to the outbreak of Bovine Spongiform Encephalopathy (BSE) in the United Kingdom which were implemented on April 21, 1997. The EC 82/97 regulation mandated that by January 1, 2000, all bovine animals must be identified with (1) ear tags that individually identify animals, (2) electronic database, (3) animal passports, and (4) that individual animal registries must be kept at each premises. As a result, on July 17, 2000, EU 1760/2000 regulation was passed, fully implementing and making mandatory the bovine identification and traceability system. According to the regulation (EC, No 1760/00), each bovine animal must be registered and individually identified using one ear tag in each ear; individual paper passports are required for all bovine animals and passports must accompany the animals when they move; the governments of the Member States must be informed of each animal movement; member States must maintain a computerized cattle tracing database, and animal keepers must maintain up-to-date registers of on-farm bovine animals.

In a bid to comply with EU Regulation 1760/2000 (EU, 2000), Botswana implemented the Livestock Identification and Trace-back System (LITS) in 2000 (Department of Veterinary Services (DVS) Report, 2010). The objectives of LITS are to establish a computerized system for cattle identification and trace-back to ensure market access for Botswana beef, to computerize separate cattle, animal disease and brand databases into a single computerized database system that can be used to achieve cattle identification and beef traceability in fulfillment of EU requirements and rapid disease trace-back and trace-forward (security and cross-border movements) and to bring about efficiency in livestock and disease information management system (Fanikiso, 2009).

According to FAO Report (2010), the overall system design of the broader LITS system including the layout of the information system is good but in general the LITS has largely failed to

meet the expectations of both the Government of Botswana and the beef sector. The current outputs are not aligned to the level of investments put into the system. Also, some components of the LITS are not aligned to the evolving needs of the beef sector. Current reports indicate that LITS is experiencing implementation challenges. Therefore, a study was conducted to evaluate performance of LITS in three villages of Kweneng District in Botswana and to ascertain whether it has enabled Botswana beef sector to meet traceability standards to secure EU market.

MATERIALS AND METHODS

A total of 50 respondents were randomly selected in Gamodubu (10), Kopong (15) and Lentsweletau (25) in Kweneng District. The three villages were chosen because of their proximity to Gaborone (the capital city of Botswana) with Lentsweletau and Kopong being furthest and nearest to Gaborone. Gamodubu is located 30 km west of Gaborone, while Kopong and Lentsweletau are located north west of Gaborone. Kopong and Lentsweletau are 18 and 60 km away from Gaborone, respectively. Gamodubu, Kopong and Lentsweletau have human populations of 988, 6395 and 3603, respectively.

A verbally guided questionnaire was administered to individual livestock farmers to collect data on socio-economic characteristics (age, gender marital status and education level), factors affecting LITS implementation in the field, challenges to LITS implementation, role of extension services in LITS implementation and LITS reliability to the farmers. Key informants (traditional leaders, police officers and extension agents) were also individually interviewed using a questionnaire that was different from that administered to farmers. Key informants views were sought on stock theft, LITS challenges and how LITS could be improved. In addition, secondary sources of data were obtained from Molepolole District, Ministry of Agriculture (Headquarters) and Police offices in Molepolole and Mogoditshane, and evaluated.

Data were entered in Microsoft Office Excel programme. Qualitative data were coded and grouped according to study themes and thereafter cleaned and analysed using Statistical Package for Social Sciences (SPSS) Tables and figures were used to present summary statistics such as mean and percentages.

RESULTS AND DISCUSSIONS

Socio-economic characteristics

Data on socio-economic status of respondents in the study area are given in Table 1. Seventy-eight percent of the respondents were males while the remainder was females. This finding is in agreement with Oladele (2011) who reported that men dominate cattle rearing and have been influential in the development of agricultural sector in Botswana.

In the present study, 96% of the respondents were aged >41years indicating that management of livestock is largely in the hands of older people than youth. This finding is consistent with Oladele and Jood (2010) in Botswana who reported that most herds are managed by older people. According to CEDA Young Farmers Guidelines, in Botswana young people aged ≤ 29 years constitute 67.6% of the total population. The Young Farmers Fund was launched in 2005 and its main objective is to foster youth enterprises in agriculture through effective pursuit of opportunities in agricultural sector.

The current study showed that 68% of the respondents were aged ≥50 years. At this age, respondents may not be enthusiastic to try new technologies whose benefits are not immediate. Table 1 shows that the majority of the respondents (76%) were married. Sixty-eight percent 68% of the respondents had formal education while the reminder (32%) never attended school. The high literacy rate in this study indicates that respondents are likely to understand extension messages and/or adopt technologies with ease. However, the fact that 32% of the respondents never attended school poses a challenge to the extension services.

Table 1. Socio-economic status of respondents in the study area

Variable	Freq.	Percent
Age		
Less than 30	1	2
30 – 40	1	2
41 – 50	14	28
Above 50	34	68
Sex		
Female	11	22
Male	39	78
Marital Status		
Single	9	18
Married	38	76
Divorced	2	4
Widowed	1	2
Educational Level		
Other (No formal Education)	16	32
Primary	14	28
Secondary	13	26
Tertiary	7	14

Livestock rearing in the villages

The number of livestock reared by respondents in the study area is shown in Table 2. It is evident from Table 2 that cattle were the most common species reared followed by goats (1984), chickens (1149), sheep (292) while horses were the least reared species (18). Lentsweletau had a high cattle population (2910).

Table 2. Number of livestock reared in three villages

Species	Gamodubu	Kopong	Lentsweletau	Total
Cattle	484	994	2910	4388
Donkeys	10	26	18	54
Horses	4	5	9	18
Goats	286	835	863	1984
Sheep	17	141	134	292
Chicken	218	320	611	1149
Total	**535**	**1327**	**1635**	**3479**

The cattle breeds reared are shown in Table 3. From Table 3, it appears that the preferred cattle breed in the study is the Brahman /*Tswana* cross (48%) followed by *Tswana* (17%), Simmental/Brahman (14%) Simmental /*Tswana* cross (6%), Simmental (6%), Brahman (6%), whereas Bonsmara and Afrikaner were the least reared. The Brahman /*Tswana* cross is preferred because it combines the good characteristics of the two breeds. Both breeds are well adapted to adverse conditions (hot and dry) and heat tolerance. According to Table 3, the second most common cattle breed reared is *Tswana*, which is tolerant to the local conditions. Brahman, Simmental and Simmental/*Tswana* cross were the third most commonly preferred breeds in this study. The respondents mentioned that they also preferred the Simmental/Brahman cross because it is a versatile breed that adapts easily to most varied conditions. This finding is in agreement with Trail *et al*. (1977) who reported that Simmental/Brahman cross (Simbra) has higher reproductive performance, faster growth rate and is viable. Also, the American Simmental Association (2003) and Simmental Association of Australia (2006) observed that Simbra combines the strengths of Brahman and Simmental, the two most populous breeds of cattle in the world. The fertility, milking ability, superior weight gain, carcass yield, temperament and rapid growth of the Simmental is complemented by heat tolerance, tick tolerance, disease resistance and hardiness of Brahman.

Bolus insertion

The current study showed that 40% of the respondents were aware that cattle should be inserted with bolus at three months of age while the majority (60%) had no idea. This finding challenges the extension service to intensify farmer education on LITS. Furthermore, 80% of the respondents said they first heard about LITS in a *kgotla* (traditional meeting place) meeting addressed by extension staff while 20% said they first heard about LITS from the radio. This result suggests that extension messages on LITS are effectively being communicated to farmers.

Table 3: Cattle breeds in the study area

Breeds	Freq.	Percentage
Brahman + Tswana	31	48%
Tswana	11	17%
Brahman	4	6%
Simmental	4	6%
Bonsmara	1	1.5%
Afrikaner	1	1.5%
Simmental + Tswana	4	6%
Simmental + Brahman	9	14%
Total	**65**	**100%**

Extension service provision

The frequency of visits by extension agents to farmers is illustrated in Figure 1. The respondents mentioned that they were visited once a month (26%); only saw extension agents during the annual vaccination campaigns (24%); only saw extension agents when they requested them to attend to their sick animals or to issue movement permits (18%); receive visits from extension agents twice a year (14%), whereas 18% of respondents said that they never received visits from extension agents. These results show that extension service/support is inadequate. Previous study by World Bank (1992) in Kenya showed that low rate of extension services resulted in weak farmer participation and lack of responsiveness.

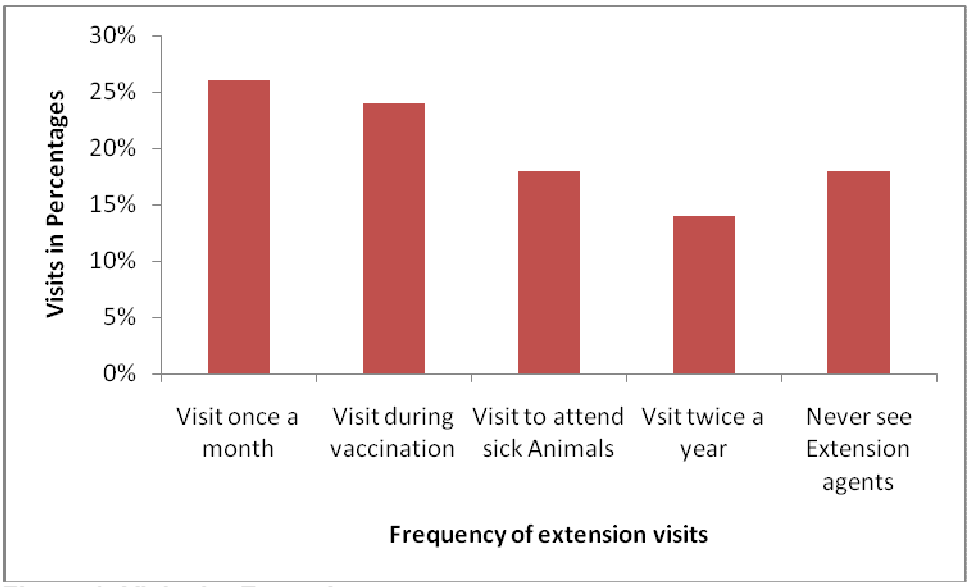


Figure 1: Visits by Extension agents

Extension agents identified constraints encountered during bolus insertion to include animals being presented with multiple brands without any affidavit making verification difficult, presentation of expired brand certificates leading to cattle not being inserted with bolus, introduction of animals into the district without movement permits and inserted bolus, and shortage of support staff at the crushes during bolus insertion. These challenges suggest that there is need to intensify farmer education on LITS in order to enhance its implementation and also for employment of additional staff during bolus insertions.

According to the respondents, extension service provided by Department of Veterinary Services (DVS) included bolus insertion (46%), annual free vaccinations (34%), sale of cattle (8%), whereas six percent said they did not receive any assistance from DVS. Furthermore, 12% of the respondents mentioned that DVS assisted them to dip, de-worm and also in attending to sick animals (8%). These responses indicate that extension service is inadequate.

LITS and stock theft

In the present study, 56% of the respondents mentioned that bolus decreased stock theft while the remainder said it has not decreased stock theft. On the contrary, Figure 2 shows that stock theft increased over time, indicating that LITS has not contributed to a decline in stock theft in the study area According to the respondents, only calves are stolen for rearing while adult animals are slaughtered and their meat sold. According to data from Botswana Police, 58 stock theft cases were reported from 2006 to 2010. Out of this (58), only 29 cases reached the courts resulting in 20 people prosecuted and 15 imprisoned. Data obtained from the Botswana Police Service through the Anti-Stock Theft Unit in Kweneng District indicate that stock theft cases reported annually are low per year compared to before the introduction of bolus. Food and Agricultural Organization (FAO) (2010) indicated that a large number of cases are often not reported to the police due to better restitution to cattle owners when cattle theft is dealt with through traditional authorities. Five cases were not proven, two were false enquiries and the remainder (2) was withdrawn by the complainants before reaching the courts.

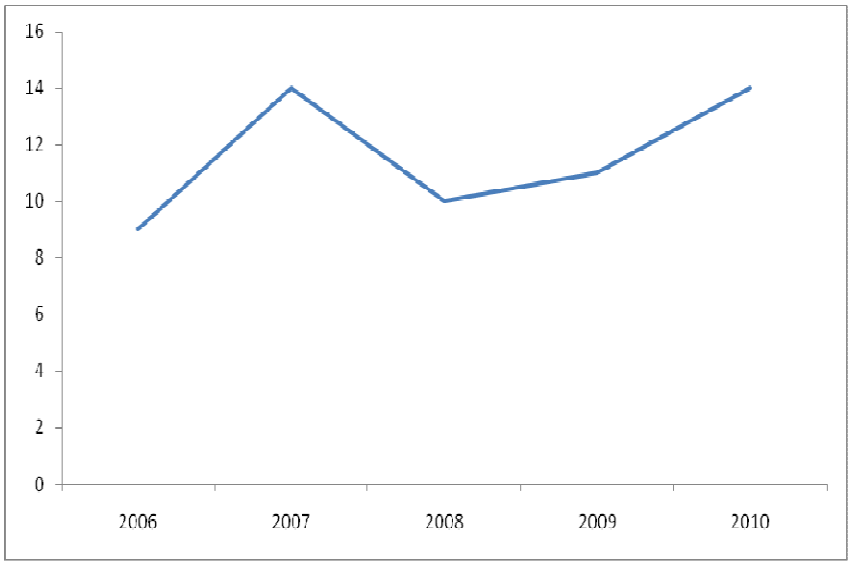


Figure 2: Stock theft cases in the study area.
Source: Botswana Police (2012)

Sale of cattle

Table 4 presents data on cattle sales. In this study, the majority (40%) of respondents said they sold cattle once a year (annually), whereas 6% said that they have not sold any cattle yet, indicating that only few cattle were sold in a year. It is evident from Table 4 that the majority (93%) of the respondents sold cattle three times in a year.

For improved service delivery, 26% of the respondents wanted DVS to hire more extension agents to relief those who go on long FMD campaigns, 22% wanted new equipment to be procured to replace the current ageing stock, 16% wanted improvement in transport while 36% wanted all the stakeholders to be housed in one building (i.e. chief, police, and extension agent). This result suggests that the respondents are not happy with service delivery probably due to inadequacy of extension service and poor condition of the equipment used for bolus insertion.

In order to improve cattle sales, extension agents suggested that the police and veterinary staff should be availed at buying points. In addition, extension agents suggested that new equipment should be purchased and transport situation improved in order to improve sale of livestock.

Table 4: Sale of cattle in the study area

Selling of cattle	Freq.	Percent
Sell cattle annually	20	40%
Sell every 2 years	11	22%
Sell every 6 months	10	20%
Sell 3 times a year	6	12%
Have not sold yet	3	6%
Total	**50**	**100%**

Improvement of LITS

Responses on improvement of LITS are presented in Table 5. Thirty-six percent of respondents said they wanted DVS to buy new LITS equipment, while 18% said that no improvement was required. In this study, 12% of the respondents wanted all cattle to be bought at the *kgotla*, 12% wanted DVS to carry out annual bolus insertion, 10% wanted changes in the Matimela Act, whereas 10% did not suggest any improvement to be made. According to Matimela Act (36:06), *matimela* are stray cattle impounded by District Councils which are auctioned after six months if they are not identified and claimed by their owners. Eighteen percent of the respondents did not respond on improvement of LITS while 12% wanted DVS to provide equipment, transport and to increase the number of extension agents. Furthermore, 10% of the respondents wanted LITS to continue as it is, 4% wanted the mandatory six weeks waiting period following bolus insertion to be reduced to one week, 2% said that the LITS system needed some improvement, 2% wanted DVS to attend to LITS urgently while 2% wanted the LITS system to capture owners' mobile phone numbers with other animal details during insertion in order to notify the owners in case of stock theft.

In this study, 36% of the respondents said that they wanted DVS to replace current field equipment. In agreement with this finding, FAO (2010) reported that field data acquisition system in Botswana is faced with recurrent failures due to ageing equipment. Failure of equipment has contributed to an increase in the use of hand written permits and parallel manual recording systems of other animal events such as official vaccinations. The use of manual permits has led to long delays in notification of animal movements and other animal events, as well as, general failure of the system.

Table 5: LITS Respondents views on how LITS could be improved

Improvement of LITS	Freq.	Percent
Buy new equipment	18	36%
No improvement required	9	18%
Buy cattle at *kgotla*	7	14%
Carryout annual bolus insertion	6	12%
Change in Matimela Act	5	10
Did not know	5	10%
Total	**50**	**100%**

In agreement with the current results, information in the LITS central database revealed that LITS system needed to be reviewed as it has problems of poor data quality and data consistency checks. Tabane (2011) reported that Botswana is at odds with EU beef export requirements as it has failed to record the history of all cattle and digitally store the information.

Challenges to LITS Implementation

According to Consult IT (2010), the challenges in the LITS system in Botswana are equipment being too old, equipment freezing during insertion, limited bandwidth for remote data transfer, non-functioning up/download, increased use of manual permits and generally that the majority of equipment are not functioning resulting *inter alia* in little or few bolus insertions in the field. This study showed that LITS programme that gives respondents the most problem is bolus insertion (30%), mainly due to shortage and breakdown of equipment during operation. Fanikiso (2009) attributed frequent breakdown of equipment to rough terrain to farming areas. According to Motseta (2011), since the introduction of LITS in 2002, most of the information technology equipment has not been replaced and are obsolete resulting in frequent breakdowns. In addition, Gaotlhobogwe (2011) reported that over the past 10 years, the equipment experienced fundamental technical problems such as freezing of personal computer screens and failure of the equipment to communicate with the reader. Inadequacy of transport for extension agents to carry out extension activities is also an impediment to bolus insertion. This finding is in agreement with Gaotlhobogwe (2011) who pointed out that when the LITS programme was rolled out; transport and logistics issues were never considered. Issuance of cattle movement permits (22%); animals showing no LITS details (18%); change of ownership (4%) and double insertions (4%) are linked to the technical problems associated with LITS.

According to Fanikiso (2009), other challenges in LITS implementation are most LITS equipment were designed for the programme and are not easily available in the market, there is limited suppliers of LITS equipment and boluses in the country, the system is mainly public sector driven and that there is poor support from the private service providers.

As shown in Table 6, 48% of cattle were inserted with bolus. The fact that only 48% of cattle were inserted with bolus suggests that LITS may not be enabling the Botswana beef sector to meet traceability standards to meet the EU market requirements. In the present study, 18% of the respondents said their cattle were not inserted with bolus as they were astray at the time of insertion, 26% said some of their cattle were not inserted with bolus as there was no bolus insertion in 2011, 8% said cattle were returned due to ineligible brand mark, whereas 4% said they were unable to get cattle into the crushes because they (cattle) were wild.

Table 6 Level of bolus insertion in the study area

Bolus insertion	Freq.	Percent
Inserted bolus	24	48%
Cattle were astray	9	18%
No bolus insertion in 2011	13	26%
Ineligible brand marks	2	4%
Cattle unable to get into crushes	2	4%
Total		**100%**

Responses on LITS improvement are illustrated in Figure 3. Forty percent of the respondents said they wanted DVS to buy new equipment for extension agents, 26% wanted DVS to increase staff at extension area level, whereas 16% said they did not know how LITS could be improved. Furthermore, two percent of the respondents said they wanted DVS to try other new systems of identification such as digital ear tags currently used in Namibia.

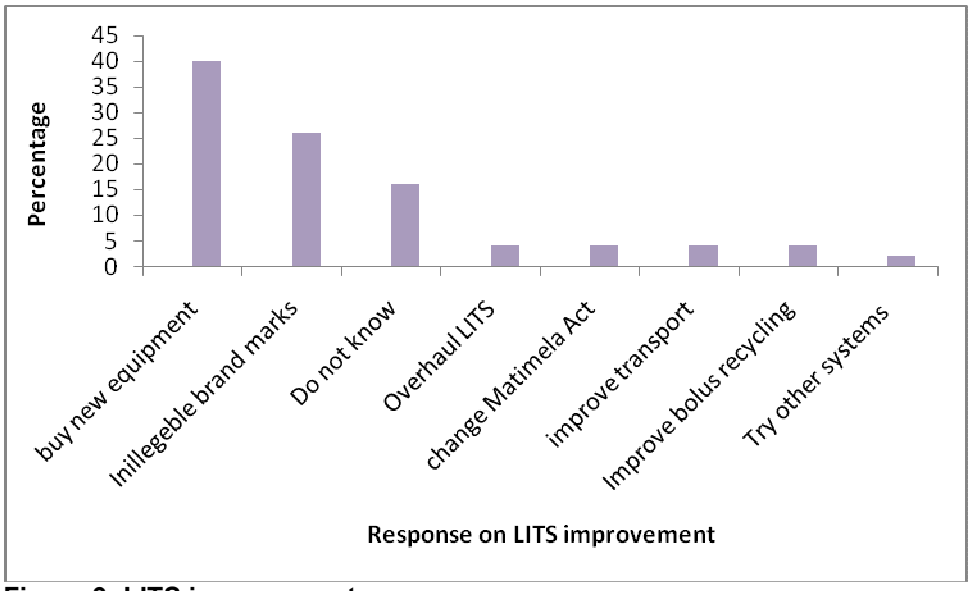


Figure 3: LITS improvement

RECOMMENDATIONS

The following recommendations are made:

- Proper records of bolus insertion should be kept in the districts and Ministry of Agriculture (Headquarters) in Gaborone.
- An effective maintenance schedule for the equipment and long term replacement plan should be developed and implemented. In addition, new equipment should be purchased to replace the current ageing equipment.
- LITS database should be re-designed to address problems of poor data quality and consistency.
- Bandwidth challenges should be addressed to enable remote data up/download.
- In order to improve staff efficiency, skills transfer plan for the DVS field teams should be developed and implemented.

CONCLUSIONS

- Only 48% of cattle were inserted with bolus suggesting that LITS is not enabling the Botswana beef sector to meet traceability standards to meet the EU market requirements.
- The study has shown that 60% of cattle farmers in the study area were aged above >50 years and had formal education. The high literacy rate of respondents indicates that extension messages are likely to be understood. However, there is need for extension agents to design and develop extension messages appropriate for farmers that cannot read and write that constitute 40%.
- The LITS system is currently experiencing implementation challenges. Generally, there is a stand still on the implementation of LITS in the districts as the majority of equipment is not functioning properly resulting in backlogs in bolus insertions.
- Approximately 50% of the respondents understood LITS and had their cattle inserted with bolus.
- Fifty percent of respondents said that bolus contributed to a decline in stock theft, indicating that LITS could have benefits. However, this claim does not seem to be supported by data obtained from Botswana Police which shows that stock theft increased over time.
- The results of this study showed that extension service is inadequate. The inadequacy of extension service has a bearing on LITS implementation.

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